

January 2017

Creating a Sustainable Global Food Supply Chain: the WINnERS Project





Foreword

By 2050, the world will be home to some 9.7 billion people¹ and it is expected that food production will need to double by this time to accommodate this steep rise in population.² Over half of the world's crop production is produced by smallholder farmers,³ yet these farmers, particularly those based in Sub-Saharan Africa, are trapped in a cycle of low crop productivity. Despite the world's reliance on this diverse farming community to produce enough crops to accommodate its ever-growing population, over recent years smallholder farmers' crop yields have either stagnated or decreased.

The reasons for this low productivity are manifold but largely can be traced back to adverse and extreme weather disruptions, such as droughts, floods and earthquakes, endured by these farmers. Not only do such weather disruptions deplete crop yield for the affected harvest, they further affect the growing conditions for future harvests, which struggle to generate an abundance of crop due to poor soil left behind.

These weather disruptions create a vulnerable environment for the smallholder farmers, who cannot make long-term deals with buyers as their crop yield year-on-year is not guaranteed. Any harvest the farmers have left over after they have taken what they need to survive is sold to passing traders, often at uncompetitive prices.

For smallholder farmers to create long-term deals with buyers, they need to guarantee crop yield by purchasing products such as fertiliser and pesticides from input providers. To do this, the farmers need investment capital which, in the clear majority of cases, they do not have. They are unable to obtain a loan from the bank, as the investment is deemed to be too high-risk, because they perhaps lack an adequate credit history or an ability to post cash collateral. Thus, smallholder farmers continue to grow low-risk, low-return crops that do nothing to help to break their cycle of vulnerability.

Given that the demand for food is expected to increase exponentially, a new sourcing model is required to create a more sustainable supply chain that works for everyone. Whilst traditional sourcing models were asymmetric, with farmers shouldering most the risk, the resilient sourcing model, suggested by the World Food Programme's Patient Procurement Platform (PPP) includes coordinated support and

services to efficiently share and manage risk across the chain. This means that each actor in the chain is equally as invested in every stage of the process from seed to sale. As such, the PPP is built to increase farmers' productivity and agricultural income to ensure it is commercially viable for all actors.

The WINnERS Project is an arm of the PPP: a weather index-based risk service that creates climate resilient chains. It offers risk management services with the sole aim to create a sustainable and commercially viable system that will protect farmers against the uncontrollable impact of global warming whilst increasing farm productivity and revenue across the supply chain.

This report is designed to highlight the transformational potential that creating a truly sustainable supply chain will have for farmers, traders, end buyers – such as manufacturers or food retailers – and, indeed, for society as a whole. It outlines the projected economic impact for Sub-Saharan Africa, the financial benefits for vendors and the wider social benefits of developing a new paradigm for the global supply chain. We hope you find it thought-provoking and illustrative of the scale of the opportunity at hand.”



A handwritten signature in black ink, appearing to read 'Gordon Conway'.

Professor Sir Gordon Conway, Senior Advisor to the WINnERS Project and Chair in International Development at Imperial College London

Executive Summary

▶ The WINnERS Project – a public-private initiative funded by the European Institute of Technology's ClimateKIC of the European Union with co-funding from the World Bank - has been launched to create a sustainable food supply chain. It is based on creating, for the first time, an insurance infrastructure whereby each party is insured against crop-loss, unlocking access to investment capital for farmers. It is being rolled out across Tanzania initially, with plans to implement throughout Sub-Saharan Africa. The project is being supported by World Food Programme's Patient Procurement Platform and other commercial partners.

▶ Giving traders, lenders and vendors the security and peace of mind that their investments are adequately protected, the WINnERS Project has been successfully piloted in Tanzania and is being rolled out across the country. Targeting a quarter of a million smallholder farmers over the next two to three years, Imperial College London estimates that the project will contribute **2% to Tanzanian GDP**, just by looking at the increase in maize production alone.

▶ The increase in production value is estimated to be close to **\$900m**, benefitting the wealth of farmers, traders and the broader economy. The positive impact would be magnified considerably by the uptick in production of additional crops and the concomitant increase in bank lending activity.

▶ Imperial College London academics conservatively estimate that the introduction of WINnERS could increase maize yields in developing economies by threefold. Were WINnERS rolled out across East Africa, the GDP impact of this rise in maize

yield would be an increase of as much as **8.6%**, contributing more than **\$24.6 billion** to the East African economy.

