CLIMATE CHANGE AND THE AGRI-FOOD TRADE

PERCEPTIONS OF EXPORTERS IN PERU AND UGANDA

International Trade Centre

TRADE IMPACT FOR GOOD

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The report presents the findings of research on the perceptions of agri-food exporters of climate change - provides direct insight into the perceived needs of business and exporters in responding to climate change impacts in Uganda and Peru, to inform ITC, its clients and other Aid for Trade practitioners on strategies to mainstream climate resilience among exporters and to improve the effectiveness of support for adaptation - Part 1 on Uganda shares the perceptions of agri-food exporters in key export sectors including coffee, tea, cocoa, cotton, fruits and spices. Part 2, on Peru, shares the perceptions of agri-food exporters in the coffee and cocoa sectors; gives recommendations from stakeholders on how to improve the delivery of climate assistance to exporters; includes bibliographical references (pp. 52-55).

Descriptors: **Climate Change, Agriculture, Food Products, International Trade, Uganda, Peru.**

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Foreword

Climate change is one of the defining development challenges for this century. Rising temperatures, more extreme weather events and other climate-related impacts are affecting the competitiveness of economies and reducing agricultural productivity. As the majority of the world's poor still live in rural areas, climate change threatens to reverse decades of development gains and places the most vulnerable – women and youth – at the greatest risk. In many scenarios, we are seeing a disproportionate impact on the poorest sections of the population despite evidence that shows they have a negligible contribution to the problem.

Exports of agri-food products are an important driver of rural growth, creating jobs and raising rural incomes. However, currently very little is known about the role that exporters play in adaptation to and mitigation of climate change. It goes without saying that exporters, particularly micro, small and medium-sized enterprises (MSMEs), play a key role in the value chain through delivery of extension services to farmers, making investments and connecting with markets. Exporters have a constant "ear to the ground" on what is happening in the field and thus have unrivalled knowledge of market trends, the challenges facing farmers and what is needed to make markets work more effectively.

Against this background, it was important for ITC to dig deeper into this issue and provide a fact-based insight into what is happening on the ground through a survey of exporters. We selected two countries where we are actively engaged in agri-food development projects, namely Peru and Uganda. I am grateful to PROMPERU and the Uganda Export Promotion Board for the support provided to ITC in carrying out the survey.

The results of the survey illustrate how the contrasting development position of the two countries has an impact on their capacity to adapt to climate change, with Peru able to invest in adaptation given its access to more resources, but Uganda unable to do the same given that the country faces greater financial and technical constraints.

The key finding emerging from this survey is that climate change makes existing challenges in the agri-food sector more difficult to overcome, and thus has a highly negative impact on competitiveness. In both Peru and Uganda, the majority of exporters surveyed reported that climate change was of equal or greater importance to their existing export challenges, most notably price volatility, high operating costs and product quality. In response, governments and agencies need to integrate climate change into sector-specific policies and investment strategies and provide a platform for more effective sharing of information on best practices. The survey finds that MSMEs are already providing locally driven, effective solutions on adaptation, but that they need support to implement these initiatives.

I hope this report will provide a fresh private-sector perspective on agriculture and climate change and, in doing so, make a substantial contribution to the Aid for Trade community on how to mainstream climate change into its programming. I look forward to engaging with our technical cooperation partners to support exporters and importers to deliver locally driven solutions to the substantial challenge of climate change.

Arancha González

Executive Director, International Trade Centre

Foreword

Climate change is affecting Peru's ecosystems and micro-climates – seen in phenomena such as higher temperatures, variable precipitation, eroding glaciers and rising sea levels – and has become a major issue on the national agenda. The Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC), presented in November 2014, contains scientific information on social and environmental effects that have become key factors in shaping responsible public policy seeking to mitigate the effects of climate change.

Such effects will be especially significant in Latin America and the Caribbean. Peru ranks third worldwide for its vulnerability to climate change. It is periodically subjected to El Niño, which increases the likelihood of flooding in some areas due to heavy rainfall, as well as prolonged droughts elsewhere in the country. At the same time, Peru's rich variety of flora and fauna is priceless, and it has an enormous diversity of micro-climates, with 27 of the world's 32 climate types found within its borders.

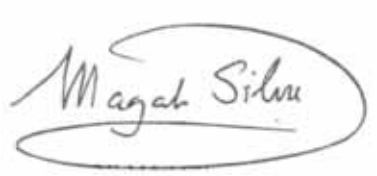
Peru has made significant efforts to increase agricultural productivity and sell its products successfully on global markets. But we need to be more than just competitive going forward. We must address the issue of climate change, which poses a major challenge to our crucial export sector, consisting primarily of non-traditional goods.

New efforts are being made through an alliance between the public and private sectors to promote sustainable businesses in sectors such as agriculture and food products. Peru's agriculture and food sector consists primarily of small and medium-sized producers which are reluctant to adopt technology to confront climate change. Considerable effort is required from all stakeholders to develop and adopt technologies and practices, such as drought-resistant crops, hydroponic agriculture and the construction of seawalls to protect against tidal phenomena. We must nevertheless continue to support producers in different regions to enable them to adopt technologies and practices suited to their circumstances.

The study conducted by the ITC, deserves praise for making producers aware of the steps they need to take to deal with climate change in terms of mitigation and, to adapt its effects on trade, and to safeguard markets for products that are important for Peru's economy. ITC surveyed food and agricultural exporters to gauge their views on climate change and its commercial impacts. In the study, 24 Peruvian coffee and cocoa exporters, associations, cooperatives and small businesses from five different regions shared their concerns about the impact of climate change on the bottom line of their exports. They also explained the strategies they use to cope with the changing climate and their capacity to mitigate climate risks.

The results show that exporters require better information to confront climate change adequately; and they need financial capital to respond to long-term climate change challenges. The ITC survey highlights key exporter requirements: help in developing new crop varieties and adapting these to changing temperatures; hedging strategies against climate change risks; stronger institutions to help them find solutions; access to adequate financing; constant availability of live weather-forecasting information; workforce training; improved infrastructure; and promotion of associations and cooperatives.

I invite you to take a close look at the results of this important survey and reflect on strategies to enable players in the agricultural export sector to continue increasing their exports and overcome the challenges that climate change poses to trade. Together, we must focus our individual and collective efforts on responding to the challenges that climate change represents for commercial exchange.



Magali Silva Velarde-Àlvarez

Minister of Foreign Trade and Tourism of Peru

Foreword

The Ugandan agricultural sector, with its related wide range of agri-business activities, employs more than 70% of the country's population. Enhancing agricultural production and productivity, along with agro-processing, is therefore critical to Uganda's economic growth.

Climate change has an adverse impact on Uganda's agriculture. As most of the sector is rain fed, the country is sensitive to climate variability. Uganda experiences increasingly erratic rainfall patterns, prolonged droughts, flooding and increased incidence of pests and diseases. Agriculture productivity has declined as a result.

Exporters cite climate change as a major threat to their competitiveness. They rank it high among other sources of uncertainty about and obstacles to competitiveness, such as price volatility, weak infrastructure and low agricultural yields.

This study by the International Trade Centre (ITC) in partnership with the Uganda Export Promotion Board (UEPB) is, therefore, timely. Its findings highlight the challenges confronting the country's agricultural sector, giving voice to farmers and small and medium-sized enterprises (SMEs) to express their perceptions of climate change, their strategies to adapt to it and their support needs.

In December 2013, Uganda approved its National Climate Change Policy (NCCP), which focuses on the impacts of climate change on national development. Agriculture is one of the policy's priority sectors. The ITC report echoes the NCCP's stated need for more work on adaptation, mitigation and research, as well as cross-cutting areas of capacity building, education and training.

ITC's work will support Uganda in implementing the NCCP by providing helpful insights on how to design better responses to climate change and ways to enhance the sector's climate resilience. The report stresses the importance of mainstreaming climate change into Aid for Trade and creating more effective platforms for sharing information on adaptation and mitigation measures.

Our expectation is that this document will reinforce efforts by the international community to direct resources into assisting landlocked developing countries to meet the challenge of climate change.

Amelia Anne Kyambadde (MP),

Minister of Trade, Industry and Cooperatives, Republic of Uganda

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This report is the result of two ITC studies on the perceptions of agri-food exporters to climate-change impacts in Peru and Uganda. The Peru study was led by Triple E Consulting (Stephan Slingerland and Jessica Yearwood), Inform@ccion (Fernando Cilloniz) and the Pontificia Universidad Católica del Perú (Alan Fairlie (PUCP) and Michael Rodríguez) under the guidance of Katarina Nossal (ITC). The Uganda study was undertaken by Hilde de Beule under the guidance of Aaban Butt (ITC). The questionnaire for both studies was developed by Semhar Mebrahtu with support from Christophe Durande (ITC), and adapted in-country by project teams. Literature reviews of climate-change impacts on agriculture were carried out by Julie Karami-Dekens and Marius Keller from the International Institute for Sustainable Development (IISD). The report was directed by Alexander Kasterine (ITC).

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Abbreviations

Unless otherwise specified, all references to dollars ($) are to United States dollars, and all references to tons are to metric tons.

The following abbreviations are used:

APPCacao	Peruvian Association of Cocoa Producers
AdapCC	Adaptation to Climate Change for Small-scale Coffee and Tea Producers
ADEX	Peruvian Exporters Association
BCR	Central Bank of Peru
CAMCAFE	National Coffee Chamber
CDO	Cotton Development Organization
COCLA	Central Agricultural Coffee Cooperative
CWD	Coffee Wilt Disease
DSIP	Development Strategy and Investment Plan
ENCC	National Strategy on Climate Change
ENSO	El Niño – southern Oscillation
FOB	Free on Board
GDP	Gross Domestic Product
GVP	Gross Value of Production
Ha	Hectares
INEI	National Institute of Statistics and Informatics
ITC	International Trade Centre
JNC	National Coffee Board
LDC	Least Developed Country
MINAGRI	Ministerio de Agricultura y Riego del Perú
MINAM	Ministry of Environment of Peru
MT	Metric Tons
NGO	Non-governmental Organization
NTFP	Non-timber Forest Products
PLANGRACCA	Risk Management and Climate Change Adaptation Plan in the Agricultural Sector
PROMPEX	Peru Commission for Export Promotion
PSFU	Private Sector Foundation Uganda
SENAMHI	Peruvian National Service for Meteorology and Hydrology
SMEs	Small and Medium-sized Enterprises
SUNAT	National Superintendency of Customs and Tax Administration of Peru
UCDA	Uganda Coffee Development Authority
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States Dollar
UTA	Uganda Tea Association
WTO	World Trade Organization

Executive summary

Agri-food exports are a major source of income for Uganda and Peru and provide livelihood for millions of people. However, like many other least developed and emerging economies, Uganda and Peru have climate-change vulnerabilities that could undermine their export competitiveness. In this context, the International Trade Centre (ITC) has undertaken a programme of research to improve understanding of the climate challenges facing agri-food exporters and specific actions required to build climate resilience. This report serves to increase awareness of the challenges, strategies and needs of agri-exporters in building adaptive capacity and responding to climate risks.

Climate change can affect agri-food exporters in a number of ways: biophysical impacts on agricultural production, damage or delays to supply-chain infrastructure, changes in overseas production and world prices, changes in policy, and business competitiveness among trading partners. These impacts pose a business risk for exporters.

Research questions and approach

This research collects the perspectives of agri-food exporters in Uganda and Peru regarding climate change and its business impacts, as well as adaptation strategies and capacity to mitigate climate risks. The research evaluates three research questions:

1. How is climate change affecting or likely to affect agri-food exporters?

2. What are the key determinants of agri-food exporters' vulnerability to climate change?

3. What is required to improve climate resilience among agri-food exporters?

A diverse range of exporters were interviewed in Uganda and Peru through face-to-face surveys. In Uganda, businesses surveyed were small and medium-sized enterprises (SMEs) exporting coffee, cotton, tea, fruit and spices. In Peru, businesses were small enterprises, export associations and cooperatives (mostly with thousands of smallholder members), exporting coffee and cocoa. The surveys were supplemented with stakeholder discussions, regional focus groups and a workshop.

Climate change and agri-food trade in developing countries

For developing countries, climate change poses an additional risk to trade and competitiveness, alongside other challenges such as weak physical infrastructure, poor access to finance and governance.

The vulnerability of agri-food exporters to climate change differs between regions, sectors and individual businesses. As exporters have minimal control of their exposure and sensitivity to climate change, they rely on their adaptive capacity in order to improve resilience to climate risks. Following a framework proposed by Smit et al. (2001), adaptive capacity depends on access to six resources: economic resources, technology, information and skills, infrastructure, institutional and policy environment, and networks and partnerships.

Uganda and Peru attract significant foreign exchange from agricultural exports and aim to expand further their farm sectors. However, both are highly exposed to current and future climate hazards. Some climate impacts have already become a concern, such as drought and flooding in Uganda and variable precipitation and glacial retreat in Peru. Both countries have seven of the nine characteristics used by the United Nations Framework Convention on Climate Change (UNFCCC) to identify economies most vulnerable to climate change.

Both countries have begun to take action at the national level to plan for climate change, and to some extent this has been mirrored at a sector level. However, few steps have been taken for agri-food industries to enable businesses to undertake detailed climate-risk assessments and to build adaptive capacity.

Research methods

Uganda and Peru were selected to compare the vulnerability and approach to climate risks by businesses in a least developed country (LDC) and an emerging economy.

Semi-structured surveys were used for data collection. These covered socio-economic characteristics, export challenges (including climate change), adaptation responses and perceived needs.

The survey was taken by 12 businesses in Uganda and 24 in Peru. Content analysis was used to identify key themes, and focus groups and personal communication were useful in confirming findings. Nevertheless, the small sample sizes prevent the findings from being applicable across the population.

Most of the businesses in Uganda were based in Kampala, with operations across various regions. The products were sourced from smallholder farmers, either directly or through middlemen. The exporters' products were largely destined for Europe, with some goods shipped to the United States and Asia.

In Peru, the businesses were located in four unique agro-climatic regions: Piura, Cusco, San Martin and Junín. These regions represent 56% of coffee production and 57% of cocoa production. All but two exporters were associations or cooperatives, nearly all had at least 250 members and the majority were exporting certified products (mostly organic or Fairtrade certification).

Perceptions of agri-food exporters in Uganda

Agri-food production and trade in Uganda

Agriculture is the mainstay of the Ugandan economy, employing 67% of the population and contributing 45% of export earnings. Traditional exports include coffee, tea, cotton and tobacco, although production is increasingly diversified. Organic certification is rising, but accounts for less than 2% of exports.

The country's agro-ecological diversity is characterized as having high potential, which can feed into agricultural biodiversity (McDonagh and Bahiigwa, 2002).

Exporters face a number of constraints to expansion: high production costs and poor storage and transport systems. A significant share of production is lost post-harvest. Agricultural exports are at the centre of the National Development Plan and export-diversification strategy.

Climate change in Uganda

Due to its equatorial climate, Uganda is subject to risks including higher temperatures, increased rainfall and extreme weather events such as storms and wildfires. Floods and droughts are the most frequent climate threats. While data remain limited, several estimates suggest that Africa will likely be hardest hit by climate change, and temperature increases could be double the global average.

The agriculture sector, which relies on rainfall, is particularly vulnerable to direct and indirect climate risks, including reduced yield, infrastructure damage and post-harvest losses. Some of these impacts have already been associated with recent droughts, glacial retreat in the Rwenzori Mountains and extreme flooding. Most sectors are expected to be negatively affected by climate change, with the possible exception of cocoa, which could benefit from the predicted increases in temperature and humidity.

Climate change has been integrated into a number of policy reforms, but the government remains constrained by limited economic resources. Climate threats have been integrated into the most recent Agriculture Sector Development Strategy (DSIP), but not into subsector strategies for crops, livestock and fisheries.

Survey results

Perceived impacts on business

The survey results assessed the perceptions of 12 exporting businesses, including coffee, tropical fruit, cocoa, tea, dried chilli and vanilla exporters. In the previous 12 months, 75% of exporters had been affected by climate hazards including drought, hailstorms, fruit fly outbreaks and excessive rainfall. Some

exporters faced difficulty with quality drying crops and meeting supplier contracts. Of those exporters affected, some experienced positive and negative impacts. For example, higher temperatures were beneficial for cocoa and vanilla production, although future increases could by offset by unpredictable rainfall.

In the past five years, 40% of exporters experienced temperature variability and 40% experienced rainfall variability. All experienced changes in seasonality. The impact of these changes were crop losses (caused by landslide, erosion and runoff), reduced yield and fruit size (as harvests matured too quickly), delays caused by roadblocks and energy supply cuts during heavy rainfall. For some, uncertainty also affected business relationships.

Exporters agreed that climate change would exacerbate disadvantages Uganda now faces on global markets. Most reported challenges included high operating costs (especially transport and energy), market competition, poor yield and quality and price volatility. Two-thirds of exporters believed that climate change was of equal or greater importance than these challenges. Most were concerned about the effects on production quantity.

Resilience and adaptive capacity

Following the framework set out by Smit et al. (2001), agri-exporters described their resilience in terms of the six factors affecting adaptive capacity.

In Uganda, financial resources were perceived to be the greatest constraint to protecting against climate change, followed by natural resources, social capital, human resources and infrastructure. All but one exporter believed their access to finance was insufficient to respond to climate change, with reported interest rates as high as 20%–25% per month.

Adaptation responses

Three-quarters of exporters were taking some action to build climate resilience. The others believed that the impacts were too big to tackle as a small business or were constrained by a lack of capacity and expertise. Of those taking action, the strategies were mostly at the producer end of the supply chain and included tree-planting and soil and water conservation practices. Two exporters had shifted or expanded their supplier base into new regions to mitigate climate risks, which to date have had localized impacts. Fewer exporters had adapted processing and transport equipment, although some had taken steps to invest in alternative drying systems and heavy-duty vehicles to cope with road damage. One had moved to collect additional weather and climate data in order to evaluate supply-chain implications.

Support needs identified

The agri-food exporters identified several measures that would help them adapt to climate change. Three-quarters saw the need for better access to finance and climate information. Finance would enable exporters to invest in sustainable practices or infrastructure improvements, to expand and diversify their facilities, and to better monitor climate impacts. Climate information was a concern, particularly given the limited national meteorological services. Access to reliable information would better enable exporters to respond to shifting weather patterns.

More than two-thirds of exporters noted that improved networks and partnerships were required. While some sectors have exporter associations, developing the membership and services provided by these associations could improve knowledge-sharing and create new opportunities to attract funding and government support for managing climate risks.

Other needs included new crop varieties, infrastructure improvements and export diversification.

Perceptions of agri-food exporters in Peru

Agri-food production and trade in Peru

Agri-food exports in Peru grew rapidly following trade liberalization and a number of international agreements in the 1990s. The main agricultural exports are coffee, preserved vegetables, grapes and asparagus. Coffee accounts for one-third of agricultural exports. Cocoa represents 2.6% of agricultural

exports, but has been increasing rapidly in recent years (16.7% a year). Peru is the biggest global exporter of green coffee beans and the second-largest exporter of organic cocoa.

SMEs manage most coffee production and trade. Small producers are grouped in cooperatives and associations to better coordinate post-harvest management, negotiate better prices and improve competitiveness. Bigger associations have up to 2,000 members. Larger industry bodies promote exports.

Despite strong economic growth over the past decade, Peru still faces high poverty and various development challenges, particularly in rural and regional areas.

Climate change in Peru

Peru contains a number of diverse ecosystems and microclimates which are vulnerable to climate-change impacts including increased temperatures, variable precipitation, glacial melt and sea-level rise. Due to El Niño, Peru is affected by inter-annual climate variability and is prone to severe floods, heavy rainfall and prolonged droughts. Climate change is expected to increase the frequency of these extreme weather events.

