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Climate Smart Agriculture in East and Southern Africa: Synthesis from Vuna Agribusiness Innovation Models

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Preface

This synthesis paper summarises overarching findings and insights drawn from a series of papers produced following action research on Climate Smart Agriculture (CSA) innovation models in East and Southern Africa (ESA). These innovation models were implemented by Vuna, a DFID funded regional CSA programme. Covering five CSA innovation models and five thematic areas, the research papers that form the basis of the synthesis explored different delivery models for promoting the uptake of CSA practices among smallholder farmers. The implementation period of the Vuna innovation models was short, ranging between nine and twelve months, and as such the insights contained herein are based on emerging signs of what works in supporting resilience building in a scalable and sustainable manner.

The synthesis paper draws from the following series of research papers:

Innovation model papers:

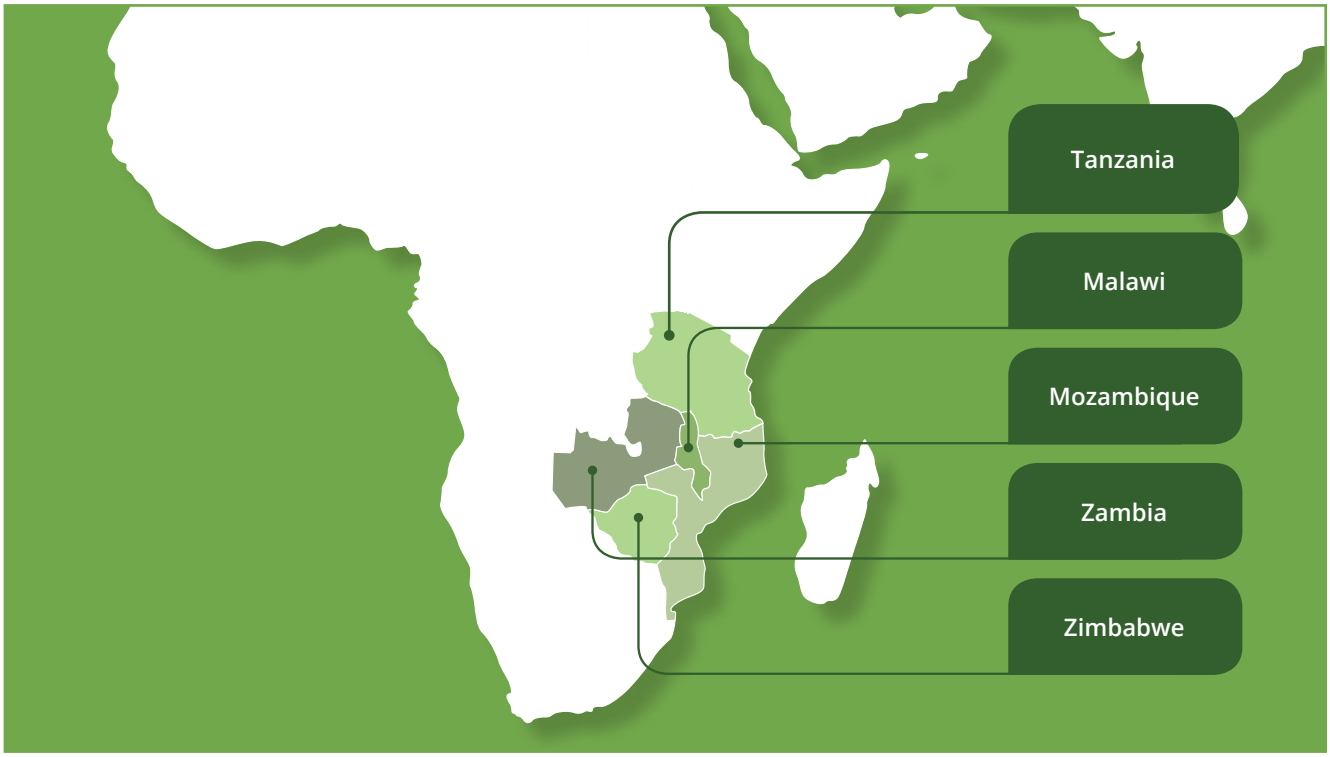
- Building Climate Resilience for Dairy Farmers, through Climate Smart Solutions: Insights from the Malawi Smallholder Dairy Sector;
- Integrating Climate Smart Agriculture in Pigeon Pea Production: Insights from Export Trading Group in Mozambique;
- Integrating Climate Smart Agriculture Capacity Development in Outgrower Schemes: Insights from Musoma Food Company Ltd and G2L Ltd in Tanzania;
- Integrating Climate Smart Agriculture into E-Voucher Farmer Input Subsidy Programme: Insights from Zambia; and,
- Building Inclusive Seed Systems for Semi-Arid Areas: Insights from Zimbabwe Super Seeds.