▶ Across Sub-Saharan Africa as a whole, the WINnERS impact on maize yield is projected to improve GDP by **2.6%**, equating to an approximate economic benefit of **\$62.9 billion**, improving the lives of millions.

▶ For the end user, such as a food manufacturer, or a major retailer, the financial benefits of an end-to-end supply chain solution could be very significant. WINnERS estimates that losses to UK supermarkets resulting from the weather driven disruption of supply chains could be close to **£2 billion** annually.

▶ De-risking supply chains could improve supermarkets' annual profits by at least **5%**.

▶ The UK's largest five food retailers would benefit, in aggregate, by at least a rise of **£112 million** per year in operating profit, by implementing a fully protected supply chain as proposed by the WINnERS Project.

▶ A quarter of a billion farmers are not integrated into commercial supply chains, representing a **\$50bn** funding gap which requires innovative solutions in order to be addressed.⁴ The implementation of WINnERS will afford opportunities for financial services firms to provide investment capital for smallholder farming operations throughout Tanzania and, in future, Sub-Saharan Africa and beyond. farming operations throughout Tanzania and, in future, Sub-Saharan Africa and beyond.

What is the WINnERS Project and how does it work?

The WINnERS Project is a demand-led consortium of private and public value chain partners that will enable investments, information, and support for smallholder farmers from the beginning to the end of the supply chain process. It seeks to create a sustainable supply chain to benefit all parties in the chain, from farmer through to the end buyer. It is based on creating, for the first time, an insurance infrastructure whereby each party is insured against crop loss; this will unlock credit and loan facilities to farmers previously precluded from financing options as they were previously considered too risky.

The project aims to give traders, lenders, and vendors the security and peace of mind that their investments are adequately protected and thereby creating a more mature, competitive market for African agriculture, one which has far greater growth potential and will contribute more to the economy.

Typically, large-scale uptake of weather index-based insurance by producers and insurance suppliers has been slow due to challenges of risk aversion, scalability, large basis risk, and poor regulatory frameworks.

The WINnERS project is overcoming these challenges by exploring contract design models where the cooperative, bank or buyer is the policy holder instead of the individual smallholder to dampen farmers' risk adversity and expand reach. The contracts are tailored to specific sourcing sites to improve the accuracy of predicted losses and minimize basis risk. With these innovations, WINnERS services and products seek to share

risk more efficiently and equitably across all supply chain actors resulting in more sustainable food production and improved market access, as well as higher incomes for smallholders and reduced exposure to climate and weather driven risks for buyers and retailers.

To date, the WINnERS project has only been trialled across a selection of smallholdings in Tanzania. However, its ambition is to implement its resistant supply chain model across sub-Saharan Africa and into Asia and South America. Indeed, it is applicable throughout the world.

Led by Dr Erik Chavez, Executive Director, together with Professor Sir Gordon Conway, Senior Advisor and Chair in International Development of Imperial College, Dr Enrico Biffis, Director of Financial Engineering, and Dr Zen Makuch, Director of Regulatory Affairs, all at Imperial College London, the consortium comprises academics from the University of Reading, the University of Hamburg and the École Polytechnique. Corporate partners include Rabobank, Willis Towers Watson, and Sainsbury's. The project is funded by the European Institute of Technology's ClimateKIC, the EU's main climate innovation initiative, with co-funding from the World Bank.