The agri-food sector is highly vulnerable, particularly as smallholders have low adaptive capacity and limited access to technical and financial support. Poverty among rural Peruvians is 60%, higher in the Andean Region. Beside crop damage, the agri-food sector is vulnerable to infrastructure damage and human capital losses. Energy is largely hydroelectric and has been affected by water scarcities during droughts and damage from floods. Likewise, road damage can delay or halt transport to export markets. Climate change is expected to have direct negative impacts such as delayed flowering and harvest, reducing crop quality, landslides and floods, reducing crop quantity. However, higher temperatures may increase cultivation areas for some crops, such as coffee and certain fruits.

The Peruvian government has integrated climate change into several national strategies, including for the agriculture sector. The Peruvian Strategy for Disaster Risk Management and Climate Change Adaptation of the Agricultural Sector (PLANGRACC-A) includes US $700 million over 10 years for adaptation priorities. Support for specific subsectors has largely been through pilot programmes promoted by international organizations and non-governmental organizations (NGOs).

Survey results

Perceived impacts on business

The survey results assessed the perceptions of 24 coffee and cocoa exporting businesses. All of these exporters had been affected by climate hazards in the previous 12 months. In the past five years, 95% of exporters had been affected by climate risks, with one-third reporting a severe impact. The main impacts included reduce harvest quantity and quality as a result of rainfall variability, pest outbreaks and flooding.

Changes in seasonality, temperature and rainfall affected about two-thirds of respondents, though responses varied between regions. Extreme weather events had affected almost 50% of exporters in Piura, compared to less than a quarter in other regions. Cusco was most affected by reduced rainfall, while Junín and San Martín were affected by increased temperatures.

Exporters overwhelmingly perceived that current and future climate change would have a negative impact on exports. They agreed that export volumes would become more volatile and unpredictable. Coffee exporters generally had greater concerns than cocoa exporters as coffee is particularly sensitive to waterlogging. A small number of exporters in Cusco and San Martin thought that climate change could have a positive impact on cocoa production, depending on the timing of increased rainfall.

While only 30% of exporters included climate change among their top export challenges, the majority (19 out of 24) thought climate change was of equal or greater importance to their existing export challenges, most notably price volatility, competitiveness and product quality. While exporters had difficulty contending with price volatility, they had taken steps to improve competitiveness and quality, including certifying products and investing in plant dryers and efficient transport equipment.

Resilience and adaptive capacity

Following the framework set out by Smit et al. (2001), Peruvian exporters all considered natural resources to be the greatest barrier to climate resilience. Other constraints included infrastructure (57%), financial resources (48%) and social capital (43%). Peru has limited port infrastructure, and only one in seven roads is paved. Exporters on the Pacific coast are more resilient in this respect. Climate variability has reduced the ability of agri-food SMEs to secure access to credit due to the perceived risky nature of agricultural production.

Adaptation responses

All but one exporter had taken at least one step to adapt to climate change. Most common strategies included investments in new technology and infrastructure as well as training and extension services for producers, particularly in high-risk areas such as riverbanks and steep slopes. One export cooperative was training its members in business management, including risk. One cocoa exporter was adjusting stock levels to mitigate production volatility. Technical innovations included mechanical dryers and shade covers to prevent crop losses. In Cusco and Piura, some exporters were supporting irrigation projects to take advantage of intense rainfall periods.

Support needs identified

Exporters' adaptation strategies were often targeted towards short-term issues rather than building long-term resilience and only two exporters believed they had the capacity to respond to future climate change. The majority were concerned about inadequate human and financial capital.

The most common needs exporters identified to help them adapt to climate change included new crop varieties and export diversification. Most exporters believed these were essential to maintain export viability. Exporters also said they needed climate-risk insurance, an improved institutional environment and better access to financing. To a lesser extent, exporters required additional climate information, human resources and new works and partnerships.

Exporters called for more coordinated government initiatives, including practical and targeted support to assist in building climate resilience.

Conclusions and Recommendations

Agri-food exporters in Uganda and Peru expect climate change to aggravate existing challenges involving production, supply-chain infrastructure and international competitiveness. Through this study, exporters have identified challenges they face in building climate resilience and prioritized their main support needs.

Peru is an emerging economy with a more advanced agri-food sector and strong networks and partnerships between SMEs. As such, Peruvian exporters have invested more to build climate resilience. However, Ugandan exporters were equally aware of climate challenges and most have adapted somewhat, despite significant financial and technical constraints.

Climate change is expected to pose an increasing risk to agri-food exports in both countries, and greater effort is needed to build adaptive capacity and resilience. There is a role for business, government and the international community to support exporters in developing economies, such as Uganda and Peru, to ensure climate-change impacts are effectively mitigated. To assist exporters and increase awareness of the risks of climate change to agri-food, this study makes the following recommendations:

Recommendation 1: Integrate climate change into long-term policy and business planning

Climate change is just one of many challenges confronting exporters. Nevertheless, nearly all exporters recognized that climate change would make existing challenges even more difficult to overcome. As such, businesses and policymakers should better integrate climate change in their decision-making. For example, governments should consider integrating climate change into sector-specific strategies and investment opportunities that could build long-term resilience under a number of climate-change scenarios.

Recommendation 2: Develop a climate data platform to facilitate information exchange

Numerous pilot initiatives are under way in Peru and a smaller number in Uganda, yet few opportunities remain for information sharing. The international community could take the lead in developing a platform for producers, exporters and experts to share best practices for building climate resilience. For example, improving the aggregation and dissemination of findings from pilot programmes could further extend their reach.

Recommendation 3: Support SMEs to implement climate resilience strategies

Agri-food exporters have identified technical and financial impediments to adaptation. A targeted training programme could help exporters plan for and respond to climate change, even with limited resources and other constraints. Each strategy would specify an approach for responding to climate risks and would enable exporters to build a business case for climate resilience.

Recommendation 4: Train SMEs to assess certification opportunities and their potential benefits

Certification is widely used in Peru, often because the associated cost is low and because production has never relied heavily on chemicals or fertilisers. In Uganda, certification is increasingly popular, but the cost of applying for certification remains a barrier. In both countries, some regions lack understanding of certification options, their requirements, costs and benefits. For many SMEs, certain certifications are likely to build adaptive capacity by encouraging producers to adopt best practices and strengthen integration into global supply chains. Enabling SMEs to evaluate alternative options, as well as providing training and support to meet certification requirements, could contribute to climate resilience among exporters.

Introduction

This report presents the findings of research on the perceptions of agri-food exporters of climate change. It provides a qualitative impact analysis and needs assessment of exporters in Uganda and Peru, to inform ITC, its clients and other Aid for Trade practitioners on strategies to mainstream climate resilience among exporters and to improve the effectiveness of support for adaptation. Uganda and Peru were selected to highlight the contrasting attitudes and challenges associated with climate change between exporters in an LDC and an emerging economy.

Agri-food exporters can be vulnerable to the effects of climate change, such as changes in temperature, precipitation patterns and extreme weather events. For example, climate change can:

- Have biophysical impacts on agricultural production, affecting the quality and quantity of traded goods.
- Affect supply-chain infrastructure, for example, transport and storage systems can be susceptible to flooding or temperature extremes, causing damage or delays.
- Affect overseas production, supply chains and, consequently, world prices and export viability.

Climate-change policies and negotiations among trading partners can also affect business competitiveness, particularly in developing countries.

Each of these challenges poses a business risk to exporters, with implications for export-led growth and development.

The ITC survey of agri-food exporters used in this research enabled companies, associations and cooperatives to report directly their perceptions of climate change and their expectations for how their business is affected or likely to be affected in the future. Exporters continuously deal with volatility, risk and other challenges in the supply chain. In this context, it is useful to understand how climate change fits among these challenges and how exporters manage climate risks and opportunities facing their business.

For governments, an understanding of the climate-change concerns facing business and exporters can help define national and sectoral strategies geared towards expanding sustainable trade and building business resilience, as well as strategies introduced specifically to mitigate and adapt to climate impacts.

For Aid for Trade practitioners and the international community, this report provides direct insight into the perceived needs of business and exporters in responding to climate-change impacts. Moreover, the research identifies key recommendations for Aid for Trade programming.

Research questions and approach

This report answers the following research questions for Uganda and Peru:

1. How is climate change affecting or likely to affect agri-food exporters?
2. What are the key determinants of agri-food exporters' vulnerability to climate change?
3. What is required to improve climate resilience among agri-food exporters?

To answer these questions, a literature review of climate change and agriculture impacts was undertaken for Uganda and Peru. This was followed by a face-to-face questionnaire of agri-food exporters in the two countries, supplemented by regional focus groups and a stakeholder workshop.

Structure of this report

The report starts with an overview of climate change in developing countries, followed by the research methods. It is then structured in two parts. Part 1, on Uganda, shares the perceptions of agri-food exporters in key export sectors including coffee, tea, cocoa, cotton, fruit and spices. Part 2, on Peru, shares the perceptions of agri-food exporters in the coffee and cocoa sectors. The final chapter contains recommendations from stakeholders on how to better deliver climate assistance to exporters.

Chapter 1 Climate and agri-food trade in developing countries

Many developing countries rely heavily on agri-food exports for economic growth and foreign exchange. Among challenges such as weak physical infrastructure, poor governance and difficulties attracting finance, climate change has added an extra risk to trade and competitiveness.

The vulnerability of agri-food exporters to climate risk differs between regions, sectors and individual businesses. Vulnerability depends not only on biophysical conditions, but also a host of socioeconomic and institutional factors. For example, where rural livelihoods are almost entirely dependent on agricultural production, people are more vulnerable to the effects of climate change than regions where employment is more diversified.

The adaptive capacity of exporters is one way to measure their ability to respond to consequences (or opportunities) associated with change. In the context of climate change, adaptive capacity refers to the inherent ability of businesses to absorb climate shocks and buffer their impacts (USAID, 2013).

According to a framework originally proposed by Smit et al. (2001), the adaptive capacity of exporters to climate change depends on access to six resources:

- **Economic resources** (e.g. revenues and profits, access to credit and insurance)
- **Technology** (e.g. product transformation, storage and transport techniques)
- **Information and skills** (e.g. market information, climate risk analysis)
- **Infrastructure** (e.g. roads, electricity, Internet)
- **Institutional and policy environment** (e.g. political stability, supporting government institutions and policies on trade, exports, including trade agreements, sanitary and other standards, etc.)
- **Networks and partnerships** (e.g. linkages with producers and buyers, government contacts)

Those most vulnerable to climate change have high exposure, high sensitivity and low adaptive capacity. Agri-exporters, with little control over exposure and sensitivity to climate change, must rely on building adaptive capacity to improve business resilience.

The case of Uganda and Peru

Uganda and Peru attract significant foreign exchange from agricultural exports (55% and 12% of merchandise exports, respectively (FAO, 2014a). Both have ambitions to strengthen economic development by promoting expansion and value addition in their agriculture sectors (Republic of Uganda, 2010b; BCR-PROMPEX, 2014).

However, both countries are highly exposed to current and future climate hazards. In Uganda, prolonged droughts and more frequent flooding are major concerns. In Peru, climate concerns include extreme weather events associated with El Niño, along with water scarcity and glacial retreat. Both countries have seven of the nine characteristics of most vulnerable countries to climate change, highlighted in Article 4.8 of the United Nations Framework Convention on Climate Change (Table 1).

Maintaining agriculture export growth may be difficult for both counties as climate change is expected to reduce their agricultural productivity. Country-specific development challenges pose a constraint to businesses looking to build their adaptive capacity (see Box 1 and Box 2). There is a risk that climate change could reverse recent socio-economic gains in some areas.

Both countries have taken some action to plan for climate change, but are only beginning to detail risk assessment and build the capacity of exporters (or producers) to respond. Peru has developed an agriculture strategy that includes risk management and climate adaptation. However, there is little

emphasis on major export products other than coffee. There is a pressing need to better understand the challenges, strategies and needs of exporters in building adaptive capacity and responding to climate risk. A summary of the agri-export sector in each country and their current response to climate risks is presented in table 2.

Table 1. Countries most vulnerable to the adverse effects of climate change as highlighted by the UNFCCC

Countries with high vulnerability	Uganda	Peru
Small island countries;	x	x
Countries with low-lying coastal areas;	x	✓
Countries with arid and semi-arid areas, forested areas and areas liable to forest decay;	✓	✓
Countries with areas prone to natural disasters;	✓	✓
Countries with areas liable to drought and desertification;	✓	✓
Countries with areas with fragile ecosystems, including mountainous ecosystems;	✓	✓
Countries with areas of high urban atmospheric pollution;	✓	✓
Countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products	✓	✓
Landlocked and transit countries.	✓	x

Source: Adapted from UNFCCC, 2007 and MINAM, 2010a.

Box 1. Uganda: Country Profile

Uganda is an LDC looking to improve development prospects through higher productivity and better access to international markets. In many ways, it has been constrained by its geography (landlocked), high cost of business (including poor infrastructure and high transport costs) and a number of other barriers to trade. Globally, Uganda ranks 158 of 183 economies on the ease of trading across borders (World Bank and IFC, 2012). For agriculture, improved productivity and better market access will be fundamental to improving climate resilience at a national level. The agri-export sector is dominated by smallholder farmers and corporate exporters, many of which are multinationals.

Box 2. Peru: Country Profile

Peru is an emerging economy that has made significant development progress since the 1990s. However, growth has been unequal and poverty remains significantly higher in rural areas. While Peru has secured greater market access for its agricultural products, including through a number of free trade agreements, productivity remains low. In particular, marginalized communities in the Andes and Amazon face a number challenges in building technical capacity and in accessing markets, due to their remote location and poor connectivity to trading ports. The agri-export sector is dominated by smallholder farmers and large exporters, although associations and cooperatives are active exporters in many major sectors and promote research, extension, marketing and international standards compliance.

Table 2. Summary of context facing agri-exporters in Uganda and Peru

	Uganda	Peru
Agri-export sector	US$ 1.1 billion (2011) 71% land under agriculture 25% of GDP 80% of livelihoods dependent on agriculture	US$ 4.5 billion (2011) 19% land under agriculture 7% of GDP 25% of livelihoods dependent on agriculture
Key agri-exports	Coffee Tea Cotton Tobacco Fishery products Cereals (especially rice, beans and maize)	Coffee (especially organic) Asparagus, grapes, chillies and avocados Plantains and bananas Cocoa Fishery products Non-timber forest products
Climate impacts	Past floods and droughts have already led to decreased water availability and production and revenue losses due to crop and infrastructure damage. Climate change may accentuate these past impacts, but a lot of uncertainties exist due to limited availability of data and analysis.	El Niño and La Niña events regularly lead to massive losses of land, crops and fishery output. Reduced water availability due to glacier retreat will particularly affect key export crops on the coast, such as asparagus. Infrastructure, such as roads, remains vulnerable to extreme events
Adaptation responses	The National Adaptation Plan of Action prioritizes actions for climate-resilient agriculture. The National Development Plan and Export Strategy emphasize export diversification and value-chain approach, although explicit mainstreaming of climate risk is lacking.	National Climate Change Strategy, Action Plan on Adaptation and Mitigation, and sector-specific plan for risk management and climate change adaptation in the agricultural sector. Detailed response priorities for certain products and/or regions, but lack of practical actions for many export crops.
Elements of adaptive capacity	Strong focus on diversification of exports and export markets Growing awareness of climate risk at the national level Low competitiveness and weak business environment Landlocked country with weak transport links High production costs (inputs, energy, storage, etc.) Limited research capacity	Strong economic growth Good access to credit Stable political environment and advanced climate policy Low spending on research and development Weak access to technology Weak transport infrastructure

Chapter 2 Research methods

This chapter provides information on country-specific survey design and implementation, sampling methodology, basic characteristics and course of analysis.

1. Survey design

Surveys were the main tool for data collection. A semi-structured survey was developed covering socio-economic characteristics, export challenges (including climate change), adaptation responses and perceived needs. The initial qualitative survey was developed in 2012 and informed by a desktop study on the climate risks facing exporters in Uganda and Peru. Prior to implementation, the survey and general methodology were adjusted to suit local requirements after in-country pilots and in collaboration with key stakeholders.

The survey contained four sections:

- Business characteristics: including size, operational age, main products, main export destinations
- Business challenges, including climate variability and change
- Adaptive capacity and response to climate risks
- Support received and support needed to adapt

2. Data collection and analysis

Study participants were identified in each country through industry experts and business directories. The face-to-face questionnaire was used to collect data from 12 participants in Uganda and 24 in Peru.

Content analysis determined key themes emerging from the interviews. Triangulation between literature, survey data, focus groups and personal communication sources was also useful in confirming findings.

Uganda

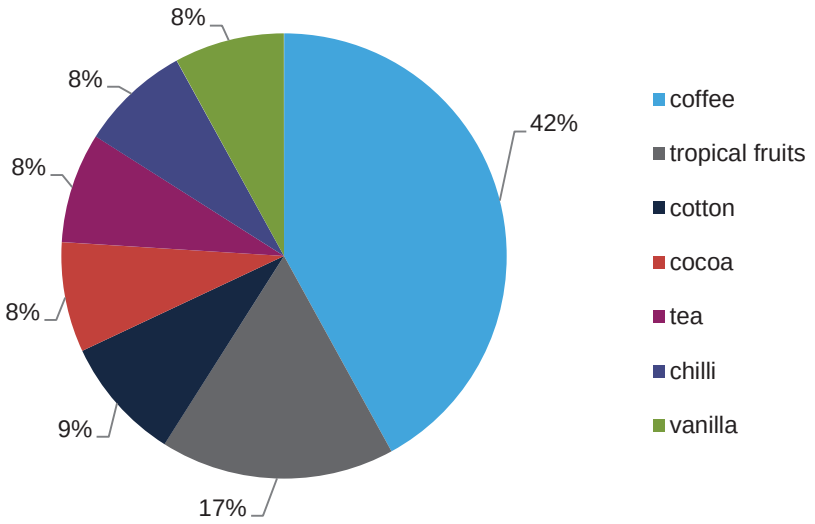
In Uganda, the survey took place between April and July 2013 and was conducted in English. Businesses were identified from a list of agri-food exporters was provided by the Uganda Export Promotion Board (UEPB). While 15 respondents were available and willing to participate in the interview, three provided incomplete data and were excluded from analysis. The remaining exporters represented diverse agri-food export industries, exporting coffee, tropical fruit (pineapple, banana, mango and passion fruit), cotton, cocoa, tea, dried chilli and vanilla (Figure 1).

Coffee berry from Uganda

The Uganda surveys were conducted face-to-face with business owners. The surveys covered companies in Kampala, Kasese, Lutembe, Bundibugyo, Fort Portal, Mityana and Mbale. For the majority, the exporter was based in Kampala with operations in the various regions. In general, the exporters surveyed were small (50%) or medium businesses (42%). (Size was defined

according to the number of employees: small businesses have fewer than 50 employees and medium have between 50 and 250 employees.) All of the exporters had been operating for at least five years and around two-thirds had foreign ownership of more than 50%.

Figure 1. Number of Ugandan exporters surveyed, by sector (percent)



Source: Authors' elaboration based on survey

The exporters' products were largely destined for Europe (mainly Germany, the United Kingdom of Great Britain and Northern Ireland, Spain and Switzerland). Only vanilla was exported to the United States. Cotton was exported to China and, to a lesser extent, Bangladesh and Thailand.