Thematic papers:

- Integrating Climate Smart Agriculture into Outgrower Models: Insights from Vuna Innovation Models in East and Southern Africa;
- Private Sector Driven Extension Models for Smallholder Farmers: Insights from Vuna Innovation Models in East and Southern Africa; and,
- Inclusive Seed Systems: Insights from Vuna Innovation Models in East and Southern Africa.

Good Practice Notes:

- Financing Smallholder Climate Change Adaptation: Good Practice Note; and,
- Climate Smart Agriculture in Livestock Value Chains: Good Practice Note.



Acronyms

Acronym	Long Form
AAER	Adopt, Adapt, Expand, and Respond
ADF	Agriculture Development Facility
AGRITEX	Agricultural Technical and Extension Services
AR5	Fifth Assessment Report
CSA	Climate Smart Agriculture
CSAP	DFID's Regional Climate Smart Agricultural Programme for East and Southern Africa (now brandedas Vuna)
DFID	United Kingdom's Department for International Development
EEF	Enabling Environment Facility
ELIF	Evidence, Learning, and Influencing Facility
ESA	East and Southern Africa
ETG	Export Trading Group
FAO	Food and Agriculture Organisation of the United Nations
G2L	G2L Company Ltd
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
MFCL	Musoma Food Company Limited
NGO	Non-Governmental Organisation
UNFCCC	United Nations Framework Convention on Climate Change
ZSS	Zimbabwe Super Seeds

> **Vuna means 'harvest' in many languages in East and Southern Africa. Our name like our work is inspired by the region.**

Synthesis summary

Climate change fundamentally threatens agricultural based livelihoods for rural populations across East and Southern Africa (ESA). Climate Smart Agriculture (CSA) is frequently promoted as a response to this challenge as it aims to improve the resilience of farming systems to current as well as future climate-related risks. Vuna, a United Kingdom Department for International Development (DFID) funded CSA programme, aimed to increase the resilience of farmers and farming systems across ESA. To do so, Vuna supported innovation models that tested and where feasible scaled-up delivery approaches and mechanisms that promoted the adoption of locally suited agricultural practices and technologies that improved smallholder farmers' resilience to climate change. Vuna adopted an action research approach to generate reliable evidence on the impact of innovations on increasing the resilience of individuals, households, and markets. Vuna's action research aimed to generate and package new evidence on effective CSA delivery models.

This study sought to contribute to Vuna's action research agenda by surfacing insights on the extent to which a subset of Vuna innovation models were adopted, with a view to understand the models' potential for sustainability and resilience building. As per the Vuna business case, the efficacy of the promoted technologies and practices was not assessed. Due to the short implementation time frame, the majority of innovation models selected for analysis had been implemented for less than one agricultural season.

The study output was four sets of papers:

- Five in-depth innovation model research papers that explored emerging lessons with regards to model adoption and ownership by pilot partners, with a view to understand prospects for model sustainability and scalability.
- Three thematic papers that categorised CSA innovation model typologies in the outgrower, extension, and seed systems thematic areas with a view to understand the categorised typologies' relative potential contribution to sustainable and scalable resilience building.
- Two good practice notes on finance and livestock that intend to guide, advise, and recommend 'what works' in designing and implementing sustainable climate smart solutions.
- One synthesis (this paper) that summarises the research context, presents the analytical framework, and concludes with the key insights distilled from the aforementioned papers.