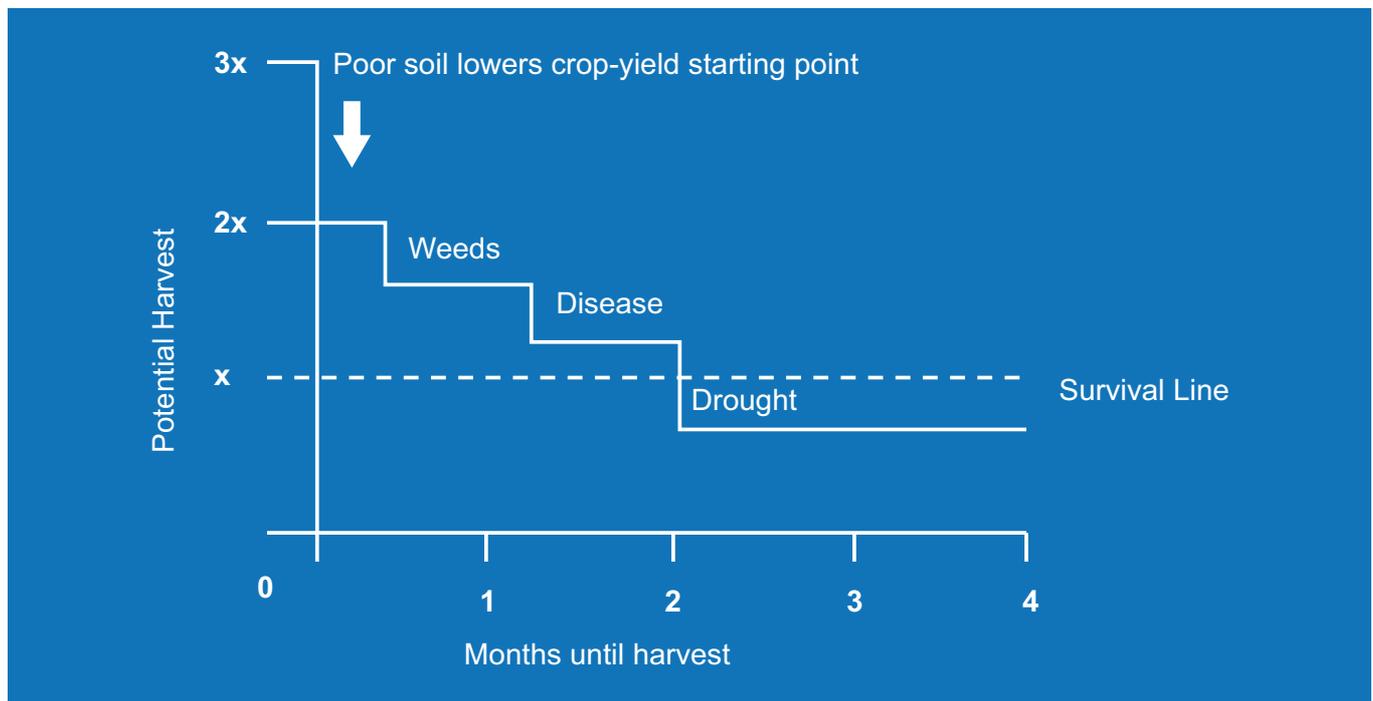
The WINnERS Project works across five programmes to achieve two goals: to ensure the supply chain is both sustainable and commercially viable for every actor from seed to sale. For further information regarding the specificities of the five programmes which together comprise the WINnERS Project, see the appendix.



Why do we need a sustainable supply chain?

Starting at the beginning of the supply chain, for a smallholder to create a stable and sustainable income from their crops, they need to agree on long-term deals with buyers. However, the impact of adverse weather conditions, such as droughts, storms, floods and earthquakes, exacerbated by climate change, means that not only does the immediate crop-yield suffer, but every yield thereafter, as future harvests must grow in the affected soil left behind. According to a report by the World Bank, global warming by 1.5°–2°C could lead to a 40–80 percent reduction in present maize, millet, and sorghum cropping areas in Africa.⁵ Indeed, model simulations estimate that in sub-Saharan Africa alone, maize yield could decline by an average of 22 percent by 2050, whilst wheat yield risks being depleted by 35 percent by the mid-century.⁶ Smallholders, particularly in Sub-Saharan Africa, live in a very precarious cycle. The impact of previous harsh weather conditions reduces the expected crop growth before the seeds for the year have even been planted. If farmers then endure further droughts, the expected yield decreases again, and so on. As such, smallholders are deemed too unreliable and high-risk for buyers to enter into long-term contracts with.

The risk of low-crop yield caused by climate change penetrates further than just obtaining contracts with buyers. The simple solution to guaranteeing crop growth, and therefore contractual relationships with buyers, is for smallholders to use fertilisers, pesticides and so on from input providers to help mitigate the impact of climate change and extreme weather phenomena. Smallholders live in a cycle of vulnerability. If their smallholding can create 3x yield of crops, and the owners only need x amount to survive, they should be able to make profit on 2x of the overall yield. However, as shown below, the starting point for expected crop yield decreases before the crops are even planted due to poor soil left behind by previous extreme weather conditions. Considering the impact of weeds, disease and drought, for example, the diagram below clearly demonstrates how when the time to harvest arrives, smallholders do not have enough produce to feed themselves, never mind sell on. To improve their productivity, farmers must invest money - money they do not have. They are unable to obtain a loan from the bank, as the investment is deemed to be too high-risk. As a result, smallholder farmers continue to grow low-risk, low-return crops. Any leftover crops are sold to passing traders at an often uncompetitive price. This means that the smallholders struggle to fund materials and training vital to their wellbeing, such as education and healthcare; and so, the cycle of vulnerability is perpetuated.