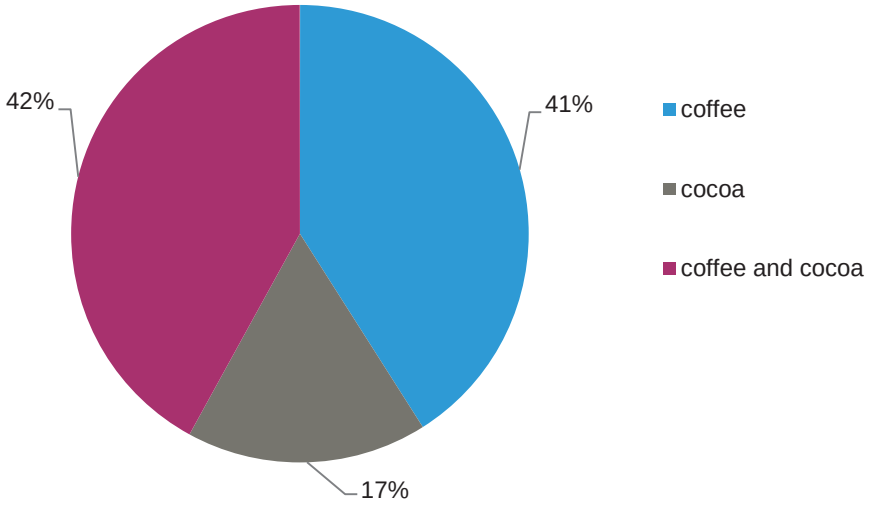
The products were mostly sourced from smallholder farmers. The tea and chilli exporters had their own estates, but also sourced from smallholders. Coffee, cocoa and vanilla exporters sourced from more than 3,000 smallholders, either directly or through middlemen.

Peru

In Peru, the survey took place between August and October 2013 and was conducted in Spanish. Coffee and cocoa were selected as two major export sectors for Peru. Exporters of coffee and cocoa were identified using national directories including CONCYTEC, AGROIDEAS and SIICEX. These directories were used to identify five to six exporters in each of four agro-climatic regions of Peru: Piura, Cusco, San Martin and Junín. These are all major producing regions and capture the diversity in Peru's climatic and agro-ecological factors (Box 3). Together, the four regions represent 56% of coffee production and 57% of cocoa production in Peru. A total of 24 exporters participated in the face-to-face survey (around 8% of the survey population), all of which could be classified as micro (fewer than 10 employees) or small enterprises (11 to 49 employees). All but two exporters were associations (29%) or cooperatives (58%), nearly all of which had at least 250 members.

The participants were major exporters of coffee, cocoa or both products (Figure 2). Coffee was mostly exported as green beans and cocoa as beans, powder, butter or paste. Only two cocoa exporters were also trading final chocolate products. Some also exported other agricultural products such as panela, beans, mangoes and grapes. All but two exporters had certification (mostly organic or Fairtrade) for their coffee and cocoa.

Figure 2. Number of Peruvian exporters surveyed, by sector



Source: Authors' elaboration based on survey

Box 3. Selection of regions in Peru

Four regions were covered by the survey: Cusco, Piura, Junín and San Martin. These are all major producing regions and were selected to capture the diversity in climatic and agro-ecological factors (Table 3, Figure 3).

- **Cusco**

Cusco, with over a million inhabitants, is the seventh most populated region in Peru. It is a highland region that is generally dry and temperate. There are two distinct seasons: the dry season and the rainy season. The average annual temperature ranges from 4.2°C–19.6°C.

Agriculture is a key economic sector accounting for over 50% of employment. In 2012, agricultural gross value of production (GVP) was US$ 453 million, mainly from potato, coffee, white maize and yucca (INEI, 2014)

- **Piura**

Piura lies on the north Pacific coast and is, after Lima, the second-largest region in Peru. Approximately 32% of its 1.8 million inhabitants are involved in agriculture (INEI, 2012). Piura is an equatorial coastal region with a warm climate all year round. The southern coast area has a semi-arid climate, with an average temperature of 26°C. The highlands are characterized by a sub-tropical humid and mild climate, averaging 15°C.

The mainstays of the economy in Piura are crude oil, agriculture and fisheries. Piura also hosts the second-largest port in Peru (Paita). The main agricultural products include rice, plantains, cotton, mangoes, limes, corn, coffee, bananas and cocoa (INEI, 2012). Agricultural GVP was US$ 531 million in 2012 (INEI, 2014).

- **San Martin**

San Martín lies at the edge of the Amazon basin. It is a poor socio-economic region and drug trafficking has generated a series of negative environmental impacts, such as deforestation, soil erosion, water contamination and the loss of biological diversity (Novak et al., 2008). The region is predominately sub-tropical with temperature averaging 23ºC–27ºC. Average annual rainfall is 1,500 mm. The eastern part of the region has heavy precipitation, thin soil, high forest cover and high biological diversity.

Palm oil is the main crop, with 91% of Peruvian palm oil grown in this region. San Martin is also the main rice and banana producing region. Yucca, tobacco, cocoa, yellow maize, bananas and coffee are also grown in San Martin. In 2012, regional agricultural GVP was US$ 679 million (INEI 2014).

- **Junin**

Junin is located in the centre of Peru between the highlands and the Amazon jungle of Peru (central Andean area). Climate varies in accordance with altitude, but averages 11ºC. In the inter-Andean valleys (mostly in Junín, Yauli, Tarma, Jauja, Concepción, Chupaca and Huancayo provinces) the climate is temperate and cold, with low humidity (dry); in the upper jungle and jungle (Chanchamayo and Satipo), the climate is warm and humid, with abundant rainfall from November to May.

Around 36% of the population is employed in the agricultural sector. Major agricultural products include potato, vegetables, grains, cattle and coffee. Other products in the Amazon basin include citrus, pineapples, bananas and avocados, and in the highlands include wheat, barley, quinoa and maca. In 2012, regional agricultural GVP was US$ 836 million (INEI 2014).

Source: Authors' elaboration based on survey

Table 3. Production of coffee and cocoa, by region in Peru, 2012

Region	Coffee		Cocoa	
	Area (1,000 ha)	Yield (kg/ha)	Area (1,000 ha)	Yield (kg/ha)
Junín	95.9	935	10.3	519
Cajamarca	65.2	1012	1.2	820
Cusco	53.7	894	16.6	335
Amazonas	48.8	793	6.7	429
San Martin	28.8	949	5.8	856
Puno	10.2	663	0.2	NA
Pasco	7.8	1010	0.3	NA
Ayacucho	6.4	678	8.8	708
Piura	6.3	355	1.0	543
Huánuco	4.7	506	4.8	480
Ucayali	2.3	1500	3.0	910
Lambayeque	1.1	479	0.0	NA
Total area / Average yield	331.7	903	59.4	603

Source: MINAGRI, 2011 yield data; MINAGRI, 2012 area data.

Figure 3. Four survey regions (in orange)

Source: Authors' elaboration based on survey

Chapter 3 Perceptions of agri-food exporters in Uganda

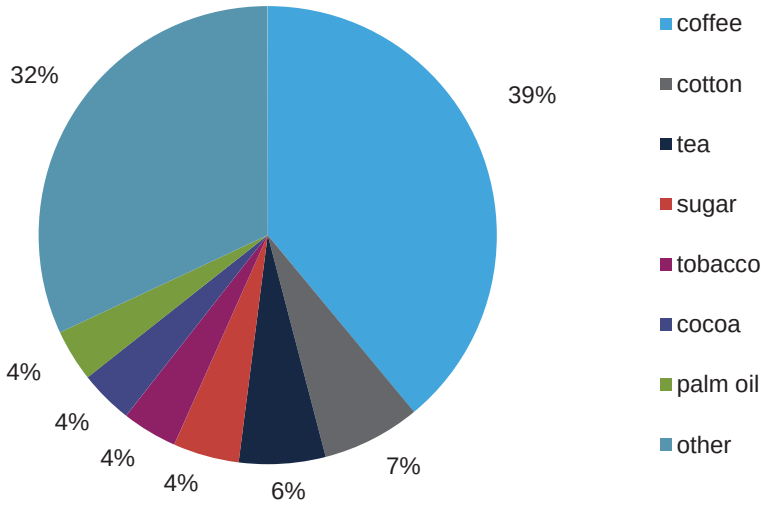
1. Agri-food production and trade in Uganda

Agriculture remains the mainstay of the Ugandan economy. In 2010–2011, the sector employed 67% of the population (UBoS, 2012) with women responsible for 50% of cash crop production (NAARI, 2003). An estimated 80% of the population derives its livelihood from agriculture indirectly (UBoS 2012). Export earnings also mainly come from agricultural commodities (45%). Nevertheless, like most developing economies, the share of agriculture to GDP has declined, from 51.1% in 1988 to 22.9% in 2011 (UBoS, 2012).

Traditional export products include coffee, tea, cotton and tobacco (Figure 4). These are mostly destined for the Common Market for Eastern and Southern Africa (COMESA), with a growing share destined for Europe (19%) and Asia (7%) (UBoS, 2012). Up to 15% of trade is informal, largely flowing to neighbouring countries, namely the Democratic Republic of Congo, Kenya, Rwanda, Sudan and Tanzania. To a large extent, this trade comprises shipments by bicycle or wheelbarrow of up to 200 kg, which do not require official registration.

Uganda has been diversifying its exports with non-traditional products such as fish and fish products (particularly Nile perch), flowers (mainly roses), fruits and vegetables (including cooking apples and bananas, hot pepper, chilli, okra, green beans, passion fruit, etc.), hides and skins, vanilla, sesame seed and cereals (especially rice, beans and maize). Organically certified exports account for less than 2% of exports (US$ 37 million in 2009–2010) (Willer and Kilcher, 2011), but have been increasing, particularly for coffee, cocoa and fruit.

Figure 4. Agriculture and livestock exports, 2011 (US$ 1.1 billion)



Source: FAO, 2014

Agricultural production is largely dependent on rainwater and managed by smallholder farmers. While exports continue to grow, the sector faces a number of constraints to expansion, including high production costs, inadequate storage and transport systems, and weak policy and institutional frameworks (AfDB, 2014). An estimated 65% of production is lost post-harvest (PSFU, 2012).

The Ugandan Government's development strategy is focused strongly on exports to achieve the country's national vision (Vision 2040), and agriculture is at the centre of its export diversification strategy. The

National Development Plan 2010–2011 to 2014–2015 (Republic of Uganda, 2010b) specifically aims at penetrating high-value markets in high-income countries for various agri-food products, including coffee, tea, maize, fish, beans, cassava, dairy cattle, beef cattle, poultry and bananas. These priorities are in line with those set out under other national programmes, the key objective of which is the promotion and development on value chains.

1.1. Coffee exports

Coffee is Uganda's main export product, contributing 22% of total goods trade in 2011 (US$ 466.6 million) (FAO, 2014a). Most beans are exported green, with only a handful of companies exporting roasted coffee (Ahmed, 2012). Coffee is cultivated in most districts of Uganda. Robusta accounts for 85% of production, with Arabica only produced in highland areas (mainly western highland, eastern Uganda (Mt Elgon) and West Nile). Both varieties require predictable rainfall during the year, with a two-month dry spell for flowering. Arabica coffee does not tolerate higher temperatures, which accelerate ripening and reduce quality. While Robusta can thrive at higher temperatures (up to 30°C), excessive heat can damage leaves and fruit, reducing both quality and yield.

1.2. Cotton exports

Cotton contributes export earnings of more than US$ 80 million annually (7% of total agricultural exports). In recent years, Uganda has been one of the top 10 organic cotton producers in the world (Truscott et al., 2011). While cotton is generally high quality, production levels have been erratic (PSFU, 2012). Cotton is used for textile, cotton wool, edible oil, seed cake and soap production, but local infrastructure is limited, with only two textile factories and a dozen privately owned cotton seed crushing and oil extraction facilities, located in various parts of the country. Most of the cotton is exported as raw product (baled cotton) through international cotton trading companies to India, China, Thailand, Malaysia, Indonesia, South Korea, Switzerland and the United Kingdom (Cotton Development Organization, 2011).

Cotton is produced in all regions, but is dominant in the east and north. Production is rain-fed and grown in rotation with other crops. Production relies on a long growing season and can be sensitive to excessive rainfall, pests and disease outbreaks. More than 150,000 smallholders grow cotton on a regular basis, typically on plots smaller than 1 hectare.

Cotton is a dominant crop in the eastern and northern parts of Uganda (© Luis Alejandro Bernal Romero)

1.3. Tea exports


Many smallholders work in tea production in East Africa

Tea is the third-largest agricultural export, contributing 6% of export earnings (around US$ 72 million in 2011). Uganda is Africa's third-biggest tea producer after Kenya and Malawi. Around 70% of Ugandan tea is sold via the Mombasa tea auction in Kenya, with 20% sold in direct sales and the remainder sold locally (Kiwanuka and Ahmed, 2012). There are 12 processing and exporting companies (BoU, 2011).

Tea is mainly produced in warmer, low-altitude areas of Uganda, including the central and south-western regions, Lake Victoria crescent, the lower Rwenzore Mountains and above the Western Rift Valley. Around 10% of arable land is planted for tea production (FAO, 2012). Tea is grown by smallholder growers (54%) and large tea estates (46%). Many small growers are affiliated with a particular tea factory or grower association. In recent years, a number of smallholders have entered tea production as it provides year-round income and entry costs are low (Kiwanuka and Ahmed, 2012).

2. Climate change in Uganda

Uganda is an LDC with high poverty. Due it its equatorial climate, it is subject to a number of climate risks, including higher temperatures, increased rainfall and extreme weather events.

2.1. Uganda's climate

Uganda experiences relatively humid conditions and moderate temperatures throughout the year, with mean daily temperatures of 28°C (UNDP and BCPR, 2013). Its climate is bimodal in the south, exhibiting two rainy seasons (March to June and October to January), with the exception of the northern-easterly region, which experiences one long rainy season (Republic of Uganda, 2007, FAO, 2014a).

The mean annual rainfall in Uganda ranges between less than 900 millimetres in the driest districts to an average of above 1,200 millimetres per year in the wettest districts located within the Lake Victoria Basin, eastern and the north-western parts of Uganda (Republic of Uganda, 2007). Three different climates characterize the country: the highland climate with cool temperatures and moderate rainfall, the savannah tropical climate in the central and western parts of the Lake Victoria Basin, and the semi-arid climate with high average temperatures and low and unpredictable rainfall (Republic of Uganda, 2007). Uganda's agro-ecological diversity characterizes it as having high potential, which can feed into agricultural biodiversity (McDonagh and Bahiigwa, 2002).

Floods and droughts are the most frequent climate hazards. Drought especially affects the "cattle corridor", the country's dryland area running from the north-east to the south-west and dominated by pastoralism. The northern region is also especially vulnerable to both floods and droughts (FAO, 2014a).

2.2. Vulnerability to climate change

While trends are uncertain and data remain limited, the main climate-change impacts expected to affect agriculture in Uganda in the future include higher temperatures, more erratic and heavy rainfall, change in the timing and distribution of rainfall, and an increase in the frequency and duration of droughts.

Climate models differ, but several estimates suggest that Africa will likely be hardest hit by climate change and that temperature increases in parts of Africa could be double the global average. East Africa has

experienced a significant increase in temperature since the beginning of the 1980s (Niang et al., 2014, Anyah and Qiu, 2012).

The future impacts of climate change are expected to include:

- **Temperature:** A significant warming has been measured in Uganda and is projected to continue. Estimates suggest that temperatures are likely to continue to increase between 0.7°C and 1.5°C by 2020–2029 and between 1.5°C and 4.3°C by the 2080s (Hepworth and Goulden, 2008).

- **Precipitation:** Average annual rainfall in Uganda could increase by as much as 7% by 2080 (UNDP and BCPR, 2013). Inter-annual rainfall variability is already high, and precipitation patterns are likely to be even less predictable as the climate changes in the future. The impacts of climate change may vary considerably between regions, with drier areas likely to receive less precipitation and wetter areas likely to receive more. There is a projected increase in rainfall during the dry season in all locations (USAID, 2013). Most of the agriculture in the country is rain-fed, which makes farmers more vulnerable to variability in climate, especially to erratic rainfall (Bashaasha et al., 2012; Ellis et al., 2006).

- **Extreme weather events:** Climate change is expected to increase the frequency and intensity of extreme weather events as hydrological cycles intensify in a warming atmosphere. Storms and high winds on the lakes could cause infrastructure damage (Timmers, 2012). Prolonged drought is expected to increase the number of wildfires (Republic of Uganda, 2007).

2.3. Potential impacts on the agri-export sector

Uganda's agriculture sector is highly vulnerable to these climate risks. Changes in rainfall, runoff and soil moisture will affect agricultural production directly as well as indirectly through changes in production areas, infrastructure damage (including transport, storage and communication), post-harvest losses and potential changes in comparative advantage. Some of these have already affected parts of Uganda:

- **More frequent droughts:** Analysis of historical data shows significant drought episodes increasing from every 20 years in the early 1900s to every five years now (Republic of Uganda, 2010a).

- **Decreased water availability:** Between 1955 and 1990, the glaciers of the Rwenzori Mountains retreated 40% (Republic of Uganda, 2007).

- **Quality and revenue losses:** Extreme flooding and droughts have resulted in crop destruction, degradation of crop quality, reduction in milk production and death of animals, and biodiversity losses including loss of spawning areas for fish (Hepworth and Goulden, 2008; Republic of Uganda, 2007; UNFCCC, 2002).

- **Infrastructure damage:** Climate volatility in 1997–1998 contributed to US$ 400 million in road damage, causing a 60% decline in coffee exports between October and November 1997 due to a disrupted transport system (UNFCCC, 2002).

The impacts are likely to vary between industries. However, the production area and yield for coffee, cotton and tea are each likely to decline.

- **Coffee** is very sensitive to rises in temperature. Uganda Coffee Development Authority (2010) attributes the overall decline of coffee production in Uganda over the last 40 years to climate variability in combination with other factors (e.g. old trees, soil fertility problems). Robusta and Arabica varieties have different vulnerabilities to climate change. Higher temperatures are predicted to dramatically decrease areas suitable for Robusta coffee production, with only higher areas remaining suitable (Simonett, 1989). Between 2007 and 2009, drier weather increased Arabica volumes by 30% while Robusta volumes declined 11% (PSFU, 2012). In addition, higher temperatures have been recognized as a cause of coffee mealy bugs (Republic of Uganda, 2010b). Warming trends in East Africa are a serious threat for coffee production (Jaramillo et al., 2011). Notably, these may cause the spread of the coffee berry borer (Hypothenemus hampei) in

previously colder areas where its presence and damage have been limited to date (Soto-Pinto, Perfecto and Caballero-Nieto, 2002).

- **Cotton** would benefit from higher temperatures and elevated carbon dioxide levels under climate change. However, reduced water availability is expected to more than offset these benefits (ITC, 2011b). For example, drought in 2009 decreased the cotton harvest by 50% (ITC, 2011a). Inadequate water availability reduces the yield and quality of cotton production. Cotton is also very sensitive to waterlogging, especially during the flowering season.

- **Tea** is highly dependent on rainfall and vulnerable to drought. In Uganda, tea is grown in relatively low areas. Tea is highly sensitive to higher temperatures, which cause leaves to wilt and a quality decline. Research suggests that the area suitable for tea production will decline significantly by 2050 (CIAT, 2011).

For annual crops, such as maize and beans, production may become unviable due to climate change as the risks of total crop destruction by extreme weather events increase (UNDP and BCPR, 2013).

Climate change is also expected to exacerbate pest and disease risks. Since 1993, coffee wilt disease (CWD) may be responsible for the destruction of more than 50% of Robusta coffee trees in Uganda, costing the industry up to US$ 9.6 million per year (Phiri and Baker, 2009). Uganda has also been affected by black twig borer (coffee), bacterial wilt (banana), cassava diseases and other tick-borne diseases. Climate change increases the risks of disease and pest populations. For example, coffee leaf rust and coffee berry disease are now being observed at higher altitudes (IISD, 2011).