The portfolio of Vuna innovation models explored in this paper series offers potentially valuable insights for stakeholders interested in supporting a more climate resilient agricultural sector across ESA. Despite the programme portfolio addressing a wide range of CSA challenges across a diverse array of countries and agro-ecosystems, a number of common factors emerged that impact the ability of smallholders and other market actors to adopt CSA innovations. Key among these include:

In the core market:

- **Security of market access:** Innovation model implementation experiences under Vuna suggest that for CSA practices to become the norm among smallholders, access to secure offtake markets is critical. Thus, effective CSA innovations must involve the participation of offtakers capable of absorbing climate smart products produced by smallholders. The potential of CSA innovations to actively strengthen market linkages should be a primary consideration in CSA innovation design.
- **Farmer-buyer relationships:** Implementation experiences highlight that it is the building of informal relationships and trust between farmers and buyers that lays the foundation for successful CSA innovation.
- **Smallholder organisation:** Smallholder focused CSA innovations need to incorporate viable mechanisms for farmer organisation where farmer cooperatives or associations are key drivers of functions or services central to the CSA model (i.e. extension delivery, input demand aggregation and distribution or output aggregation etc.). Where farmer mobilisation is critical for CSA uptake and adoption, innovation models need to incorporate the cost of the mobilisation process.

Within the supporting functions:

- **Climate smart inputs:** Innovation models required practice change alongside the adoption of new, improved, and climate resilient inputs. CSA innovations that depend on input systems, must be particularly cognisant of the strengths and weaknesses of those systems, and, where necessary, be prepared to intervene to strengthen the sustainability and independence of all these systems.

- **CSA skills:** Building the skills and capacities of smallholders and extension providers to improve CSA practice and adoption is central to CSA innovation success. Given the critical nature of access to quality extension for CSA uptake among smallholders, effective CSA innovations must incorporate a realistic mechanism(s) and valid business case for sustaining extension provision. While specific models may vary, effective CSA innovations must include a credible and achievable vision for who provides and pays for extension delivery.
- **Innovation finance:** Initial Vuna experiences highlight the potential role of finance in reducing perceived risks of innovation among implementers and smallholders, thus stimulating rapid early adoption of CSA practices. However, financing tools (e.g. subsidies) must be designed with a commercial orientation to enhance their sustainability.
- **Information:** Information flow in support of CSA innovation is a critical complement to skills development, but also goes beyond awareness around climate smart agricultural practices and technologies. Particularly important is information on the commercial costs and benefits of CSA improvements as a critical catalyst of response. Demonstrating the business case for CSA lies at the heart of model uptake by farmers and other partners alike.

Within the Enabling Environment:

- **Policy environment:** Implementation experiences in Mozambique, Tanzania, and Zambia demonstrate how the policy environment can influence CSA innovation and uptake. For example, in Tanzania export restrictions on food crops triggered an oversupply of maize and subsequent fall in price, providing momentum for farmers to diversify into more climate smart crops, such as beans. This, and other documented cases highlighted that CSA innovations must be cognisant of how policy trends, risks, and opportunities can trigger CSA uptake or disadoption.

Vuna's pilot implementation experiences highlighted some emerging lessons that can inform on-going and future CSA innovation design and implementation. These include:

- **Innovation definition and pathway to change:** In the context of CSA, innovation refers to changing or creating more effective business models, processes, products, and ideas that support climate resilience. Within the Vuna portfolio, each innovation model was underpinned by a specified pathway to change. This specification was critical, as it underpinned the rationale of each innovation. Clarity as to the innovation and pathway to change appears linked to model efficacy. Vuna experience in extension provision, for example, underlines this dynamic. In the case of Zimbabwe Super Seeds (ZSS), the innovation encompassed a novel partnership with the Zimbabwean government extension agency underpinned by a clear change strategy. This clarity supported model ownership, and thus efficacy.
- **Lesson:** Programmes must be clear on what constitutes an innovation, ensure that partners have bought into the nature of the change being proposed, as well as their role in effecting the change during and post programme funding.
- **Verifying the business case:** A key objective of any pilot intervention should be to prove and document the business case for innovation as it affects each key partner. This is critical to proving the efficacy of the innovation as well as driving wider uptake.
- **Lesson:** Generating the evidence to verify the business case for CSA innovation requires projects to put in place robust measurement frameworks around pilot activities. Effective and adequately resourced measurement frameworks should be integral to the design and funding of all CSA initiatives.
- **Analysis-led and multi-faceted intervention design:** Pilot experiences demonstrated the value of rigorous analysis underpinning intervention design and implementation, as well as the value of adopting a multi-faceted approach to address dynamic and complex climate and market risks. Innovation models often included multiple interventions that addressed the core market as well as an array of supporting services and functions. This was a key strength of many innovation models.
- **Lesson:** Effective CSA intervention necessitates rigorous understanding of the wider context or system around CSA innovation, and should anticipate the need to intervene in multiple aspects of those systems in support of CSA uptake.
- **Sustainable vision building:** The foundations for sustainability are often laid in the early stages of an intervention, i.e. at the pilot stage. Signs of sustainability and potential barriers to it are, therefore, already emerging across innovation models. If there is a common theme in the variability of emerging markers of sustainability it is the specificity and feasibility of a long term vision. Positive signs of sustainability are most evident where there is an explicit identification of who will do/use and pay for the respective activities and services required by the model.
- **Lesson:** Effective CSA innovations are those that build an explicit and credible long term vision for innovation delivery. That vision should be explicit about who will do/use and who will pay for each and every activity or service/product critical to the innovation during and post the project period.

- **Partner identification and selection:** Vuna worked with an array of different partners (producers, processors, traders, extension providers, etc.) across its portfolio. These partners were, unsurprisingly, critical to the success of those projects and the innovations they sought to promote.
- **Lesson:** Partner selection should be based on rigorous due diligence. While never foolproof, CSA initiatives need to assess the capacity and willingness of partners to commit to not only the pilot but also the long term investment in those CSA innovations that prove viable. In instances where the selected partner demonstrates willingness but has limited capacity, programmes must be prepared to provide additional and often specialised support to ensure that model sustainability is not comprised. Within the Vuna portfolio, these dynamics can be observed in Tanzanian based outgrower models (see Section 3.2.5).
- **Partnership negotiation and management:** The nature of partnership agreements is critically important to the success and replicability of CSA innovations. Specifically, the level of support provided and the reciprocity built into the partnership are significant determinants of whether partner behaviour change will be sustained. Evidence suggests a direct correlation between the level of contribution (often, but not exclusively, financial) made by partners and innovation ownership. For example, Zimbabwe Super Seeds (ZSS) readily co-invested in model critical activities and are committed to continued model adoption post-Vuna funding.
- **Lesson:** For CSA initiatives, the type and scope of support provided to partners must reflect the nature and risk profile of the innovation as well as the capacity and incentives of individual partners. Importantly, the type and level of support needs to develop and catalyse genuine behaviour change rather than to distort market signals and, potentially, undermine long term partner commitment and ownership.

“Vuna’s pilot implementation experiences highlighted some emerging lessons that can inform on-going and future CSA innovation design and implementation.

1 Introduction

Climate change fundamentally threatens agriculture-based livelihoods for rural populations across East and Southern Africa (ESA). Declining and variable seasonal rainfall patterns, rising temperatures, and increasing frequency of extreme events such as floods and droughts are reducing productivity, food security, and incomes. Many countries in the region with the support of international funding partners are promoting the adoption of climate smart agriculture (CSA) as a response to this challenge. CSA aims to improve resilience of farming systems to current as well as future climate-related risks. This term has been formally defined by the Food and Agriculture Organisation of the United Nations (FAO) as consisting of three components: (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change; (3) reducing and/or removing greenhouse gases (GHG) emissions, where possible[1].