However, it is not just the smallholders who would benefit from a fairer supply chain system. By sharing the risk shouldered by the farmers, buyers will have a more regular and reliable amount of produce to trade. This not only makes the buyer's job easier, as he only needs to travel to one farm to get what he needs, but also makes it safer to trade, as the buyers are insured by the risk contracts put in place by WINnERS and its partners.

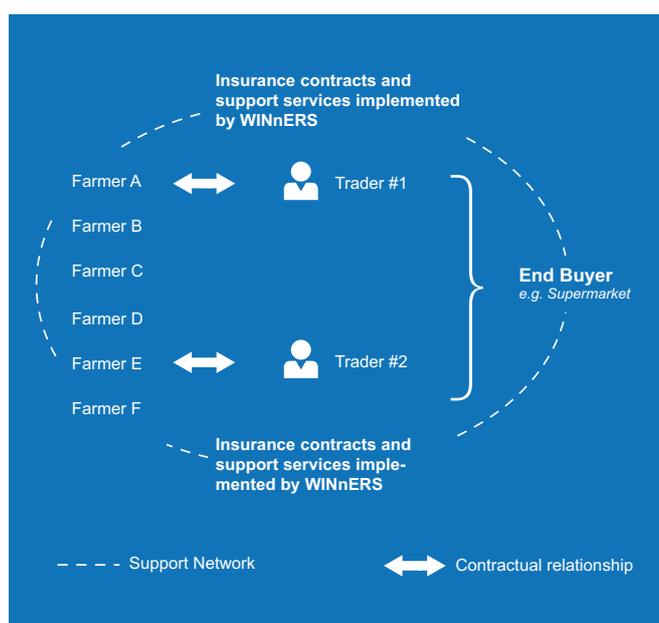
Moving to a new paradigm for the global food supply chain.

Given that the demand for food is expected to increase exponentially, a new sourcing model is required to create a more sustainable supply chain that works for everyone. The traditional sourcing model looks like this:⁷



Traditional supply chains have been asymmetric. Due to the unreliability of smallholders in emerging markets, traders buy crops from as many farmers as needed until they have enough to sell on to end buyers. The only real relationship lies between the trader and end buyer; so long as the trader has enough crops to meet the demands of the end buyer it does not matter how many farmers he buys crops from. As such, farmers shoulder the bulk of the risk of extreme weather conditions: if one farmer cannot provide the crops to the trader, they will lose out on an income, but it does not impact the trader who can just move on to the next farm.

The WINnERS model looks like this:



By establishing contracts between farmers, traders and end buyers, the WINnERS project spreads risk evenly throughout the supply chain. When one trader is committed to one farmer, the risk of crop-loss is spread across all stages: if crop-yield is low for the farmer, because of extreme weather events like droughts, storms or floods, it affects the whole supply chain, all of whom rely on the harvest of that one smallholding. This means that each actor in the chain is equally as invested in every stage of the process from seed to sale.

The insurance contracts set up by WINnERS aim to provide a fair platform whereby lasting relationships are built across the supply chain to benefit all those involved.

In short, everyone is a WINnER when climate risk is shared.

The economic and social benefits of WINnERS

Tanzania

The WINnERS Project trial is currently underway in Tanzania. Based on the creation of a sustainable insurance market in the country, and targeting a quarter of a million smallholder farmers over the next two to three years, Imperial College London estimates that the project will contribute 2% to Tanzanian GDP, just by looking at the increase in maize production alone.

The increase in production value is estimated to be close to \$900m, benefitting the wealth of farmers, traders and the broader economy. The positive impact would be magnified considerably by the uptick in production of additional crops and the concomitant increase in bank lending activity.