Rail infrastructure is limited in Uganda with most goods transported by road (©flikr/John Hanson – U.S. Army)

In contrast, some agriculture sectors and regions are expected to benefit from climate change. For example, El Niño impacts in 1997–1998 increased tea and livestock production in some arid areas of Kenya due to improved water stocks and fodder availability (ICRAF, n.d.). Higher temperatures could enable new, previously unsuitable crops to be grown (for example, cassava is now growing in the Rwenzori Mountains) or may increase crop yield for others (such as potatoes) (Republic of Uganda, 2007).

2.4. National policies for climate-change mitigation and adaptation

In spite of its limited economic resources, the Government of Uganda has taken several steps to review climate-change risks and address mitigation and adaptation needs.

In 2007, Uganda introduced a **National Adaptation Programme of Action (NAPA)** under the guidance of the UNFCCC and UNEP. The plan helped to identify new priority activities to respond to immediate adaptation needs (those that for which delay would increase vulnerability and costs at a later stage). However, their implementation has been hampered by lack of funding and poor coordination.

In 2008, Uganda established a **Climate Change Unit** within the Ministry of Water and Environment with the objective of strengthening the country's implementation of the UNFCCC and the Kyoto Protocol. As one initiative, the Unit is looking to develop guidelines to mainstream knowledge on climate change and adaptation methods among local governments.

The Ministry of Agriculture, Animal Industry and Fisheries has integrated climate threats into its most recent **Agriculture Sector Development Strategy (DSIP 2010–2011 to 2014–2015)**. The DSIP was developed using climate-risk assessment and aims to better evaluate adaptation priorities, focusing initially on the regions and sectors most vulnerable to climate impacts. For example, the current DSIP will include

pilot projects to improve water efficiency for livestock and support research for drought-resistant crop varieties.

Climate risks have not been included in agriculture subsector strategies (including crops, livestock and fisheries strategies). However, the government is looking to integrate climate change in the next revision of these sector strategies.

The Ugandan Carbon Bureau is also acting to support Clean Development Mechanism projects by allowing organizations to register their activities that generate carbon credits. The Bureau offers support in preparing project proposals, undertaking baseline assessments and registering projects through the UNFCCC. The activities to date have mainly been rural energy, energy efficiency and forestry projects.

3. Survey results

The results of the agri-exporters survey conducted in Uganda are presented in this section. The survey assessed the perceptions of 12 exporting businesses to climate change.

3.1. Perceived climate impacts on business

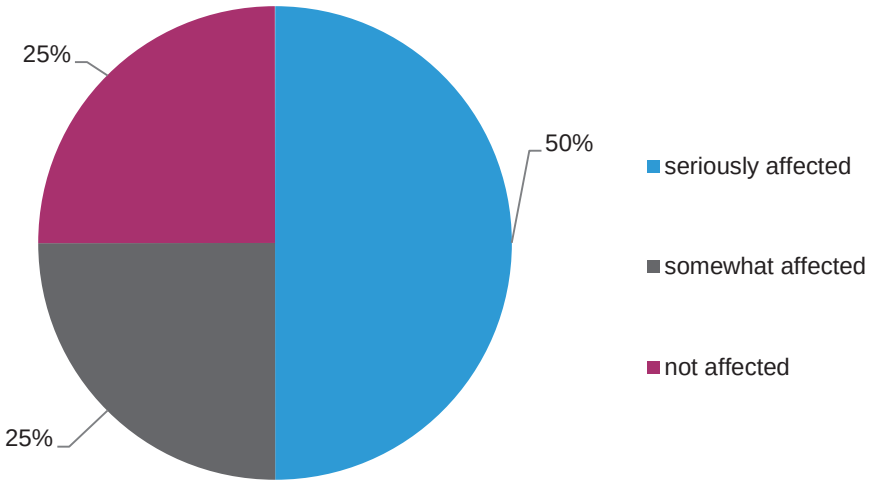
Mostly negative impacts associated with climate hazards

In the 12 months before the survey was carried out, climate hazards significantly affected 50% of exporters and somewhat affected 25% of exporters. Only 25% of exporters surveyed had not been affected by climate hazards (Figure 5).

For 75% of respondents, the impacts of climate hazards were only negative. These impacts included crop losses due to drought and hailstorms, fruit fly outbreaks associated with excessive rain, declines in production quantity and quality as a result of rainfall variability, and difficulty in harvesting and drying crops due to excessive rainfall. Some exporters had difficulty meeting contracted supply arrangements.

For 25% of exporters, the impacts of climate hazards were mixed. For example, higher temperatures and associated humidity benefitted cocoa and vanilla production, but concerns remained that these gains would be offset by higher rainfall (e.g. reducing vanilla harvest from two seasons to one season a year).

Figure 5. Perceived impact of climate hazards over the past year



Source: Authors' elaboration based on survey

Climate change is perceived to exacerbate other challenges facing exporters

Exporters in Uganda face many disadvantages on world trading markets. High operating costs, particularly for transport and energy, were the most commonly reported challenge, followed by market competition (Figure 6). Many exporters were struggling to compete with overseas producers and meet market requirements. Low and inconsistent product quality was a concern for exporters of coffee, cocoa, cotton and fruit.

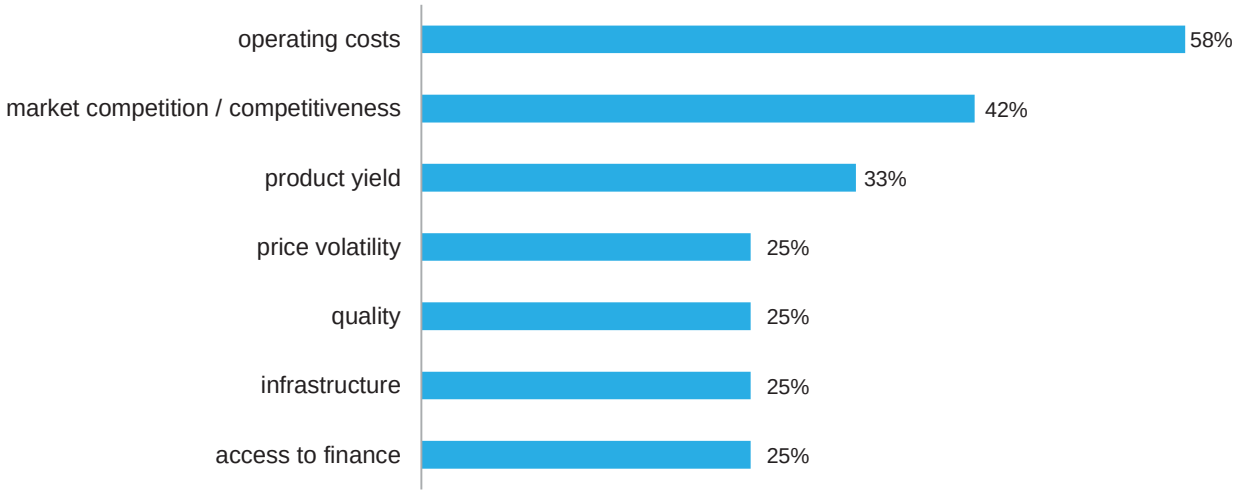
> "Market demands have changed and sustainability has become a very important requirement, even a must"
>
> -Coffee exporter, Kampala 2013

> "The more the temperature and humidity increase, the more areas where cocoa and vanilla can be grown"
>
> -Cocoa and vanilla exporter, Kampala 2013

Ugandan exporters lose market share due to limited storage facilities and poor infrastructure. Infrastructure bottlenecks can lead exporters to stop buying products. As a result, farmers lose income and post-harvest losses can be high. Furthermore, as Uganda is landlocked, products must pass through other countries such as Kenya. Consequently, trade takes longer, is more costly and can depend on the politics of the transit country.

Two-thirds of exporters believed climate change was of equal or greater importance than their greatest export challenges. The main concern was decline in production quantity. One exporter said changing climates overseas were also relevant. For example, longer summers in Europe can increase production and thereby reduce demand for Ugandan fruit.

Figure 6. Key trade challenges for agri-food exporters (% of survey responses)

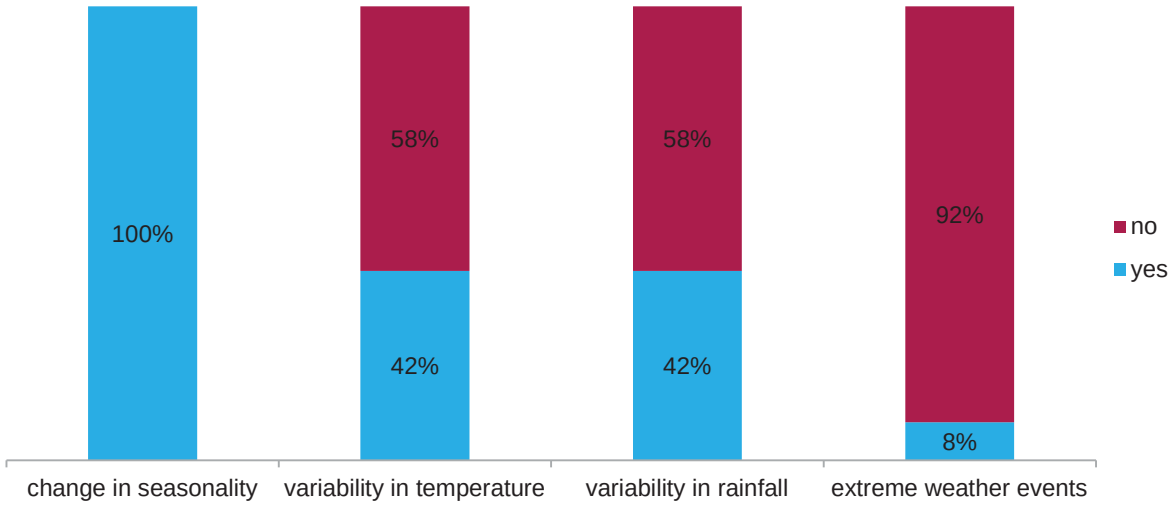


Source: Authors' elaboration based on survey

3.2. Direct and indirect impacts

All exporters surveyed reported changes in seasonality associated with climate change in the past 5-10 years. Around 40% had experienced temperature variability and 40% experienced unpredictable rainfall. Only 8% had experienced extreme weather events, although many reported excessive rainfall, hailstorms and droughts.

Figure 7. Perceived climate impacts in the past 5-10 years



Source: Authors' elaboration based on survey

The most notable consequences of these climate impacts were crop losses, reductions in performance and quality, delays, and additional business costs.

Crop losses: Prolonged rains have increased the incidence of landslides, erosion and runoff affecting cotton, coffee and fruit exporters in particular. Cotton exporters reported out-of-season rains to be the main concern, with some flowers rotting in 2012. Banana yields have declined as a result of pest outbreaks. Poor drainage in many agricultural regions means that farmers cannot cope with excess rainfall. Drier weather and higher temperatures also affect fruit production. Passion fruit, once harvested in January and June, is now harvested only in June. This has reduced revenue by up to 50% for some exporters.

> "Climate change can be quite dramatic as our company depends on climate both for production and processing. It leads to insecurity. Even if the crop is good, there is uncertainty as to whether it can be processed at a competitive cost.
>
> -Fruit exporter, Lutembe 2013

Productivity and quality: Several exporters reported declining crop yield and quality. Unpredictable weather has reduced performance and quality of spices, fruit, maize and cotton in particular. Higher temperatures have caused early flowering and reduced yield and size for fruits, lowering farmers' incomes. Tea has matured too quickly, reducing quality. Tea companies have estimated losses of 5%-10% in their income due to temperature variations. Drought has cut coffee production and trade in central and south-west Uganda. Extended rains have reduced harvest quantities of vanilla.

Flooding causes transport delays in Kampala, Uganda (© flickr/350.org)

Processing delays and additional costs: Processing delays have affected exporters, adding to production costs. Prolonged rain has hampered road access, affecting the transit of coffee and tobacco, while heavy rainfall has also made energy supplies unreliable. Processing plants run below capacity as quantities are reduced. Fruit processors are unable to use the sun and warm air for drying. Exporters' sales have become more volatile and unpredictable. Changes in supply-chain operations have strained relationships between exporters and their suppliers.

3.3. Sector impacts

In Uganda, cotton, coffee and tea exporters are particularly concerned about climate change.

Coffee: Droughts in the coffee sector, particularly in central and south-west Uganda, have reduced yields and slowed the ripening process. During the harvesting season, droughts wither coffee trees and turn green leaves pale. Rain helps coffee cherries ripen and enables them to absorb water, which allows swelling and coloration. Without rainfall, the cherries turn yellow with little or no mucilage, making them hard to pulp. On the other hand, heavy rain disrupts exports as it leads to problems in drying the berries, storage and transportation. Over time, higher temperatures are likely to decrease the suitability of some coffee-growing areas. Coffee exporters have built resilience by sourcing from diverse regions around Uganda. Smallholder farmers that rely on their own production are more vulnerable.

Cotton: Drought in the cotton sector can cause crop failure. In 2009, a severe drought during the ideal planting window (June to early August) led to a decline in production. Extended rains in 2012 reduced cotton harvest by 10,000 bales as the cotton rotted. Exporters found that smallholders had begun to shift away from cotton production during drought periods, making it difficult to maintain export viability.

> "A failure of the crop due to the lack of rain is a disaster for the farmer and has a financial impact that can be felt for a long period. Almost four out of seven seasons have been disturbed by unpredictable rains."
>
> -Cotton exporter, Kasese 2013

Tea: Climate change reduces the quantity and quality of tea harvested. Traditionally, tea in Uganda is grown in colder, relatively higher altitudes. A report released by the International Centre for Tropical Agriculture (CIAT, 2011) predicted that rises in average temperature will make some of Uganda's most lucrative tea-producing areas unsuitable for tea production. Furthermore, rising temperatures lead to increased attacks from pests and diseases and steep declines in tea production.

Fruit and spices: Some fruits and spices, including passion fruit and vanilla, will not flower when it rains, and fruit can die at higher temperatures in insufficient shade. One vanilla exporter reported estimated loss in sales of almost 50%.

Cocoa: Changes in climate have had a positive impact on cocoa production in Uganda. More regions will become suitable for cocoa growing if temperatures continue to rise in the coming years (Box 4).

Box 4. Case study cocoa: Could Ugandan exporters benefit from climate change?

In contrast with most other products, exporters perceived that cocoa production would benefit from changes in climate, particularly predicted rises in temperature and humidity levels. In Uganda, cocoa has traditionally been grown in the Bundibugyo area bordering the Democratic Republic of Congo. However, as seasons become less pronounced and rainy seasons extend, the sector is considering opportunities for expansion. Specifically, there is interest in converting tobacco and coffee plantations to cocoa plantations.

Cocoa can already be produced year-round, causing fewer buying peaks than other cash crops. This benefits farmers who can develop a constant income stream and more readily manage their finances. Buyer relationships in cocoa are also less strained.

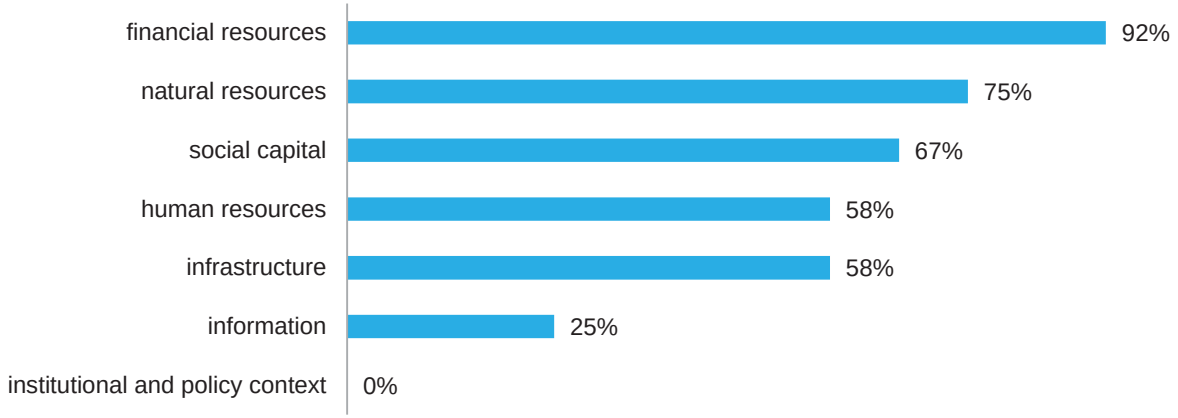
However, many exporters face high transaction costs for entering the sector. In the 1970s, the Government of Uganda made some efforts to support cocoa growing by establishing nurseries and processing facilities. According to Esco Uganda Ltd, limited support is available and the country is missing out on an industry with significant domestic potential.

Despite limited support, Esco developed several nurseries and employed field staff to promote cocoa plantations on smallholder farms under a cost-sharing relationship with GIZ. Esco Uganda has also invested in storage and processing capacity for cocoa since 2000. Cocoa plants take three years to produce fruit, so support for the upfront investment is needed to encourage a shift in smallholder behaviour. While Esco has made this investment, it also bears the risk that new buyers will enter the market once production is established and expected returns will not be captured.

3.4. Agri-food exporters' resilience and adaptive capacity

The vulnerability of agri-exporters to a changing climate depends on their sensitivity and their capacity to adapt to climate change. Following the framework set out in chapter 2 (Smit et al., 2001) agri-exporters described their resilience in terms of the seven factors influencing adaptive capacity: natural resources, financial resources, technology and informational resources, infrastructure, institutional/policy environment, human and social capital. In Uganda, financial resources were perceived to be the greatest challenge to building exporters' resilience.

Figure 8. Perceived impacts of climate change on adaptive capacity



Source: Authors' elaboration based on survey

Financial resources

All but one exporter believed their financial capacity was inadequate to respond to climate change. Ugandan exporters have limited access to economic resources, partly due to corruption and high interest rates. According to exporters, interest rates can be as high as 20%-25% per month, and in some cases more than 100% a year. Cooperative exporters (owned and managed by smallholder farmers), such as those for cotton, found it particularly difficult to access loans. As trust between farmers and banks is already low, climatic events and associated crop losses can create difficulties both in repaying debt and accessing finance and insurance.

Natural resources

The majority of Uganda's exporters believed that climate change would affect natural resources. Ugandan farmers face difficulty with optimal management of land resources due to lack of land ownership and increasing land fragmentation associated with deforestation and urbanization. Lack of land ownership creates a disincentive for farmers to appropriately manage natural resources and obstacles to implementing adaptation measures. For example, according to fruit exporters, growers have difficulties guaranteeing organic quality.

Increasing population density and urbanization have fragmented farm land and average farm size has been shrinking. This makes it difficult for farmers to realize economies of scale and to diversify production in order to build climate resilience. Tea and cocoa exporters, for example, have been unable to expand production or purchase new processing facilities due to higher land prices.

Climate change-driven water scarcity is also a concern for exporters of cotton, tea, cocoa and vanilla. Many are taking steps to construct dams and plant shade trees to reduce water losses.

Social and human capital

Coffee, tea and cotton exporters are part of national associations or cooperatives. The tea association in particular has helped exporters by improving the sector's ability to contribute to government negotiations and access finance. Developing and strengthening these partnerships is important for developing both formal and informal skills and sharing knowledge and innovative solutions between value chain actors.

> "It is hard to plan with the farmers. We encourage them to grow (a particular crop), but due to the shift in seasons, the produce becomes available when we don't have the market anymore. This leads to a lot of frustration and problems."
>
> -Fruit exporter, Kampala 2013

Almost 60% of exporters surveyed thought that poor human capital could affect their resilience to climate change. The knowledge and skills to help small-scale farmers adapt to climate change are limited, and high levels of illiteracy affect the uptake of new technologies. For example, vanilla exporters shared concerns that harvest was picked too early, reducing quality. The number of extension workers is also insufficient. For example, the cotton growers' cooperative has five extension workers for 15,000 farmers.