While CSA offers many of the technologies and practices required to overcome current and future climate risks, a key challenge is how these promising solutions are to be delivered to farmers[2]. Many farmers operate in poorly integrated market systems. For various reasons,farmers have limited access to suitable inputs, technology, information, and extension services. They also lack consistent and predictable access to markets for their produce, severely limiting income opportunities. These factors undermine farmers' capacity and willingness to invest in many of the CSA investments that are likely to improve their resilience to climate risk. As such, complementary investments to overcome these underlying challenges are needed to promote the adoption of technologies and management practices that help make farmers more resilient to a changing climate. Over the short to medium term, technology adoption and crop choice by farmers in ESA will be shaped less by changes in climate than by market incentives and opportunities[3]. Continuing efforts are therefore needed to strengthen the broader market systems to improve farmers' access to new technologies and create the incentives to invest in and apply these technologies. Stronger commercial value chains can improve the incentives and capabilities of farmers to adopt these technologies. If farmers are well integrated into markets, they are better equipped and more likely to embrace technologies and practices that adjust their farming systems as climate risks increase.

Vuna, a United Kingdom Department for International Development (DFID) funded CSA programme implemented in ESA, adopted a market systems approach in its investments to support the adoption of CSA. The programme designed 'innovation models[4]' to improve the capacity and provide incentives for the adoption of CSA technologies and practices. Through action research, some of the Vuna supported innovation models were analysed to assess the extent of their adoption by market players, and their potential sustainability. This synthesis paper summarises key findings from that paper series and distils insights to guide development practitioners and programme managers in designing and implementing similar programmes in the future.

1 FAO, 2013; p. ix

2 Rosenstock et al., 2016; FAO 2016, IFAD 2017

3 Mutamba, 2016

4 Innovation model refers to a combination of interventions-technological and organisational-adopted by Vuna implementing partners (grantees) in the delivery of climate smart agricultural services, practices, or products to farmers and/or other value chain actors.

1.1 Climatic risks and trends in East and Southern Africa

Climate risks are endemic to agricultural production in ESA. Large inter- and intra-annual rainfall variability[5] is a major challenge for agricultural production in many parts of ESA. Rainfall is variable in timing, amount, and intensity. Seasons start late and end early, mid-season dry spells are common, and both drought and flooding are common. In recent decades, the southern parts of the region have been struck by five major, widespread, and numerous smaller droughts[6]. These have resulted in crop failure, degradation of rangelands, depletion of water sources, and have often led to significant loss of crop harvest and livestock. The FAO (2016) cites 20-60% losses in animal numbers during serious drought events in the past two or three decades. These risks have been identified as the most significant climate-related threat to food production in the near term[7]. These risks are magnified by highly sensitive rain-fed production systems and the limited adaptive capacity of the majority of farmers due to poverty and resource constraints.

The rise in global GHG appears to be increasing these climate risks. The Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment reports (AR5) conclude that temperatures in ESA have already increased by 0.5-1.0 degree centigrade over the past 50 years. If current trends in greenhouse gas emissions persist, temperatures are projected to rise by 2 degrees centigrade by mid-century, and by 3-6 degrees by the end of the century in most of ESA. In southern Africa, historical rainfall records indicate a reduction in late summer precipitation during the second half of the 20th century[8]. A number of studies also confirm intra-seasonal changes to the onset of the rainy season, increasing intensity of dry spells, and increasing intensity of daily rainfall[9]. Although projections for rainfall are less conclusive, decreases in rainfall are projected in many parts of southern Africa by the mid-21st century[10]. In most regions, rainfall is expected to become more variable. The frequency and intensity of extreme events such as droughts and flooding is increasing. The AR5 cites a number of studies that show that droughts and floods have become more frequent in ESA[11]. The combination of higher temperatures and variable rainfall may also be contributing to rising pest and disease pressures.

In combination with higher temperatures, lower rainfall and erratic seasonal rainfall patterns result in significant yield losses due to moisture stress, especially when they occur at critical stages of crop development such as flowering and grain filling[12]. These changes are also shifting the areas suitable for production of certain crops and livestock, meaning that farmers need to adjust their production systems to suit the changing climate. Given the devastating effects of droughts, the prospect of continuing increases in temperature, and the likelihood of more erratic rainfall, investments in shorter season, more drought, and heat tolerant crop varieties, as well as field level practices that reduce evaporation, enhance water-harvesting, and water-use efficiency, are a priority. More successful responses to current climate risks will significantly improve capacity to respond to future climate risks.