Africa



Academics from Imperial College London conservatively estimate that the introduction of WINnERS could increase maize yields in developing economies threefold. They calculate that, were WINnERS to be rolled out across East Africa, the GDP impact of this rise in maize yield would be an increase of as much as 8.6%, contributing more than \$24.6 billion to the East African economy. Furthermore, across Sub-Saharan Africa as a whole, they believe that WINnERS would similarly improve GDP by 2.6%, equating to an approximate economic benefit of \$62.9 billion, improving the lives of millions.

End users – supermarkets and manufacturers

For the end user, such as a food manufacturer, or a major retailer, the financial benefits of an end-to-end supply chain solution could be very significant. Computations made by WINnERS estimates that losses to UK supermarkets resulting from the weather driven disruption of supply chains could be close to £2 billion annually. Furthermore, de-risking supply chains by improving resilience of key sourcing markets to climate events could improve supermarkets' annual profits by at least 5%.

To put this into context, the UK's largest five food retailers would benefit, in aggregate, by at least a rise of £112 million per year in operating profit, by a fully protected supply chain as proposed by the WINnERS Project.

Financial services



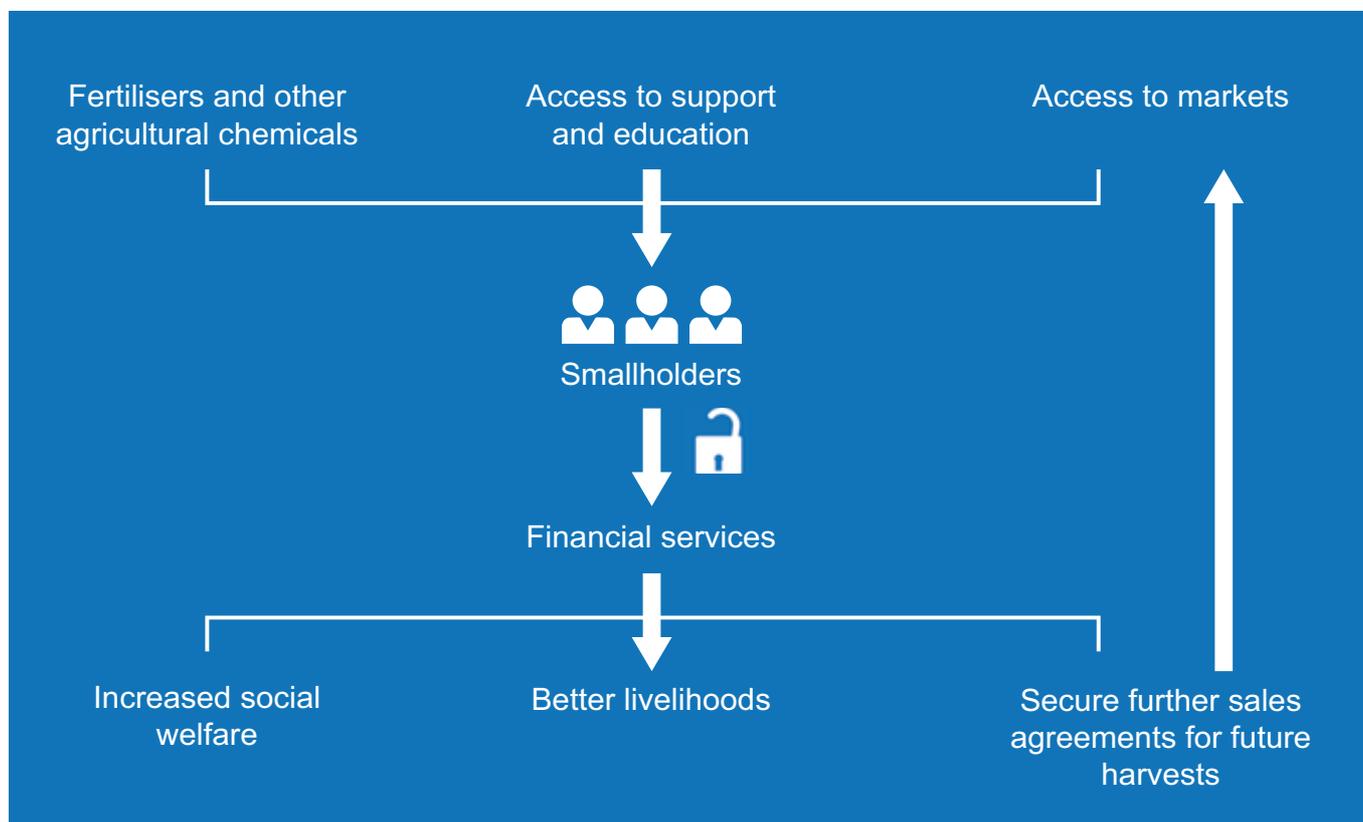
In terms of the opportunity for financial services companies, according to a report by the Mastercard Foundation a quarter of a billion farmers around the world are part of loose supply chains or not integrated at all into commercially viable food production programmes.⁸ This represents an overall financing gap for short term agricultural needs (harvest, inputs, exports, etc.) of around \$60 billion.⁹ Around \$6 billion of this gap is covered by supply chain parties and a similar amount by formal financial institutions.¹⁰ WINnERS calculates that there is a residual funding gap of almost \$50 billion which requires innovative solutions in order for this significant