Infrastructure

More than 58% of exporters saw infrastructure as inadequate for responding to climate change. Freight and cargo costs reduce the competitiveness of Ugandan exports relative to neighbouring countries, such as Kenya and Tanzania. Storage facilities are also inadequate for some products, contributing to post-harvest losses and reduced quality. Poor infrastructure creates difficulties in maintaining quality consistency and responding to unexpected market fluctuations.

Almost all the surveyed companies complained about the unreliable and expensive electricity supply. Consistent electricity shortages and low voltage damage machines, which must be repaired regularly. High electricity bills, machinery repairs and damage to crops in storage considerably increase costs of production for exporters.

Exporters in the fruit sector have tried to reduce their reliance on electricity by improving the efficiency of dryers and investing in biogas to lower energy consumption. Biogas digesters are also being tested out in the coffee sector for drying.

Transport costs account for nearly three-quarters of exporter costs. Most surveyed companies commented on the improved road network, especially compared to the situation five years ago. However, the situation is still challenging for some of the companies, especially during the rainy season and for those operating in hilly or mountainous areas. Fruit producers, for example, were unable to access farmers during the rainy season due to poor road networks. As a result, exporters are more frequently obliged to heavily invest in expediting crops from the field to meet buyer contracts.

Information resources

> "Building and maintaining trust with farmers is very important and sometimes very challenging. Farmers lose trust if you are not able to link what you teach them to reality."
>
> -Coffee exporter, Kampala 2013

Access to timely market and climate information via reliable and affordable Internet and telecommunications links can increase exporters' capacity to adapt to climate risks. For example, weather forecasts are crucial for determining the success of agri-enterprises. Exporters reported that few meteorological centres remain in operation in Uganda, and most are ineffective due to mismanagement. The Government of Uganda recognizes the impact of inadequate and inefficient flow of information to businesses, including farmers (Republic of Uganda, 2007).

While a quarter of respondents viewed lack of information as creating climate vulnerabilities, half saw the lack of reliable climate and weather data as a business risk, including cotton, chilli and coffee exporters. There is little confidence among exporters that governments will revive meteorological institutes. One exporter recommended that producer associations be supported to collect climate data.

Internet access has improved in Kampala, but remains fragmented in regional areas. This has forced most exporters to base trading operations in Kampala in order to maintain access to price data and communicate with buyers.

Institutional and policy environment

Uganda has made some progress in liberalizing trade, such as through the East African Community (EAC) Customs Union and the Common Market for Eastern and Southern Africa (COMESA). Most exporters think they are operating in an effective policy environment. However, they remain concerned about the prevalence of non-tariff barriers. For example, tea exporters are subject to 48 different taxes.

> "Climate variability is a reality in the country. Everybody agrees that something should be done."
>
> -Coffee exporter, Kampala 2013

Specifically on climate policy, exporters feel that there remains a disconnect between agriculture, trade and environment policies. The government has limited capacity to fund research and development in climate-resilient crop varieties. Nevertheless, exporters did not perceive that climate impacts had weakened the institutional and policy environment.

3.5. Agri-exporters' adaptation responses

Three-quarters of Ugandan exporters were taking some action to build resilience to climate change. One exporter claimed it was not acting on climate change, but was promoting good agricultural practices among suppliers to reduce vulnerability to weather variation and extremes. Of the other two exporters not taking measures, one perceived climate change impacts to be too big to tackle as a small business, the other claimed a lack of capacity and know-how on how to reduce climate risks.

Sustainable agriculture practices

Of the exporters already taking action, the strategies to improve resilience have been mostly at the producer end of the supply chain. Exporters have encouraged or supported suppliers to plant trees (especially shade trees) and implement more sustainable practices for soil conservation and water management. One exporter had supported suppliers in implementing drip irrigation.

Checking for pests and diseases in Kawanda, Uganda (© Neil Palmer – CIAT)

Forest and wetland conservation was also seen as an important measure. Several exporters saw deforestation and increasing population density as the root cause of rainfall variability. However, they considered such measures as the responsibility of government rather than individual exporters.

Diversified supplier base

Two exporters were responding to climate variations by expanding or shifting their pool of suppliers to new regions. Because climate hazards such as drought and storms have often been localized, exporters have managed risk by building relationships with buyers in different regions.

Technologies to improve supply-chain efficiency

Fewer exporters were taking actions to improve climate resilience in processing and transport. An exporter of pineapples and bananas had shifted to solar dryers and was looking at the viability of biogas produced from pig farming. Cocoa and coffee exporters had invested in heavy-duty vehicles to cope with Ugandan roads. Cocoa, coffee and cotton exporters had also added drainage systems around their processing facilities to adapt to periods of intense rainfall.

> "Climate hazards do not yet have a crucial impact as we buy in the whole of the country. (Uganda) has so many different regions with their own flowering periods that there is always enough production. Climate change is not an issue yet, but it does form a future threat."
>
> -Coffee exporter, Kampala 2013

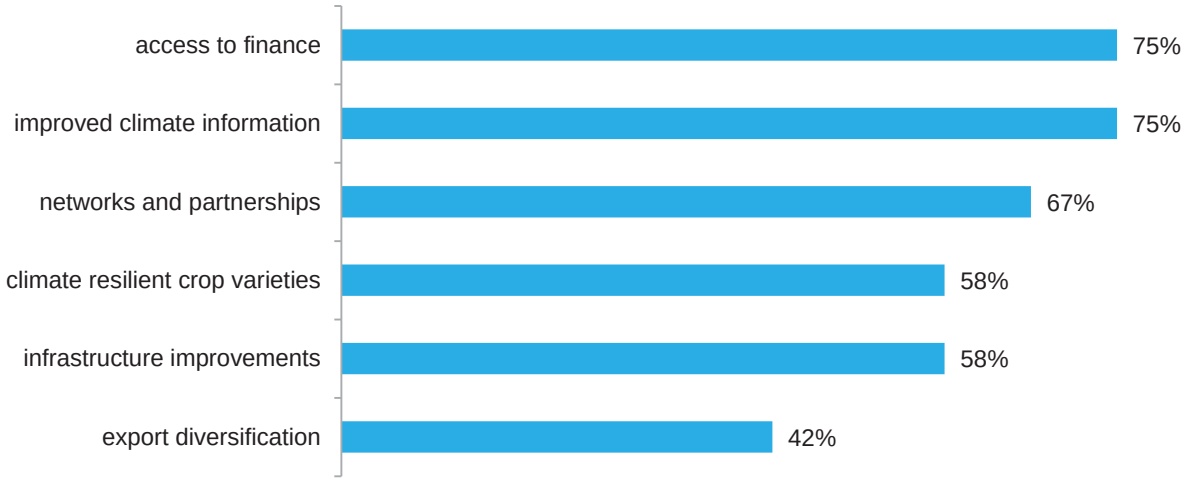
Improved climate information

Only one exporter had taken steps to collect additional data on weather and climate patterns. Data are collected from farmers' rain gauges and combined with satellite weather information. The exporter works with a consultant to evaluate supply-chain implications.

3.6. Support needs identified by agri-exporters

The most common adaptation measures that would support exporters in Uganda in adapting to climate change were perceived to be access to finance, improved climate information and better networks and partnerships (Figure 9). Three-quarters of respondents highlighted the need for improved financial services in order to invest in climate adaptation. Three-quarters also believed that improved knowledge of climate change impacts would help them to prepare for and manage risks.

Figure 9. Additional measures needed to respond to climate-change impacts



Source: Authors' elaboration based on survey

Access to finance

Exporters thought that poor access to finance limited their capacity to invest in sustainable practices or infrastructure improvements to adapt effectively to climate change. Some exporters also demand finance in order to expand and diversify their facilities. One exporter would like finance to be able to establish weather-monitoring and climate-research activities. Smaller exporters and cooperatives had the most difficulty accessing finance, with larger, international companies facing fewer constraints. Finances were also important for exporters to shift sourcing to new regions or diversify their export base. Improving

access to financial services, in particular savings and credit products, would increase opportunities for smallholder farmers and exporters to adopt more efficiency technologies and improve resource allocation to build resilience.

Climate information

Additional climate information was important for exporters looking to build climate resilience. Uganda has limited meteorological services and climatic data are limited. Access to reliable information is needed to enable producers and exporters to respond to climatic extremes.

Due to the costly nature of weather and rainfall data collection, exporters in the coffee industry suggested that data collection could be coordinated by the industry through the Uganda Coffee Federation (UCF). Other exporters noted the need for building the capacity of the Uganda Meteorological Department and Uganda Bureau of Statistics (UBOS) and creating weather information centres at village level. This is done by involving local farmers, pastoralists, extension workers, schools and other actors in collecting, summarizing and interpreting hydrological, meteorological and impact data on crop yields and ecosystem changes.

Networks and partnerships

More than two-thirds of exporters saw that improved networks and partnerships were required to assist in adapting to climate change. Stronger relationships between farmers and buyers were seen as particularly important in coordinating responses to climate volatility and reducing harvest and post-harvest losses. New partnerships or exporter associations could benefit Uganda to deliver effective extension services. To date, exporters have not been successful in delivering adaptation training to farmers because of poor understanding and a lack of incentive to implement changes. Networks and partnerships could form new ways to share information and collectively respond. In addition, spice exporters said new partnerships could provide a mechanism for undertaking research, funding seed banks and attracting government support to respond to climate change.

Crop varieties

Around half of exporters expressed a need for improved climate-resilient crop varieties. One coffee exporter had begun to host breeding trials for drought-resistant coffee varieties and optimal production systems for soil and water conservation.

Infrastructure

Exporters agreed that improved infrastructure was needed to reduce the cost of trade. Investment in road access, alternative energy and additional storage were needed to improve competitiveness. Although infrastructure used in primary processing, disease control, quality assurance and water use was seen to be inadequate, several exporters also saw the need to increase irrigation infrastructure or introduce new technology for irrigation efficiency. For example, drip irrigation had proven useful for those fruit and spice producers that could afford it.

Export diversification

Exporters identified the need to diversify exports in response to climate volatility. Several exporters were looking at diversification, such as integrating cocoa exports into their trade mix. Some exporters believed that farmers needed additional support to diversify production to build climate resilience. For example, several banana growers rely on Matoke banana monocultures, which can be vulnerable to extreme weather events. The benefits of diversification though the planting of shade trees, such as mango, were also reported.

Chapter 4 Perceptions of agri-food exporters in Peru

1. Agri-food production and trade in Peru

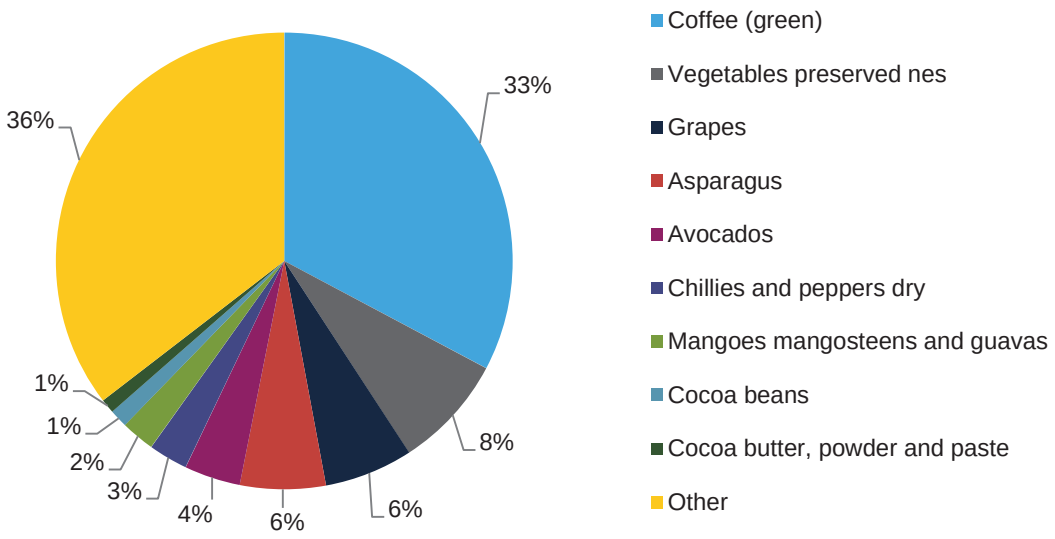
Agri-food exports have increased rapidly in Peru since the 1990s, when the government implemented a number of reforms to liberalize trade. Several international agreements have helped promote the expansion of agricultural exports, notably the United States Andean Trade Preference Act (1991), the Law on the Promotion of the ecological agriculture (Law 768-2006-CR) and a number of free trade agreements, including with the United States, the European Union, Japan, Mexico, Singapore, Chile and China. Today, agriculture (including hunting and forestry) employs 24% of the Peruvian labour force and contributes 7% of GDP (BCR-PROMPEX, 2014).

The main agricultural exports of Peru are coffee, preserved vegetables, grapes, asparagus, avocados and chillies (Figure 10). Coffee is the primary product and amounted to one-third of total agricultural exports in 2011. Exports increased by an average 34.7% a year between 2009 and 2012. Cocoa (including beans, butter, powder and paste) represents 2.6% of total agricultural exports. Between 2009 and 2012, cocoa exports grew an average of 16.7% a year. Globally, Peru is recognized for its coffee and cocoa products and is the top exporter of green coffee beans (FAO, 2014a) and the second-largest exporter of organic cocoa (MINCETUR, 2009).

Most production is undertaken by smallholders, with a farm size averaging 3.2 hectares. Around one-third of production takes place in the arid coastal area, partly due to better infrastructure and soil quality; the rest is undertaken in the rain-fed Andean highlands and jungle areas. The highlands lack water-storage capacity and transport costs are high given the rugged mountainous terrain. Less agricultural production takes place in the jungle areas, which are often too wet for cultivation and are subject to a number of land use restrictions.

SMEs manage most coffee and cocoa production and trade. An estimated 600,000 Peruvians are involved in coffee production and trade, and another 200,000 in cocoa production and trade (MINAGRI, 2013). Many of these are smallholders in rural and marginalized communities. The majority of small producers are grouped in cooperatives or associations, enabling them to coordinate post-harvest management, as well as negotiate better prices (Box 5).

Figure 10. Agriculture and livestock exports 2011 (US$ 4.5 billion)



Source: FAO, 2014b

Box 5. Industry associations and cooperatives

Most coffee and cocoa producers in Peru are associated in cooperatives. This has enabled small producers to establish strategic alliances within the value chains and improve their competitiveness on international markets. The larger associations have up to 2,000 members and collectively manage more than 7,000 hectares. The majority of associations trade products directly and have long-term relationships with coffee traders. Through the cooperatives, smallholders negotiate better prices, reduce costs of post-harvest management and develop marketing strategies.

In 2009, there were 78 registered coffee cooperatives and 180 associations, a network comprising more than 50,000 families and 165,000 hectares of coffee, including 120,000 hectares of certified coffee (Mogrovejo et al., 2012).

The Peruvian Chamber of Coffee and Cocoa (CAMCAFE) promotes exports of coffee and cocoa. The National Coffee Board (JNC) and the Peruvian Association of Cocoa Producers (APPCacao) guide production and market access.

- **The Peruvian Chamber of Coffee and Cocoa (CAMCAFE)**

The Peruvian Chamber of Coffee and Cocoa was founded in October 1991. It provides services to producers, exporters and manufacturers, largely the promotion of Peruvian coffee and cocoa products worldwide. The Chamber implements research and capacity building projects funded by member contributions and supported, in part, by national and international donors.

- **National Coffee Board (JNC)**

The National Coffee Board (JNC), established in 1993, is an industry body aimed at promoting industry growth on the national and international markets and supporting economic and social development in Peru. The JNC provides services, such as training, market linkages and trade fair participation for its members. The board brings together 44 coffee associations and cooperatives, representing 40,000 families from 14 coffee-producing regions. The JNC is a member of the Sustainable Commodity Assistance Platform (SCAN) in Peru, which aims at sustainable develop of coffee production, processing and marketing in Peru to improve the income of farmers.

- **Peruvian Association of Cocoa Producers (APPCacao)**

The Peruvian Association of Cocoa Producers (APPCacao) was founded in May 2008 and represents approximately 15,000 cocoa farmers, distributed among 20 producing organizations. APPCacao is supported by member contributions and international and national donors. It aims to add industry value by generating and promoting integrated and sustainable development and promoting Peruvian cocoa on domestic and international markets.

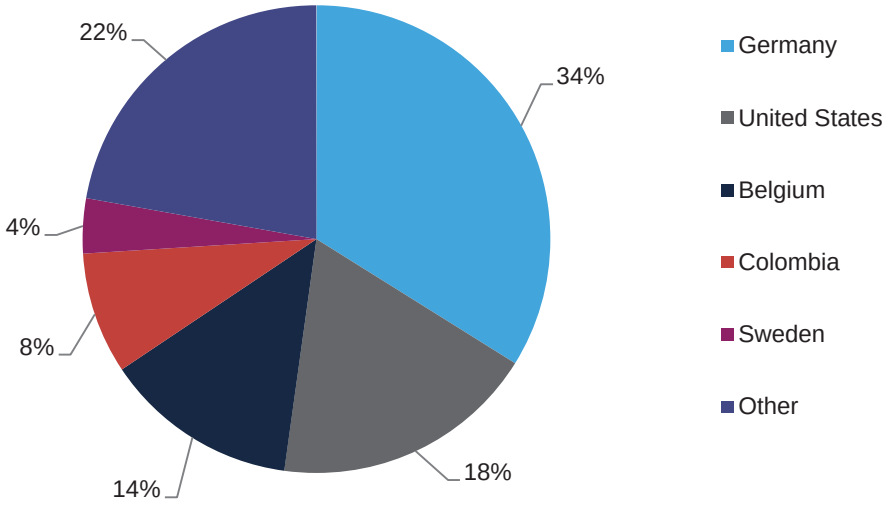
1.1. Coffee exports

Nearly all Peruvian coffee is exported as green beans. In 2011, exports reached a record value of US$ 1.6 billion before dropping to US$ 1.0 billion in 2012. The main markets are Germany (33.9%) and the United States (18.3%) (Figure 11).

Trade is dominated by three major exporters: Perales Huancaruna, Comercio and Cia, and Internacional del Café. These three companies account for 40% of coffee exports. Most remaining exports are traded by producer associations and cooperatives.

Most Peruvian coffee is exported as green beans (© flickr/Dennis Tang)

Figure 11. Main destinations for Peruvian coffee, 2012



Source: BCR-PROMPEX, 2014

Coffee grows best between 600 and 1,800 metres above sea level and is suitable for almost all geographical regions in Peru. Nearly 75% of coffee is grown above 1,000 metres, in the Andean and Amazon jungle regions.

Production volumes are highest in Junín (25.2% of production in 2012), Cajamarca (21.3%), San Martín (17.8%), Cusco (13.8%) and Amazonas (12.6%). The coffee grown is predominantly Arabica, followed by Robusta. Other, less popular varieties include Coffea liberica, Coffea dewevrei, Coffea stenophylla, Coffea congensis, Coffea abeokutae, Coffea klainii, Coffea zanguebariae and Coffea racemosa (Agrobanco, 2007).

Production is most suited to humid areas with relatively high temperatures (20°C–25°C). Coffee is a semi-shade plant and needs protection from the wind and frost. New plantations take two years to mature before fruiting, with maximum fruiting occurring when the plants are 4-5 years old. Plants can be productive for up to 20 years, after which yield and quality decline.