Vuna supported innovation models promoted the adoption of CSA solutions that improved the capacity of smallholder farming systems to respond to climate risk. The innovation models were designed to help farmers and agribusinesses alike gain better access to CSA solutions, and ensure that they have both the capacity and the incentive to use them. Innovation models also sought to strengthen and broaden commercial agricultural markets and improve linkages with smallholder farmers.

1.2 Vuna programme context

1.2.1 Vuna project design and implementation timeline

Established in 2015, Vuna[13] is a DFID funded initiative for ESA that aims to promote "*Transformative change across the agricultural sector… such that a majority of farmers in ESA are climate resilient*"[14]. In its programme design, Vuna acknowledged that in order to achieve this goal, 15-20 years of active promotion and support for the adoption of CSA was required[1]. However, with funding of GBP 18,2 million over three years, the programme focused on laying the foundations for farmer

5 Variable level, but also variable timing of the start and end of rains, and of mid-season dry spells, as well as extremes.
6 Droughts were experienced in 1991-1992, 1994-1995, 2000-2001, 2005-2006, and 2015-2016
7 FAO, 2016, Niang et al., 2014
8 Niang et al., 2014
9 Tadross et al., 2005, 2009; Thomas et al., 2007; Kniveton et al., 2009, as cited in Niang et al., 2014, p.1209
10 Niang et al., 2014
11 Funk et al., 2008; Williams and Funk, 2011; Shongwe et al., 2011; Lyon and DeWitt, 2012, as cited in Niang et al., 2014, p. 1211
12 Iqbal et al., 2009; Lobell et al., 2013; Moriondo et al., 2011, as cited in Porter et al., 2014, p. 497
13 Previously Climate Smart Agricultural Programme (CSAP)
14 CSAP, 2015. Inception Report. Draft Final. 11 December 2015.

climate resilience through evidence generation, improving the enabling environment, piloting and where appropriate scaling interventions that harnessed commercial incentives to promote the adoption of CSA.

To ensure rapid mobilisation and implementation of projects, Vuna applied a "*guided, supported and managed project development and implementation process*". Figure 1 illustrates the five phases that led to the establishment and implementation of projects across the five target countries. Project concepts were identified during the Vuna implementation stage. During the project idea generation phase, the suggested projects were then investigated and screened. Subsequently, during the project plan development phase these ideas were developed into complete project plans. Each project plan demonstrated how the project contributed to the programme's outputs and provided a detailed project budget. Once developed, each project went through an internal and DFID approvals process. Thereafter, calls for grant proposals, receipt and evaluation of applications, award, and contracting of grantees was completed.

At the earliest, project innovation models implementation started in December 2016 and at the latest started in April 2017 with all projects closing in December 2017. This resulted in a maximum of 12 and a minimum of 8 months in project implementation. Given the long term nature of CSA adoption (i.e. at least 3 to 5 years to pilot projects and an even longer period to scale-up), the results achieved in one calendar year provided nascent insights on the potential impact of Vuna supported interventions.