gap to be addressed. The WINnERS project supports farmers and banks in fostering financial inclusion by covering loans and collateral against weather losses; the implementation of WINnERS will afford opportunities for financial services firms to provide investment capital for smallholder farming operations throughout Tanzania and, in future, Sub-Saharan Africa and beyond.

Society 

In addition to financial considerations, there are many social benefits to the WINnERS Project, for all actors across the supply chain, from the farmer to the trader, the seller to the consumer.

The WINnERS Project could help transform smallholder farmers' livelihoods. The services and support offered by the new, fairer supply chain model means that farmers are given access to not only the funding and security to progress their farming businesses, enabling them to purchase key products such as fertiliser and pesticides, but the ability to improve their prospects and create a virtuous circle. Sustainable future prosperity will afford farmers access to education and healthcare and provide a long-term opportunity to build their farms into something much bigger. The access to financing, previously difficult to attain, should increase the size of their farms and their yield, as they can plant more high-profit, high-return seeds that were previously deemed a high-risk investment.





The challenge ahead

The WINnERS Project in Tanzania is viewed very much as the first step in a global journey. By 2020 we plan to roll our schemes out across 16 countries in Sub-Saharan Africa, 5 in Latin America and 4 in Asia.

This ambitious programme will ultimately result in the creation of a sophisticated and insured market for soft commodities in emerging markets. It will, however, require partnership from a wide community of stakeholders. We are actively discussing with insurers, asset managers, banks, public bodies and end buyers (manufacturers and supermarkets) with a view to developing the network of organisations in the WINnERS Project.

Our ambition is to expand significantly the number of partner companies committed to taking the project into its next phase by this time next year. The pilot scheme in Tanzania has been a hugely successful proof of concept; the next phase of this project could be transformational for the global supply chain and for African economies. Our aim is to see all parties become WINnERS.

Appendix

The first programme (WP1) is led by the University of Hamburg; it uses specialist tools to collect climate data, such as temperature, wind, pressure, and humidity, in specific areas to predict the likelihood of extreme weather events occurring. Once this data has been harvested, WP1 then analyses the extent to which these weather events will disrupt food production in the affected area. The data uncovered by WP1 acts as a foundation for the assessment of agricultural risk carried out by the **second programme** (WP2).

WP2 is led by the University of Reading. The programme uses the data from WP1 to create crop modelling simulations, in collaboration with the University of Florida, to better inform risk mitigation scenarios. These simulations use different variables, such as the amount of fertilizer used in the soil, to determine an accurate and far-reaching catalogue of risk in any given climate circumstance. The crop model simulations in these sites have focused on the threat of drought. The modelling assesses the outcomes of using drought tolerant and non-drought tolerant maize varieties under short, medium and long growing periods. These findings, combined with on-the-ground field observations, like farm management practices, is translated into accurate crop-loss predictions in every scenario. These predictions serve to better inform risk mitigation scenarios.

Work **Programme Three** (WP3) is led by the Department of Finance at Imperial College Business School and the Department of Economics at Ecole Polytechnique. It uses the risk data evaluated in WP2 to build insurance contracts that ensure weather and climate risks are fairly distributed across the supply chain. This will be designed and sold in collaboration with insurance broker Willis Towers Watson and the World Food Programme's PPP. In addition to the predicted weather-driven harvest losses, the insurance

contracts will also acknowledge the terms by which insurance pay-outs are to be distributed, outline the incentives to each actor for establishing long-term relationships across the supply chain (stretching from the smallholder farmer to the buyer to the end manufacturer) and establishing long-term relationships between policy holders and members of the supply chain.