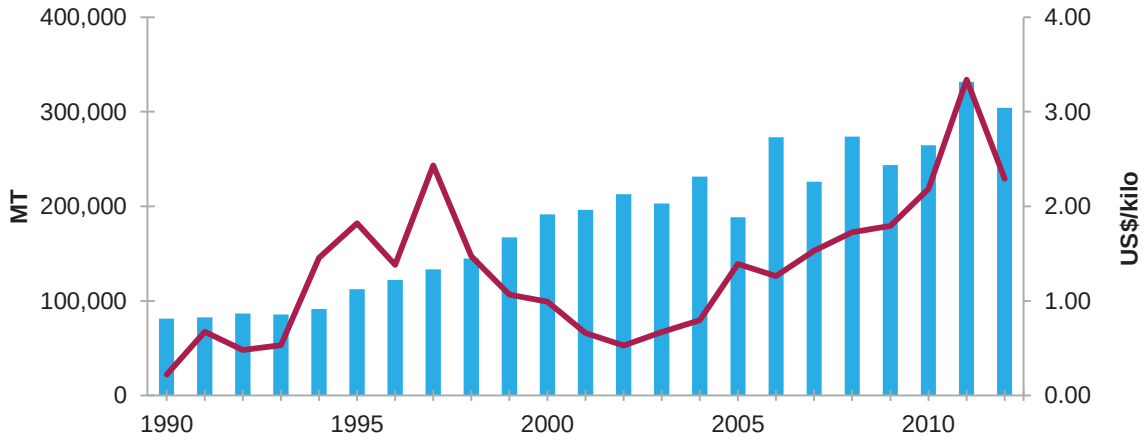
The most common pests and diseases affecting production in Peru are coffee berry borer (*Hypothenemus hampei*), coffee rust (*Hemileia vastatrix)*, coffee leaf miners (*Leucoptera coffeella*), Mycena citricolor and Pillicularia koleroga. In 2012 and 2013, a serious outbreak of coffee rust significantly hampered yields (Box 6).

Coffee production tripled in the past two decades (Figure 13). This is partly a consequence of increased prices and export opportunities. Coffee prices have continued to improve since 2004, though there was some evidence of a downturn in 2012.

Figure 12. Coffee production areas

Source: CPC, 2014

Figure 13. Coffee production and farm gate price, 1990-2012



Source: MINAGRI, 2013

Table 4. Coffee production by region, 2012

Ranking	Region	Quantity produced	Area harvested	Yield	Share of production
		Mt	Ha	Kg/ha	%
1	Junin	76,714	82,047	935	25.2
2	Cajamarca	64,900	64,130	1,012	21.3
3	San Martin	54,181	57,093	949	17.8
4	Cusco	42,096	47,087	894	13.8
5	Amazonas	38,317	48,319	793	12.6
6	Puno	7,364	11,107	663	2.4
	Total	304,121	338,004	900	100

Source: MINAGRI, 2013

Box 6. Yellow rust outbreak in 2012 and 2013

Coffee producers in all regions of Peru were affected by yellow rust in 2012 and 2013. Yellow rust is a type of fungus that attacks branches and leaves, reducing coffee yields and quality. The rust outbreak was exacerbated by the more humid climate in recent years, along with poor management practices. According to news reports, it is estimated that yellow rust affected about 108,000 hectares of coffee and around 160,000 producers have reported difficulties in repaying debts as a result of crop losses. The government has introduced mitigation measures, including distributing farmer kits with fertilizers and pesticides and issuing lines of credit to support farmers in renewing coffee plantations and meeting debt repayments. While there are organic solutions to manage the outbreak, farmers lack the knowledge or the resources to implement them, and limited extension services are available.

There is a need to renew plants affected by the rust. While this creates short-term costs for producers, there is an opportunity for growers to plant newer varieties with higher productivity and greater disease resistance.

1.2. Cocoa exports

Peru has significantly expanded its cocoa production in the past 10 years and now produces more than 50,000 tons of beans. Cocoa is cultivated on the eastern slope of the Andes. Optimal growing conditions are in tropical areas with temperatures between 25°C and 29°C. The main growing regions are San Martín (33.3% of production), Cusco (18.4%), Junín (13.7%), Ayacucho (11.2%) and Amazonas (8.1%) (Figure 14).

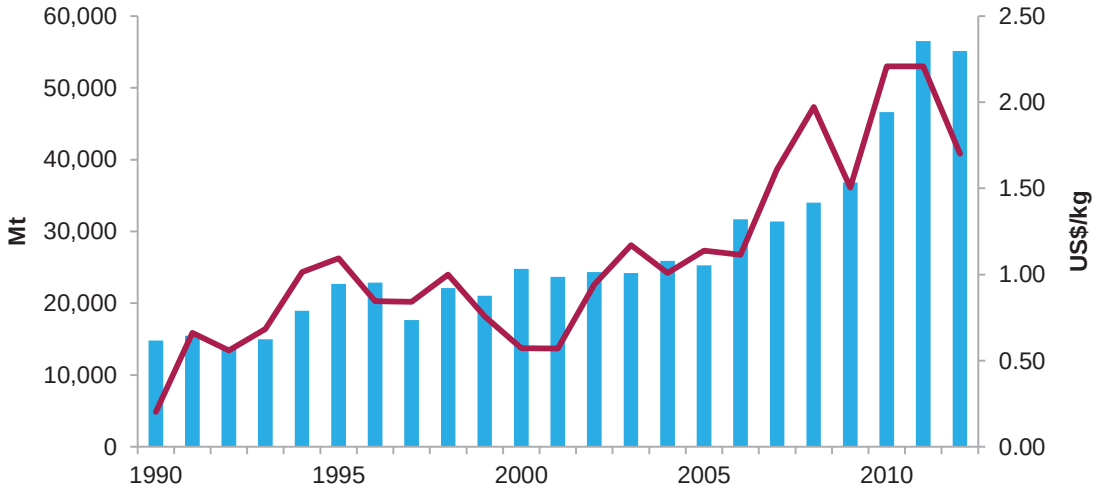
Cocoa beans in Peru

The main varieties grown in Peru are *Criollo, Forastero, Trinitario and CCN51.* Criollo is a native cocoa and is recognized globally for its high quality and low tannin content. It is difficult to grow and has low yields, but it is used in fine chocolate manufacture. In Peru, it grows in San Martín, Amazonas, Piura and Junín. The cocoa tree grows in deep, fertile soils, rich in organic matter, and with a good drainage. The crop is harvested several times throughout the year as fruit ripens. The large oval-shaped fruit contains 20 to 40 seeds. The most common diseases affecting cocoa in Peru are caused by fungus and include frosty pod rot (Moniliasis), witches' broom disease (caused by *M. perniciosa*) and black pod rot (caused by *Phytophthora sp.*). Most producers are smallholders cultivating one to two hectares with 100 to 6,000 plants per hectare. Yields vary from 300 to 2,500 kilograms per hectare depending on factors such as variety, plant age, diseases and environmental conditions.

Figure 14. Cocoa growing regions of Peru

Source: CPC, 2014

Figure 15. Cocoa production and farm gate price, 1990-2012



Source: MINAGRI and FAO, 2012

Table 5. Cocoa production by region, 2012

Ranking	Region	Production quantity	Area harvested	Yield	Share of production
		Mt	Ha	Kg/Ha	%
1	San Martin	18,369	20,617	891	33.3
2	Cusco	10,165	27,324	372	18.4
3	Junin	7,557	11,450	660	13.7
4	Ayacucho	6,186	8,787	704	11.2
5	Amazonas	4,484	6,683	671	8.1
6	Ucayali	2,568	2,980	862	4.7
	Total	55,111	87,112	633	100.0

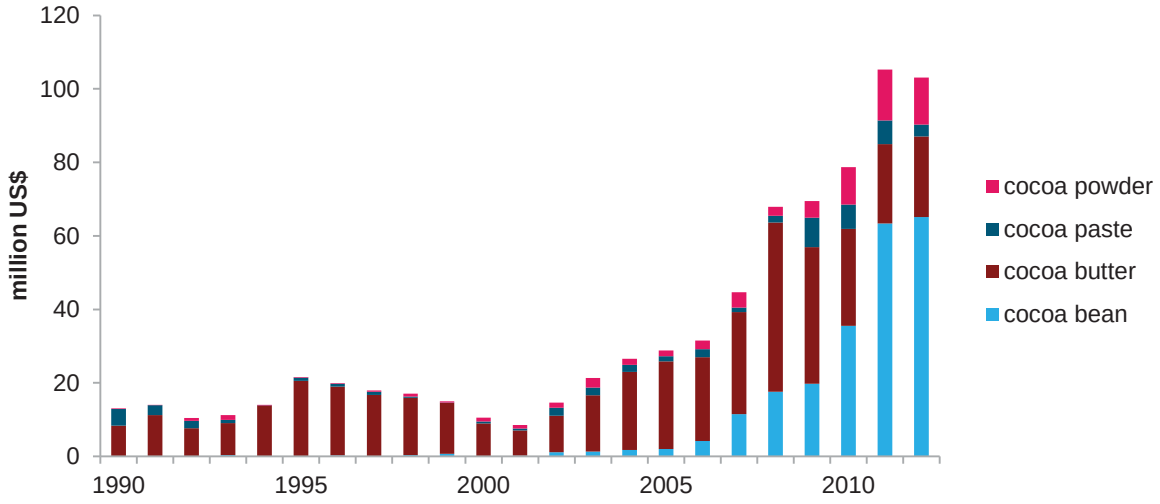
Source: MINAGRI, 2013

The majority of cocoa production is for export. Cocoa exports have increased rapidly since 2006, alongside strong increases in world prices, reaching record export revenues in 2011 (US$ 105 million). Peruvian cocoa is exported either as raw or as a processed product, including cocoa beans and cocoa butter, and to a lesser extent cocoa powder and cocoa paste. However, there are constraints to exporting higher value products, including chocolate, due to limited resources for storage and trading, low human capital and limited investment in machinery and equipment needed to add value (MINCETUR, 2009).

The main markets are the Netherlands, Belgium, Germany and Italy for cocoa beans; the United States, France and the Netherlands for cocoa butter; and Brazil, the United States, Venezuela and Chile for cocoa powder (Table 5). Around 15% of cocoa exports are certified organic or Fairtrade.

Major cocoa bean exporting companies and cooperatives include Amazonas Trading (15.6% of exports in 2012), Cooperativa Acopagro (13.1%), Cooperativa Naranjillo (13.0%) and Sumaqao (10.6%). The main cocoa butter exporting companies are Machu Picchu (58.6% of exports in 2012), Compañía Nacional de Chocolates (17.1%) and Romex (14.5%). For cocoa powder, Machu Picchu is the dominant exporter (73.4% of exports in 2012).

Figure 16. Cocoa exports, by type, 1990–2012



Source: BCR-PROMPEX, 2014

Table 6. Main destinations for Peruvian cocoa exports, 2012

Ranking	Country	Export value	Export quantity	Share of exports
		US$	Kg	%
Beans				
1	Netherlands	12.4	4 840	19.1
2	Belgium	12.1	4 819	18.7
3	Germany	8.6	3 188	13.4
4	Italy	8.2	3 058	12.6
5	Malaysia	5.9	2 477	9.1
	Total	64.7	25 132	100.0
Butter				
1	United States	6.0	2 450	27.9
2	France	5.1	2 300	24.0
3	Netherlands	3.9	1 601	18.2
4	Turkey	2.7	1 140	12.4
5	Germany	1.4	383	6.3
	Total	21.4	8 833	100.0
Powder				
1	Brazil	2.8	560	22.4
2	United States	2.5	414	19.4
3	Venezuela	2.0	405	16.2
4	Chile	1.5	325	11.7
5	Bolivia	0.8	185	6.7
	Total	12.6	2 511	100.0

Source: BCR-PROMPEX, 2014

Box 7. Coffee and cocoa as a substitute for drug production and trafficking

Since the 1990s, the Peruvian government has promoted coffee and cocoa as an alternative to coca production. The “Alternative Development” strategy was part of Peru’s response to ongoing drug trafficking. In San Martin, coca production during the 1970s and 1980s led to degradation of soils, biodiversity loss and pollution runoff. Further, the industry caused insecurity and violence among communities.

International organizations, such as USAID, have supported the Peruvian government to promote the replacement of coca crops with cocoa, coffee and oil palm. The substitution away from coca has been slow, given the financial security it has provided smallholders. Farmers were provided large incentives, including subsidies, infrastructure and employment opportunities. As a downside of this assistance, it is reported that many farmers are dependent on financial support and have poor business skills and little willingness to innovate.

1.3. Voluntary markets, standards and certifications

Peruvian exporters participate in a number of voluntary certification schemes to improve farm management practices and secure higher returns in global markets. These higher returns are awarded for exceptional quality, native varieties (with unique characteristics) and sustainability.

Sustainability certified exports of coffee and cocoa

Sustainable coffee certification has become a distinctive feature of Peruvian coffee production. This includes coffee certified as organic, Fair Trade or Rainforest Alliance, among others. Peru has produced organic certified coffee since 1989 (with OCIA certification) and Fairtrade certified since 1994 (Schreiber and Costilla Mora, 2011, Claro Fair Trade, 2008). It is now the world’s largest exporter of

Fairtrade coffee. In 2011, around 35% of Peru's coffee cultivation area held at least one certification (125 million kg) (Schreiber and Costilla Mora, 2011).

A significant share of Peru's cocoa is also certified for export. Peru is the second-largest exporter of organic cocoa (after the Dominican Republic) (Larrea and Lynch, 2012). Other major certifications include Rainforest Alliance, Fairtrade International, UTZ Certified and IFOAM standard (Larrea and Lynch, 2012).

Climate variability and change are not a central focus of any certifications for coffee and cocoa. However, Fairtrade and UTZ integrate climate-related issues and carbon emissions among other social and environmental issues (ITC, 2014). While the price premium associated with certification can be marginal, certified products often have price volatility, which can help in building resilience among smallholders (Sinclair et al., 2007). A 2013 Rainforest Alliance survey found that certified farmers reported better farm management and organization, improved access to education and training, and improvements in soil and biodiversity. Another report suggests that organic producers achieve 46%–150% higher yields as a result of improvements made to agricultural practices (Cueva Benavides, 2013).

Main sustainability export certifications in Peru

There are a variety of standards for which exporters can be certified (ITC, 2014). Most of these standards are the same for coffee and cocoa. The main standards require independent monitoring and certification. The Sustainable Commodity Assistance Network (SCAN) has been working in Peru since 2009 to support the development of a common standard for producers to meet the four main certification requirements (SCAN, 2014):

- **Organic**: Organic coffee is produced without synthetic substances such as most chemical fertilizers, pesticides and herbicides. As 80% of Peruvian coffee farmers have never used synthetic soil additives, it is relatively straightforward for them to meet certification standards as long as the costs can be met. Certification typically costs an exporter US$ 600–800 per year. Some certifications, such as IMO Control, cost up to US$ 1,500 per exporter (Sinclair et al., 2007). There are an estimated 25,000 certified organic coffee producers in Peru, receiving a price premium of US$ 250–300 per ton (Cueva Benavides, 2013).

- **Fairtrade:** Fairtrade certification aims to promote higher social and environmental standards in developing countries. Certification from Fairtrade International provides a guaranteed minimum contract price and that exports are produced exclusively by smallholder farmers. Certification costs US$ 1,170– 2,770 per year (FLOCERT, 2014).

- **UTZ:** The UTZ certification includes requirements for good agricultural practices, safe and healthy working conditions, abolition of child labour, and protection of the environment. There are 17 Peruvian coffee producer organizations that are certified, and 24 cocoa producer organizations (UTZ, 2014).

- **Rainforest Alliance:** Rainforest Alliance certification aims to conserve biodiversity and improve livelihoods and workers' welfare (Rainforest Alliance, 2014). The certification mandates a set of sustainable farm-management practices set by the Sustainable Agriculture Network.

- Other certifications include:

    - "Bird-Friendly" (Smithsonian Migratory Bird Centre) – "Bird-friendly" shade-grown organic coffee

    - C.A.F.E. (Coffee and Farmer Equity) Practice – Starbucks' ethical certification for coffee, focusing on social responsibility and environmentally sound cultivation and processing.

Table 7. Key coffee and cocoa certifications

Criteria	IFOAM	Fairtrade	Rainforest Alliance	UTZ
Third part auditing	Yes	Yes	Yes	Yes
Validity of certification	1 year	4 years	3 years	1 year
Cost of certification	Depends on certification body	US$ 1,170 – 2,770 annually	Depends on certification body	US$ 500 – 4,500 annually

Source: FLOCERT, 2014 and ITC, 2014

2. Climate change in Peru

Despite strong economic growth over the past decade, Peru still has high poverty and a number of developmental and environmental challenges. Peru contains several diverse ecosystems and microclimates. According to recent studies, Peru is vulnerable to increased temperatures, variable precipitation, glacial melt and sea-level increase (USAID, 2011).

2.1. Peru's climate

Peru's climate varies from dry and warm on the Pacific coast, mild in the Andean valleys, cold in the highlands, and hot and humid in the Amazon area. Temperatures vary from sub-zero to above 36ºC and rainfall varies from less than 200 millimetres in the coast to 2,800 millimetres in the Amazon jungle (SENAMHI, 2014).

Due to the El Niño phenomenon (Box 8), Peru is affected by inter-annual climate variability, air movements and changes in water temperature. Consequently, the coastal area is prone to severe floods and heavy rainfall as well as droughts. Peru is regularly exposed to devastating natural disasters, such as floods, landslides, droughts and frost, which are frequently related to the El Niño phenomenon.

Box 8. El Niño

"El Niño" (also El Niño South Oscillation, or ENSO) is an event defined by the persistent increase in sea surface temperature and weakening of winds in the Central and Easter Equatorial Pacific, for at least four consecutive months. It arrives every three to seven years and continues for 12 to 18 months, accompanied by a change or disturbance in the South Oscillation (SENAMHI, 2004).

2.2. Vulnerability to climate change

The main climate risks expected to affect agriculture in Peru include higher temperatures, glacial melt, periods of intense rainfall and extreme weather events. Climate change is expected to impede economic development through direct effects on infrastructure, housing and human life (Libélula, 2008). One recent study suggested that the cost of climate change to Peru would reach US$ 400 million by 2030 (at least five times the cost of adaptation and mitigation) (Loyola, 2009).

> "(Climate impacts) could increase the existing challenges imposed by the tropical geography, strong dependence on agriculture, rapid population growth, poverty and the limited capacity to resist climate changes"
>
> -MINAGRI, 2010

While trends are uncertain, the key climate impacts likely to affect Peru are (USAID, 2011):

- **Temperature:** Climate models consistently estimate significant increases in average temperatures in Peru over the coming decades. Since 1960, mean high temperatures have risen by an average rate of 0.2°C per decade. It is projected that the maximum temperature will increase by around 1.6°C by 2030.

- **Glacial melt:** Peru is home to 70% of the world's tropical glaciers. The glaciers provide a critical supply of water for irrigation, electricity and household use. Over the past 30 years, Peru has lost 22% of its total glacier area due to rising temperatures.
- **Precipitation:** Although overall precipitation has not changed significantly, the intensity of rain and drought has increased, and dry periods are longer.
- **Extreme weather events:** Between 1970 and 2010, 72% of the natural disasters in Peru were climate-related. These include hurricanes, severe droughts, landslides and floods (Libélula, 2008). The occurrence of disasters is on the rise: flooding increased by more than 60% from 1970–1980 to 1990–2000, and mudslides by almost 400% in the same period.

2.3. Potential impacts on the agri-export sector

Rural smallholders are highly susceptible to extreme weather events due to lack of information, low adaptive capacity and limited access to schemes of technical and financial support. Poverty among rural Peruvians was 60% in 2008 and 90% in the southern Andean Region (MINAM, 2010a).

Peruvian agriculture has already been affected by climate variability. In particular, weather events related to El Niño and La Niña, floods, frost, short summers and droughts have affected yields and quality of production. Between 1995 and 2007, an estimated 444,707 crop hectares were lost due to weather events at a cost of US$ 910 million (MINAGRI, 2011). The most affected regions included Puno and Apurimac in the south, Junín and Huanuco in the centre, Cajamarca and Piura in the north, and San Martin in the east. In 2006–2007, losses exceeded 85,000 ha and US $612 million as a result of El Niño events combined with flooding and extreme cold temperatures.