These factors enable insurers and re-insurers to work out accurately the levels of risk to be translated across the supply chain. WP3 also enables food buyers, retailers, and manufacturers to estimate revenue savings for short to medium term commodity purchases. The contracts created by WP3 are set up with the aim of creating long-term relationships across the supply chain. For instance, rather than the buyer purchasing crops from a variety of farms, the insurance contracts set up by WP3 will trigger individual relationships between the buyer and a single farm. As such, the risk of crop loss caused by extreme weather is absorbed by the two actors: both parties therefore become equally as invested in the wellbeing of the harvest. This not only improves the livelihood of smallholder farmer, who is able to share the burden of the risk and create a stable income in the process, but also improves the buyer's welfare, who now knows that he can trust just one farmer to obtain the harvest he needs. This is just one example of how the initiative to spread the risk benefits all involved.

The **fourth programme** (WP4) is led by Imperial College London's Centre for Environmental Policy with support from The World Bank, The International Finance Corporation, the University of Leuven, Princeton University, and the University of British Columbia. It seeks to demonstrate the impact of the WINnERS project on the well-being of participating smallholder farmers. WP4 will run thorough assessments

of the impact the WINnERS project has had across the initial control trials already taking place in several regions of Tanzania.

The project's overall aim – to empower smallholder farmers to defend their harvests from the effects of climate change and extreme weather events – will be measured by both quantitative and qualitative research. Indeed, the core topics for assessment include the changes in household demographics and income, the changes in agricultural practices, adoption of new farming technology, how farmers think their risk has changed and improved livelihoods that comes from an increase in food and income.

Most topics for assessment are easily measurable, as figures such as change in crop growth, income and profit can be found through quantitative research. Qualitative research is needed for areas such as change in agricultural practice and improvement in livelihood; WP4 proposes to use detailed questionnaires to gauge this data.

The **final programme** (WP5), also led by Imperial College London's Centre for Environmental Policy, seeks to ensure that the insurance frameworks set up by WP1 to 4 are appropriately contracted, regulated, supervised, and safeguarded, placing user-protection at its core. Contracts will be honoured and enforced through access to arbitration, dispute resolution and financial education – particularly for smallholders. Contracts will be embedded with monitoring mechanisms to ensure each actor is compliant with the contracted terms. WP5 also serves to drive policy engagement, hence the creation of this report unveiling the success of initial pilot programmes in Tanzania, seeking to catalyse wider debates regarding the use of risk mitigation products to help all actors in the supply chain safeguard against climate and weather threats.

References

All statistics if not referenced are calculations courtesy of Imperial College London and the WINnERS team.

¹ (2016). *McKinsey on Sustainability and Resource Productivity*. McKinsey and Company. p. 58

² H. Buffett, E. Chavez & G. Conway. (2016). *How Partnerships can create resilient food supply chains*. Aspen Ideas Journal. <https://www.aspeninstitute.org/aspen-journal-of-ideas/partnerships-create-resilient-food-supply-chains/>

³ Ibid

⁴ Dalberg Global & Development Advisors. (2016). *Inflection point: Unlocking growth in the era of farmer finance*. The Mastercard Foundation. http://www.mastercardfdn.org/wp-content/uploads/2016/04/Inflection-Point_April-2016.pdf

⁵ (2016). *Enhancing Resilience to Natural Disasters in Sub-Saharan Africa*. The World Bank. https://www.imf.org/external/pubs/ft/reo/2016/afr/eng/pdf/chapter3_1016.pdf

⁶ H. Buffett, E. Chavez & G. Conway. (2016). *How Partnerships can create resilient food supply chains*. Aspen Ideas Journal. <https://www.aspeninstitute.org/aspen-journal-of-ideas/partnerships-create-resilient-food-supply-chains/>

⁷ Ibid

⁸ Dalberg Global & Development Advisors. (2016). *Inflection point: Unlocking growth in the era of farmer finance*. The Mastercard Foundation. http://www.mastercardfdn.org/wp-content/uploads/2016/04/Inflection-Point_April-2016.pdf

⁹ Ibid

¹⁰ Ibid