Besides crop damage, agricultural producers and exporters are also vulnerable to infrastructure damage (such as storage and transportation) and losses in human capital.

The Second National Communication of Peru to United Nations Framework Convention on Climate Change (MINAM, 2010b) states that climate change could have both positive and negative impacts. On the one hand, rains could delay flowering and harvest and reduce crop quality, and landslides and floods could cause crop losses. On the other hand, higher temperatures may expand the potential cultivation area for some crops at higher altitudes and may increase sugar concentrations in fruit. A study by Torres Ruiz de Castilla found that higher temperatures in Peru could reduce mango yields by 3.9% and banana yields by 2.5%, but could boost yields for coffee (Torres Ruiz de Castilla, 2010).

Agri-exporters are not only affected by direct climate impacts on production, but also by the exposure of support systems (such as water provision, energy and infrastructure) to climate risks. Energy production is largely dependent on hydropower, and has in the past been hit by both water scarcities during droughts, and infrastructure damage resulting from floods and landslides. Roads are regularly affected by floods (especially along the northern coast and in the Amazon) and landslides (in the mountains), which can delay or prevent the transport of cocoa and coffee.

Uncertainty remains about the impact on the coffee and cocoa trade, which could vary between producing regions as follows:

- **Coffee***:* Several estimates suggest higher temperatures associated with climate change could benefit Peruvian coffee. For example, AdaptCC (2010) found that more areas in Piura may become suitable for coffee cultivation from 2020 to 2050. Torres Ruiz de Castilla's 2010 study suggests an 18%–41% increase in coffee productivity by 2030 due to higher temperatures. However, these potential improvements could be offset by changes in the timing and quantity of rainfall, which affects coffee flowering and reduces quality.
- **Cocoa:** Cocoa production is sensitive to temperature and soil conditions. Temperature deviations below 15°C or above 30°C can reduce yields as well as daily temperature oscillations of more than 9°C. Cocoa trees depend on moist soil and require rainfall of at least 100mm per month (Leguía et al., 2010). Research in Peru has found that the land area suitable for cocoa production in Peru will decline due to climate change in San Martín, Huánuco, Loreto and Cusco (Leguía et al., 2010).

2.4. National policies for climate change mitigation and adaptation

The Peruvian government has introduced a set of tools and measures to mitigate and adapt to climate change. The main instrument in Peru for adaptation issues is the **National Climate Change Strategy,** introduced in 2003 and currently being updated. It aims to reduce the adverse effects of climate change through a) studies to identify the most vulnerable areas and/or sectors towards which adaptation projects should be targeted and b) controlling greenhouse emissions through renewable energy and energy efficiency programmes (CONAM, 2002).

Peru has also adopted an **Action Plan for Climate Change Adaptation and Mitigation** including several specific measures for the agriculture sector such as promoting sustainable land use, agro-forestry and organic agriculture, and additional research and training on climate-related issues (MINAM, 2010). It also calls for risk and vulnerability studies in various sectors, including water, agriculture, economy, fishing and areas of high biodiversity.

The Ministry of Agriculture and FAO have also approved a **Plan for Risk Management and Climate Change Adaptation of the Agriculture Sector (PLANRMCCA-A)** for 2012–2021 (MINAGRI and FAO, 2012). The plan includes an investment of US $700 million towards mitigating climate-change impacts on the agricultural sector. The plan prioritizes 159 adaptation measures selected during regional workshops in 2011- 2012 and to be implemented by regional governments.

The PLANRMCCA-A considers strategies for reducing vulnerability and adapting to climate change. The plan includes

- Early warning systems for disaster prevention
- Agricultural insurance scheme
- Promotion of local contingency plans, along with surveillance and health monitoring of pests and diseases
- Promotion of native species and traditional farming practices
- Water infrastructure
- Reforestation and forest conservation
- Knowledge and information management

PLANRMCCA-A also includes measures to improve hygiene to reduce disease risk, develop new drought and frost resistant varieties, and expand the application of sustainable agriculture practices specific for coffee.

A number of independently managed programmes are being conducted, mainly promoted by international organizations, to facilitate climate adaptation in the agricultural sector (Table 8).

Table 8. Current adaptation programmes for agriculture in Peru

Project Name	Objective	Sector	Funding source(s)	Geographic Focus	Years
Ongoing					
Climate Change Adaptation Programme in Peru (PACC)	To reduce climate vulnerability for the local populations of Cuzco and Apurimac, focusing on water resources, disaster prevention and food security.	General	SDC	Regions of Cusco and Apurimac	2009-2016
Terraces Recuperation in the Andes	To support research to scale up and find the technical and financial feasibility to co-finance pre-Columbian Andean terrace reconstruction as a practical way to execute adaptation projects in the field.	Agriculture (coffee)	IADB	Peruvian Andes	2010-2014
Adaptation for Smallholders to Climate Change (AdapCC, 2010)	To support coffee and tea farmers in Cafédirect's supply chain in developing strategies to cope with the risks and impacts of climate change.	Coffee tea	GIZ/GTZ/ Cafédirect	Kenya, Mexico, Nicaragua, Peru, Tanzania, Uganda	2010-
Coffee and Climate Initiative	To enable coffee farmers to effectively respond to changing climatic conditions by: combining best-practice farming methods and hands-on tools / forming a network of all relevant stakeholders in the field/applying a 360 precompetitive approach/including the entire value chain http://toolbox.coffeeandclimate.org/content/	Coffee	Various	International	2010-
Sustainable development model for Peruvian coffee (SCAN)	To achieve comprehensive and sustainable development of coffee production, processing and marketing in Peru, to increase farmers' income.	Coffee	SCAN Peru	Peru	2011-2014
Bringing agriculture capacity, carbon and knowledge to REDD+ (Back to REDD+)	To illustrate how farming can shift from being part of the problem to part of the solution to deforestation and climate change.	Coffee, cocoa, tea	Solidaridad	Colombia, Mexico, Peru	2012-2015

Source: USAID, 2011. Adapted from Peru Climate Change, Vulnerability and Adaptation Desktop Study.

3. Survey results

The results of the survey of agri-exporters conducted in Peru are presented in this section. The survey assessed the perceptions of 24 coffee and cocoa businesses to climate change and was complemented by focus groups and a multi-stakeholder workshop.

3.1. Perceived climate impacts on business

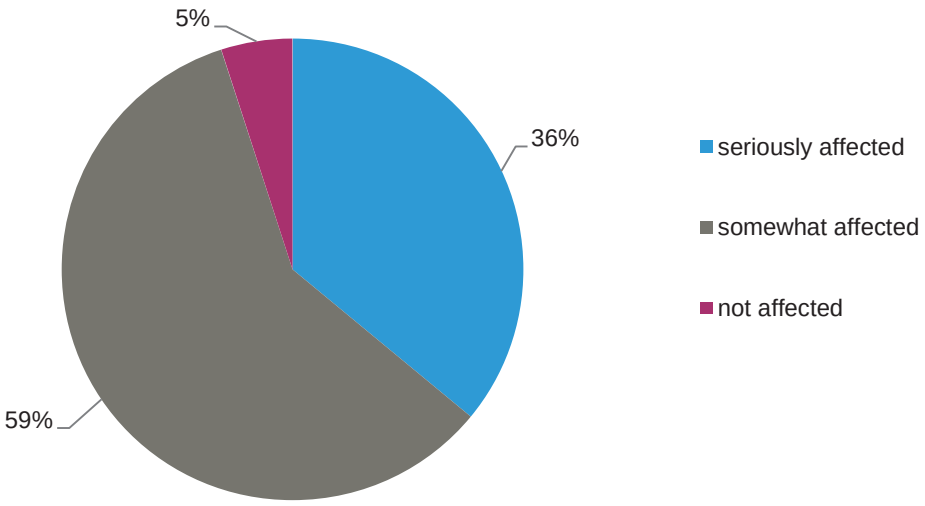
Climate risks are perceived to negatively affect exports

Almost all surveyed exporters perceived that climate risks had affected their exports in the past five years (95%), with one-third of respondents reporting a severe impact (Figure 17). In the past 12 months, all exporters were affected to some extent and, of these, three-quarters had been severely affected.

Exporters overwhelmingly perceived that current and future climate change would negatively impact exports. These impacts included reduced harvest quantity and quality as a result in changes in rainfall timing, pest outbreaks and possible flooding. Exporters also expected export volumes to become more volatile and unpredictable. Exporters were more concerned about coffee than cocoa production, as coffee crops are highly sensitive to waterlogging.

A small number of producers in Cusco and San Martin perceived that exports could be both positively and negatively affected by climate change, depending on specific local impacts. For example, increased rainfall could favour cocoa production, depending on its timing.

Figure 17. Perceived impact of climate hazards over the past five years



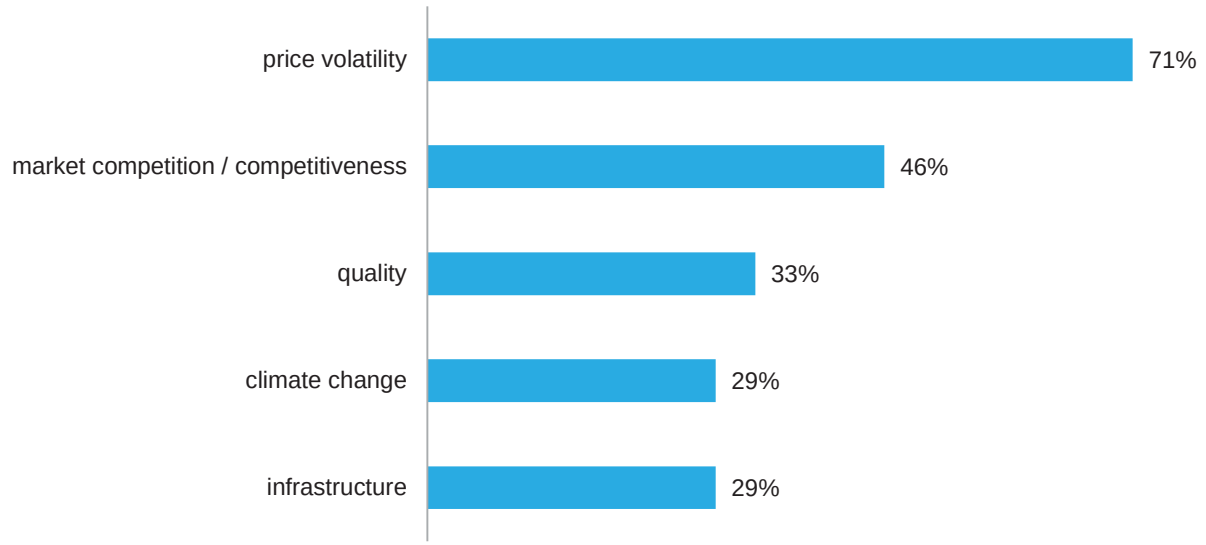
Source: Authors' elaboration based on survey

Climate change is perceived to exacerbate other challenges facing exporters

Exporters in Peru face a number of challenges. Among the primary concerns of exporters are price volatility, market competition and product quality (Figure 18). Some exporters also identified infrastructure, access to finance, certification requirements and labour shortages among their top barriers to trade.

While only 30% of respondents identified climate change among their top three export challenges, the majority (19 out of 24) perceived it to be of equal or greater importance to the other main export barriers they encountered. Climate change was perceived to negatively impact prices, competitiveness and product quality, among other challenges.

Figure 18. Key trade challenges for coffee and cocoa exporters



Source: Authors' elaboration based on survey

Price volatility was raised as a concern for exporters as a result of a decline in world prices in 2012 and 2013. Competition from exporters in South America, Central America and Africa was also believed to create additional pressure on exporters in Peru. Several exporters were concerned about market intermediaries who offer farmers higher prices during harvest, creating incentives for farmers to break their contracts with cooperatives. Intermediaries offering on-the-spot sales also enable farmers to avoid transport costs associated with delivery of harvest to the cooperative warehouse.

Product quality was of concern to exporters, particularly the decline in quality associated with the outbreak of yellow rust. Poor quality also made it more difficult for some farmers to meet international standards for trade, thereby reducing market returns. Climate variability, especially intense rainfall and high temperatures, had caused early ripening of coffee beans and reduced quantity and quality of the product in the past two seasons. Climate variability was perceived to have intensified pest and disease pressures.

Poor roads and prohibitively high transport costs were another challenge. Smallholders in isolated rural areas have limited infrastructure and transport options. In particular, during the rainy season, roads deteriorate and delivery can be delayed. Many exporters reported that post-harvest infrastructure was inadequate and a cause of delays.

While exporters find it difficult to respond to price volatility, they have taken steps to improve competitiveness and product quality. These include certifying products, providing technical assistance to suppliers (for attaining certification, improving quality and implementing best practices), and investing in plant dryers, mills and trucks to reduce transaction costs and crop losses. Some respondents also emphasized the importance of insurance to manage risks.

3.2. Direct and indirect impacts

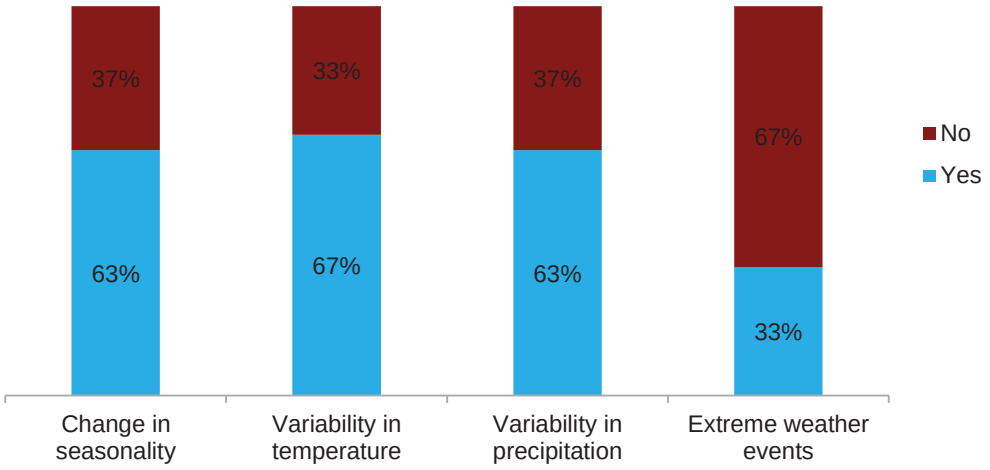
Exporters had mixed perceptions about which climate-related challenges had affected them in the past 5–10 years. Around two-thirds of respondents said that changes in temperature, changes in seasonality as well as rainfall variability had affected their exporters in terms of trade volume and/or value (Figure 19). One-third said extreme weather events also had affected exports.

The responses were mixed between regions, though all exporters in Piura perceived changes in seasonality (Table 9). Four respondents reported all four challenges (in Cusco, Piura and San Martin), while three respondents perceived none of the challenges to date (in Cusco and San Martin). Almost 50%

of exporters in Piura reported that extreme weather events had affected trade, compared to fewer than a quarter in other regions.

The most notable impact in Junín and San Martin was temperature changes. The main impact In Cusco, where rainfall has declined in recent years, was rainfall variability.

Figure 19. Perceived climate impacts in the past 5 to 10 years



Source: Authors' elaboration based on survey

Table 9. Perceived climate impacts in the past 5 to 10 years

Region	Changes in seasonality	Changes in temperature	Rainfall variability	Extreme weather events
	%	%	%	%
Cusco	63	63	75	25
Junin	50	75	50	25
Piura	100	67	67	50
San Martin	20	60	40	20

* Total sample size 24

Source: Authors' elaboration based on survey

Exporters perceived the most notable consequences of these climate impacts to be reductions in productivity and quality, the emergence of pests and diseases, and soil deterioration.

Productivity and quality: In general, exporters thought that climate impacts had reduced productivity and lowered product quality, leading to a drop in export revenue. The timing of pollination, flowering and ripening has changed, resulting in declines in quantity and quality as well as delays. For instance, excessive rainfall caused coffee fruits to ripen more quickly, resulting in lower quality harvest. Extreme hot and cold periods have also led to crop failure, and in some cases killed plants, generating extra costs for plant replacement. Heavy rainfall has caused waterlogging, reducing crop quality and quantity. In some cases, road damage has resulted in delivery delays.

> "Production will be lower until coffee plants adapt to new climates…which takes a long time"
>
> -Coffee exporter, Cusco

Pest and disease outbreaks: Both coffee and cocoa exporters thought that climate change had increased outbreaks of pest and disease such as Monoliasis, Phytophtora, Queresa and Sahrbegella singularis, for cocoa in Piura; and yellow rust for coffee nationwide. In Piura, exporters reported that up to 35% of production in some areas had been affected. Some coffee production systems are less resilient than others. This is especially acute in organic coffee production, where pesticides are not used and alternative pest management systems are sometimes are lacking.

> "The rust outbreak has already affected our livelihoods…Climate change will definitely have a strong affect because of the harm it will do to crops."
>
> - Coffee export cooperative, Cusco

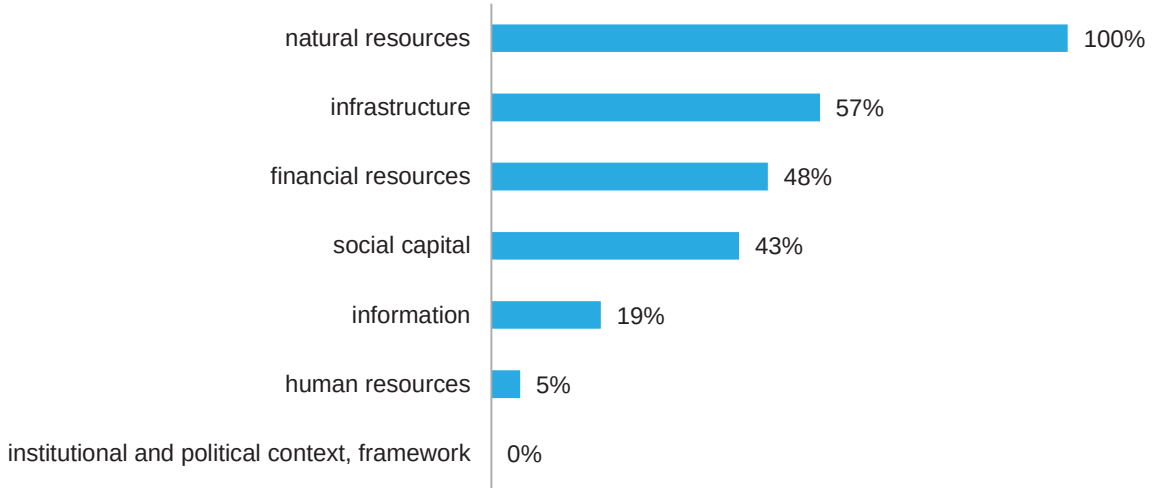
Soil fertility: Several exporters said that climate change could lead to further declines in soil quality. Events such as floods and landslides have reduced topsoil cover and the level of organic matter.

Perceived future impacts: Exporters said climate change would affect production and trade in the future. The most commonly perceived impacts were on quantity and quality of production. These changes could affect competitiveness and profitability. While some exporters believed that new varieties would emerge with greater climate resilience, the adaptation lags could affect customer relationships.

3.3. Agri-exporters' resilience and adaptive capacity

Exporters' resilience to climate change is linked closely with their capacity to adapt. Based on the framework set out in chapter 2, exporters described their adaptive capacity in terms of six factors (Smit et al., 2001): natural resources, financial resources, technology and informational resources, infrastructure, institutional/policy environment, and human and social capital. Among the respondents who had perceived climate impacts in the past 5-10 years (all but three), all believed their resilience had been affected. For all respondents, natural resources was a concerning factor for adapting to climate change (Figure 20).

Figure 20. Perceived impacts of climate change on adaptive capacity



Source: Authors' elaboration based on survey

Natural resources

Exporters of agri-food products rely heavily on natural resources such as soil, water, phosphorus and various minerals. These resources are likely to be directly affected by climate change, including variations in temperature, the level and timing of rainfall, and increased intensity and frequency of climatic events. These impacts vary among agricultural products, regions and production systems.

> "Before, the coffee harvest season began in March. Now it begins in May or June."
>
> - Coffee export cooperative, Cusco

Exporters surveyed in Peru expressed concern that natural resources would be affected by excessive rains, causing landslides, topsoil losses and changed maturation periods. Changes in temperature have already triggered pest and disease outbreaks, particularly yellow rust in coffee. For cocoa, production

quality is at risk from higher temperatures, which affect fruit maturation. Respondents were also concerned about potential deterioration in soil fertility, causing reduced yields and product quality.

Infrastructure

Peru has limited port infrastructure and poor road infrastructure. For example, only one in seven roads is paved (World Bank, 2014). These infrastructure deficits are an impediment to trade. In addition, changes in climate create challenging circumstances as flooding and associated road blockages are already common. Exporters on the Pacific coast are likely to be more resilient as they have better access to ports and rely less on inland road infrastructure.

> "When roads are interrupted, it delays the delivery process and it is not possible to meet orders on time. Carriers also raise their rates."
>
> - Coffee exporter, Piura

Exporters viewed climate variability to have exacerbated infrastructure challenges in the past 5−10 years. Deliveries have been delayed because of collapsed bridges, obstructed or deteriorated roads, and landslides. In addition, weather events had disrupted power supplies and telecommunications infrastructure, with consequences for the entire value chain from suppliers to buyers. Some exporters were concerned that climate change could also increase storage costs as a result of higher humidity.

Financial resources

While Peru has a relatively strong economy, agricultural businesses still face difficulties accessing credit and trading across borders. Limited financial resources prevent exporting SMEs from adapting effectively to climate change.

Climate variability affects the ability of SMEs to meet loan repayments and the perceived risky nature of agricultural production has made it difficult for agribusinesses to secure access to credit. Exporters are concerned that access to credit will become even tougher in the future and that interest rates will rise.

Social and human capital

Both formal and informal skills, knowledge, and partnerships are relevant for SME resilience. In Peru, the majority of coffee and cocoa is exported through cooperatives, which provide a mechanism for knowledge sharing and reduced transaction costs.

Exporters believe that relationships between suppliers and buyers were imperative to enhance climate resilience. Concerns were expressed that climate change could impact these relationships, particularly when contracts could not be fulfilled. Financial and emotional stress as a result of climate variability over the past 5−10 years has strained some supplier relationships. Producers have had difficulty meeting agreed volumes, and lower quality has meant that their payments have been reduced. This has created disincentives to work in the sector, particularly among young people.

Information resources

Peru is not well connected to information technology services compared with other countries. In 2010, only 3.14% of the population had a fixed broadband connection, compared to the Latin American average of 6.66% and the world average of 7.75%. It has 10 times fewer Internet servers per capita than the world average. On the other hand, Peruvians are well connected by mobile services (World Bank, 2014).

Climate-specific data are scarce, however, and public information is limited. The lack of relevant information combined with low connectivity could pose an obstacle to adaptation for agri-exporters.

Exporters perceived difficulties accessing information on trade and climate. In particular, there were concerns about weather events causing power outages and telecommunications failures. For exporters, there is a risk to communication with both suppliers and customers that could affect trade.

Institutional and policy environment

Despite some ongoing social challenges, Peru has become a stable country with a reliable policy environment. More specifically regarding climate-change policy, Peru has made progress in developing strategic guidelines and action plans at the national, regional and sectoral levels. Areas for further improvement include the need for more detailed and practical action plans for climate-change adaptation, better coordination between institutions, and more human and financial resources for the implementation of these plans (UNDP and BCPR, 2013).

3.4. Adaptation responses of exporters

Peru's coffee and cocoa exporters have begun to take action. All but one of the exporters surveyed had implemented at least one measure to adapt to climate change. These measures most commonly included investments in new technology and infrastructure, as well as training and extension services for producers. One cocoa exporter was adjusting stock levels to build resilience against production volatility.

Technology and Infrastructure

Exporter cooperatives and associations have worked with their members to introduce new technologies to build climate resilience. These include mechanical dryers or *fitotoldos* (shade covers) to prevent crop losses due to high rainfall during the drying process, a shift towards newer crop varieties, providing mowers to remove weeds and prevent disease proliferation, and upgrading irrigation infrastructure. In Cusco and Piura, exporters were supporting small irrigation projects and building channels in streams to take advantage of intense rainfall periods.

Training and extension services

The main activity supported by exporters' training is improved agricultural practices and raising farmers' awareness of climatic changes and, in particular, climate risk areas such as riverbanks and steep slopes. Most commonly, this training is focused on installing covers or vegetation to improve shade management and using trees and hedges to prevent soil erosion caused by rainfall. Also, extension services included training in pruning, fungicide application and changes in the timing of planting and harvest response, as well as advice on suitable crop diversification (such as cocoa in lowland areas and bananas in highland areas). One export cooperative was training its members in business management, including finance and risk management.

3.5. Support needs identified by agri-exporters

At this stage, exporters surveyed were not undertaking substantial measures in relation to climate adaptation. Their management strategies were targeted towards managing short-term issues rather than building longer-term resilience. Some actions, such as improvements in agricultural practices and enabling suppliers to meet certification standards, were expected to help build climate resilience, although they were not specifically implemented for this purpose.

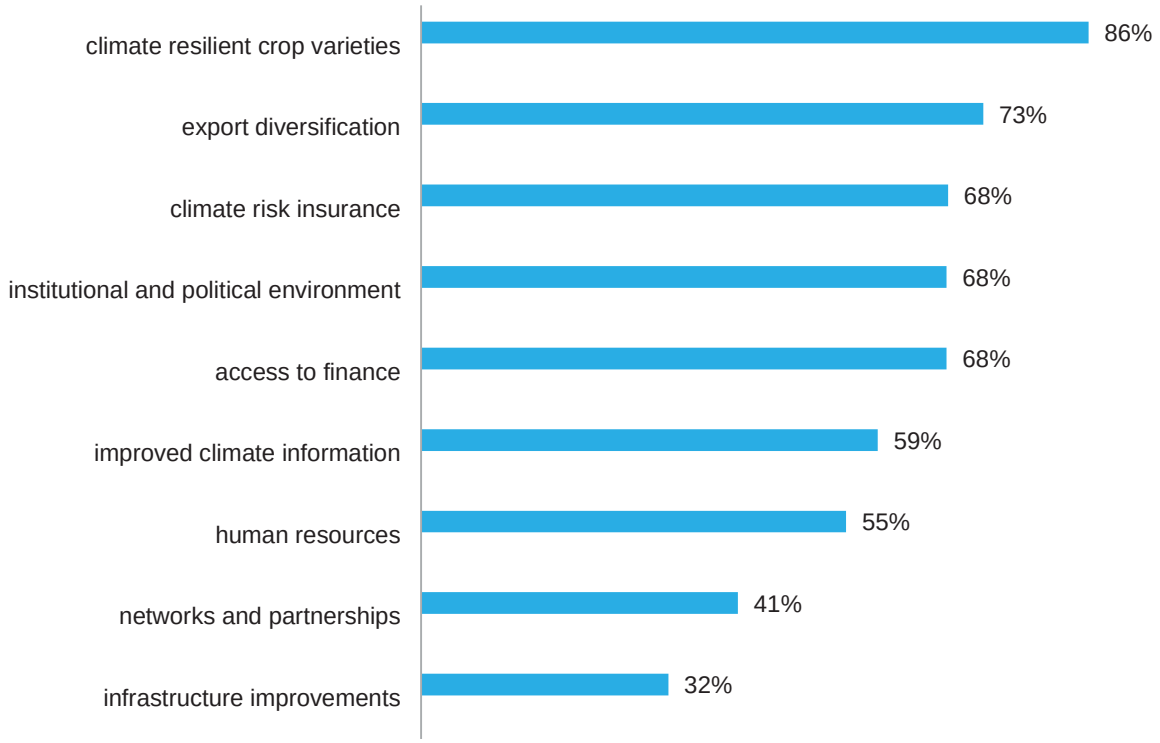
Only two exporters believed they had the capacity to respond appropriately to climate impacts in the future. The majority remained concerned that they did not have adequate human capital or financial resources to adapt. Even respondents who implemented measures faced financial challenges in doing so. Many respondents claimed they would do more if provided with financial support.

While there are a number of government initiatives, exporters perceived there to be little practical implementation or targeted support to assist in building climate resilience. Initiatives were seen as fragmented, diverse and largely constrained to pilot activities.

Respondents reviewed the adaptation measures they believe would support them in adapting to climate change (Figure 21). The most common responses were the need for more resistant crop varieties and export diversification. More than 80% of respondents said climate-resilient crop varieties were important to strengthen export resilience, and three-quarters believed they would need to diversify their exports to remain viable.

Nevertheless, only two exporters said they had considered shifting away from agro-exports and only one weighed moving to another region in Peru in order to maintain business operations.

Figure 21. Additional measures needed to respond to climate-related risks and their impacts



Source: Authors' elaboration based on survey

Chapter 5 Conclusions and recommendations

Agri-food exporters in Uganda and Peru face diverse and concerning climate risks. Climate change is expected to have major biophysical impacts on agricultural production, as well as impacts on supply-chain infrastructure, shifts in overseas production in competitor or consumer markets, and changes in climate-related policies among trading markets. Exporters recognize a number of actions that could improve their adaptive capacity and build their business resilience.

However, exporters and their associations need a business case for climate adaptation, including forecast impacts on productivity and profits. While more exporters have been affected by climate variability in recent years, and are concerned about future changes, there is limited awareness of the costs and benefits of climate adaptation and the case for managing climate risks in the longer term.

The following recommendations would help improve awareness of climate risks affecting agri-food export businesses and would support exporters in responding to these risks. There is a role for businesses, governments, NGOs and international organizations in ensuring that the impacts of climate change on export growth and associated development prospect are effectively mitigated.

Recommendation 1: Integrate climate change into long-term planning

In both countries, climate change was perceived to be one of many challenges facing the agri-export industry. In Uganda, exporters are most concerned about poor transport and delivery infrastructure, high energy costs and inconsistent quality. In Peru, the major concerns are price volatility, product quality and poor infrastructure. Exporters have limited resources (financial and human) for overcoming these challenges, many of which could be exacerbated by climate change. The majority of exporters recognized that climate change was of equal or greater importance to the other challenges they faced.

Consequently, exporters should try to integrate climate-change considerations into business planning and investment decision-making. For example, several exporters in Peru expressed concern that climate change was not integrated into their risk-management strategies. While other challenges may be more immediate, actions to address these should consider long-term scenarios and potential opportunities to strengthen climate resilience.

As well as business decisions, policy decisions could better integrate climate-change risks. The governments of Uganda and Peru have both implemented national strategies on climate change. However, relatively little guidance or support is provided at a sector level. Governments should consider developing sector-specific export strategies that integrate climate-change risks and appropriate responses.

Ugandan exporters are relatively less likely to invest in climate resilience, given the view that producers have limited awareness or capacity for improving product quality or reliability and exporters were unable to appropriate the benefits from extension advice or disseminating best-practice technologies. Exporters are also concerned about their ability to build climate resilience given poor roads, electricity supply and other infrastructure challenges. As such, government strategies (and supporting aid) should consider opportunities for good public investment that could improve resilience and serve to attract greater private sector investments.

Recommendation 2: Develop a climate information platform to facilitate information exchange

A large number of pilot initiatives on climate adaption are under way in Peru, and a smaller number in Uganda, but there are few opportunities for information sharing. The Aid for Trade community could take the lead in developing a platform for producer organizations, exporters, NGOs and governments to share innovation and best practice for building climate resilience.

While there have been a number of climate-adaptation initiatives in Peru, most include only a small number of beneficiaries and run for only a short period. By improving the aggregation and dissemination of the results and lessons of these initiatives, there is an opportunity to greatly extend their reach. An information

platform could be developed in partnership with CAMCAFE, APPCacao and JNC for the coffee and cocoa sectors.

Compared to Peru, Uganda does not have large, well-developed associations and cooperatives that could provide a hub for agri-export sector leadership and information. There are likely to be benefits from engaging smallholders in similar arrangements to improve information sharing and the uptake of best practices.

Recommendation 3: Support SMEs to implement climate-resilience strategies

Agri-food exporters in Uganda and Peru have identified technical and financial challenges in adapting to climate change. Actions that have been implemented to adapt to climate change are often isolated, rather than a strategic attempt to build long-term resilience.

In Uganda, exporters thought they could better adapt to climate change with additional finance, climate information, networks and partnerships and new climate-resilient crop varieties. Meanwhile, Peruvian exporters have a relatively better financial system and more advanced networks and partnerships across the coffee and cocoa sectors. As such, their main adaptation needs related to new crop varieties and export diversification, alongside insurance and governance improvements.

Targeted training for exporters to enable the development of climate-resilience strategies could help exporters plan and respond to climate change, even with limited resources and other constraints. Each strategy would specify an approach for responding to various climate risks and help to build long-term resilience.

Beyond training, new and innovative approaches are needed to improve access to finance and financial management tools, particularly insurance.

Recommendation 4: Train SMEs in certification opportunities and how to benefit from them

Certification is widely used in the coffee and cocoa sectors of Peru, particularly for organic products. Uptake has been high, especially where certification costs are low or price premiums substantial. For example, the transition to organic coffee was low-cost in Peru because 80% of coffee farmers had never used chemical fertilizers or pesticides. However, because many farmers have not changed their practices, many potential gains could be made from adopting additional certifications.

In Peru, many SMEs have a poor understanding of the requirements and the potential benefits of implementing certain sustainability practices. Producer associations and exporters should evaluate the costs and benefits of alternative certifications, including in terms of their impact on long-term climate resilience. By adopting best practices required for certification, SMEs could improve their performance and be eligible for price premiums.

In Uganda, certification is increasingly popular, but the costs can deter some exporters. Ugandan exporters require additional information on the costs and benefits of certification to determine whether this investment is worthwhile. Additionally, exporters would benefit from training and support to meet certification requirements where these can also help build adaptive capacity to climate risks.

For both countries, resources such as ITC standardsmap.org provide a useful, up-to-date guide to certifications and their requirements.

Appendix I Survey participants

Table 1. Study participants, Uganda

Region	Organizations and initiatives	Stakeholder type	Survey
Uganda	Ease Agriculture Co. Ltd	Agribusiness service provider	
	Uganda Carbon Bureau	Carbon financial and advisory services	
	Amajaro Ltd	Exporter (coffee)	X
	Kyagalanyi	Exporter (coffee)	X
	Esco (U) Ltd	Exporter (cocoa, vanilla)	
	British American Tobacco	Exporter (tobacco)	
	Uvan Ltd	Exporter (vanilla)	X
	Kawacom Ltd	Exporter (coffee)	X
	Nyambya Tea Company Ltd	Exporter (tea)	X
	Tamteco	Exporter (tea)	X
	Uganda Tea Association	Export association (tea)	
	Ugacof Ltd	Exporter (coffee, cocoa)	X
	Export Trading Co. Ltd	Exporter (sesame, maize, beans, soy, cocoa)	X
	The Grain Council	Producer association and exporter (grains)	
	Amfri Farms Ltd	Exporter (coffee, tropical fruits, cocoa)	X
	Bio Uganda Ltd	Exporter (tropical fruits, fresh and dried)	X
	Mayana Ltd	Exporter (tropical fruits, chilli)	X
	Nyakatonzi Growers Cooperative	Exporter (cotton)	X
Africa	Carbon Africa (Ltd)	Climate financial services	
	Cafe Africa	Regional exporter (coffee)	
Global	TATA Global beverages	Global beverage-distribution company	

Table 2. Study participants, Peru

Region	Organizations and initiatives	Stakeholder type	Survey	Focus group
Lima (Pilot)	Cecovasa (Puno)	Coffee exporter	X	
	Hugo Valdivia Canal Exportaciones	Coffee and cocoa exporter	X	
Cusco (R1)	Central de Cooperativas Agrarias Cafetaleras – COCLA	Coffee and cocoa cooperative	X	X
	Cooperativa Agraria Cafetalera José Olaya	Coffee and cocoa cooperative	X	
	Cooperativa Agraria Cafetalera Mateo Pumacahua	Coffee and cocoa cooperative COCLA	X	X
	Cooperativa Agraria Cafetalera Maranura	Coffee and cocoa cooperative – COCLA	X	
	Central de Asociaciones de Productores Agropecuarios de los Valles de La Convención y Yanatile (CAPACY)	Coffee association	X	
	Cooperativa Agraria Cafetalera Aguilayoc	Coffee cooperative – COCLA	X	X
	Cooperativa Agraria Cafetalera	Coffee and cocoa cooperative	X	X

Region	Organizations and initiatives	Stakeholder type	Survey	Focus group
	Santa Ana			
	Rainforest Alliance	NGO		X
	Cooperativa Manco Inca	Cooperative		X
Junin (R2)	Cooperativa Kemito Ene	Coffee and cocoa cooperative	X	
	Cooperativa Pangoa	Coffee and cocoa cooperative	X	
	Cooperativa Agraria Cafetalera Perené	Coffee cooperative	X	
	Cooperativa La Florida	Coffee cooperative	X	
	Asociación Agro Café	Coffee association		X
	Asociación Central de Productores de Café	Coffee association		X
	Cooperativa Tahuantinsuyo	Cooperative		X
	Cooperativa Juan Santos Atahualpa	Agriculture cooperative		X
	Manager of Economic Development of the Chanchamayo Provincial Municipality	Government		X
	NGO Centro de Investigación, Educación y Desarrollo (CIED) – Selva Central	NGO/Research		X
	District Coordinator of the Rust National Program (MINAGRI-Villa Rica)	Government		X
	DEVIDA San Ramón Office	Government		X
	Special Project Pichis Palcazu, La Merced	Government		X
	DESCO - Centro de Estudios y Promoción del Desarrollo	NGO		X
Piura (R3)	Asociación de pequeños productores agropecuarios de Morropón (ASPROMOR)	Cocoa association	X	
	Asociación de pequeños productores de cacao de Piura (APPROCAP)	Cocoa association	X	
	Junta de Usuarios de San Lorenzo (JUSAL)	Cocoa association	X	
	Cooperativa Agraria Noorandina	Coffee and cocoa cooperative	X	
	Corporación de agricultores ecológicos y solidarios (CAES)	Coffee association	X	
	Central Piurana de Cafetaleros (CEPICAFE)	Coffee and cocoa association	X	
	Swisscontact	International cooperative		X
	Programa Desarrollo Rural Sostenible – PDRS	Initiative – International cooperative		X
	Regional Direction of Agriculture	Government		X
	Universidad Nacional de Piura – Department of Economics	Research		X

Region	Organizations and initiatives	Stakeholder type	Survey	Focus group
San Martin (R4)	Asociación de Productores Cafetaleros Fruto de Selva	Coffee cooperative	X	
	Asociación de Productores Agropecuarios del Valle del Alto Mayo (APAVAM)	Coffee cooperative	X	
	Cooperativa Agraria Cafetalera Oro Verde	Coffee and cocoa cooperative	X	
	Asociación de Productores Ecológicos (APROECO)	Coffee association	X	
	Industrias Mayo	Cocoa and cocoa products exporter	X	
	Instituto de Cultivos Tropicales	Research institute		X
	Centro de Investigación tecnológica – CITE Cacao	Research institute		X
	San Martin Regional Government	Government		X

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