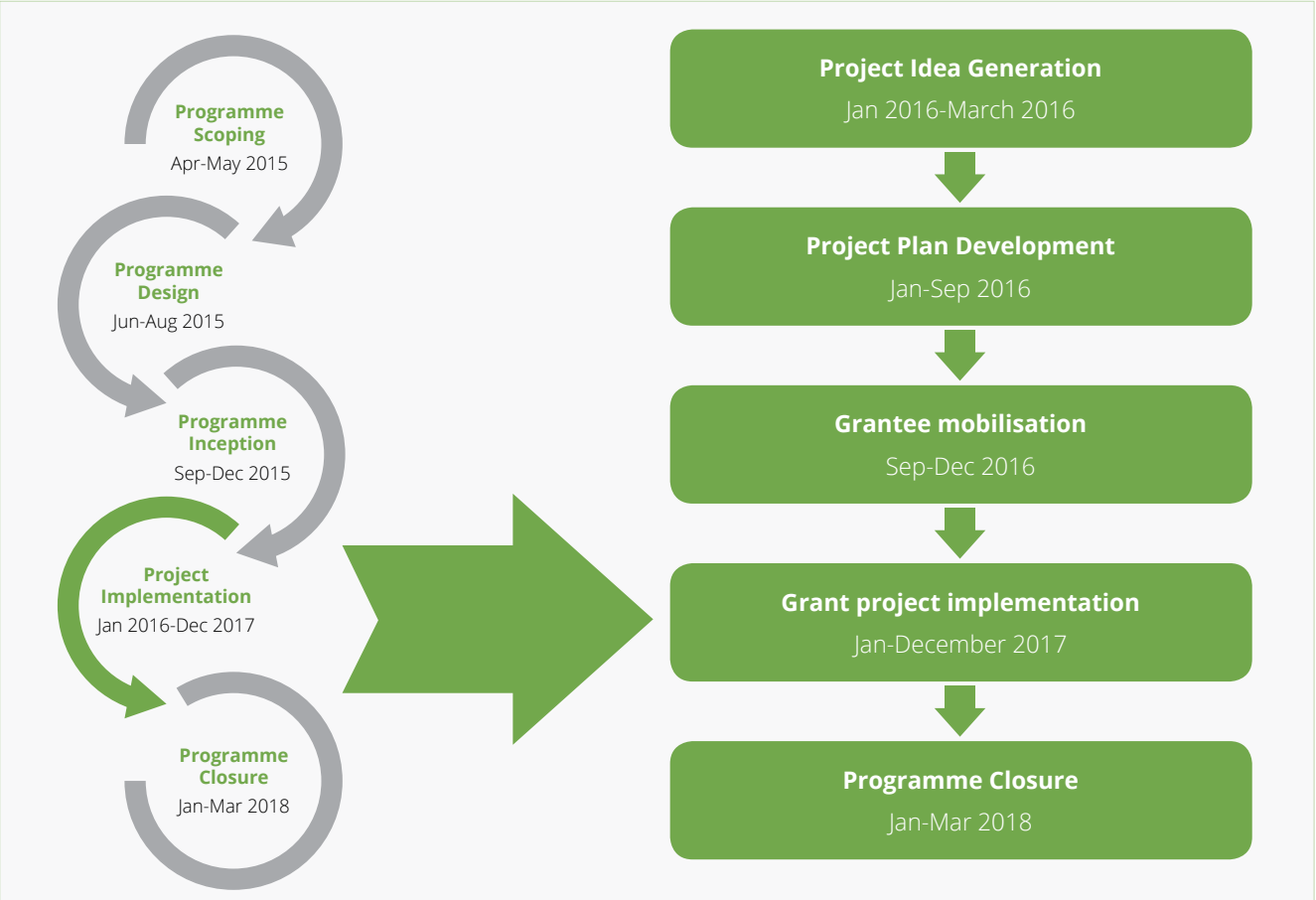


Figure 1: Project life cycle

1.2.2 Vuna Agricultural Development Facility innovation models

Vuna was organised into three facilities: Evidence, Learning, and Influencing Facility(ELIF)[15]; Enabling Environment Facility (EEF)[16]; and the Agricultural Development Facility (ADF). The ADF sought to pilot and where appropriate scale-up approaches to the adoption of locally suited agricultural practices and technologies that improved smallholder farmers' resilience to climate change. The ADF innovation models addressed farmers' adaptation needs through providing risk management services (risk management models), climate relevant inputs (input-based models), CSA relevant extension services (farming practice models) and access to markets (market-based models). In design and practice, innovation models supported multiple

15 The ELIF sought to improve the use of CSA evidence, by extracting and applying existing evidence and better packaging and disseminating learning.

16 The EEF sought to strengthen the enabling environment for CSA by focussing on policy, information, climate finance, and education.

adaptation pathways by providing services that cut across two or more model typologies. However, an innovation model's core purpose, objective, or driver was often rooted in one model typology. This dynamic is summarised in Figure 2. The illustration highlights that while model entry points were rooted in a specific typology, the individual model always provided cross-typology technologies, services, and products. For example, while the ZSS entry point was improving access to quality seeds, the model also addressed issues of farming practices and market linkages.

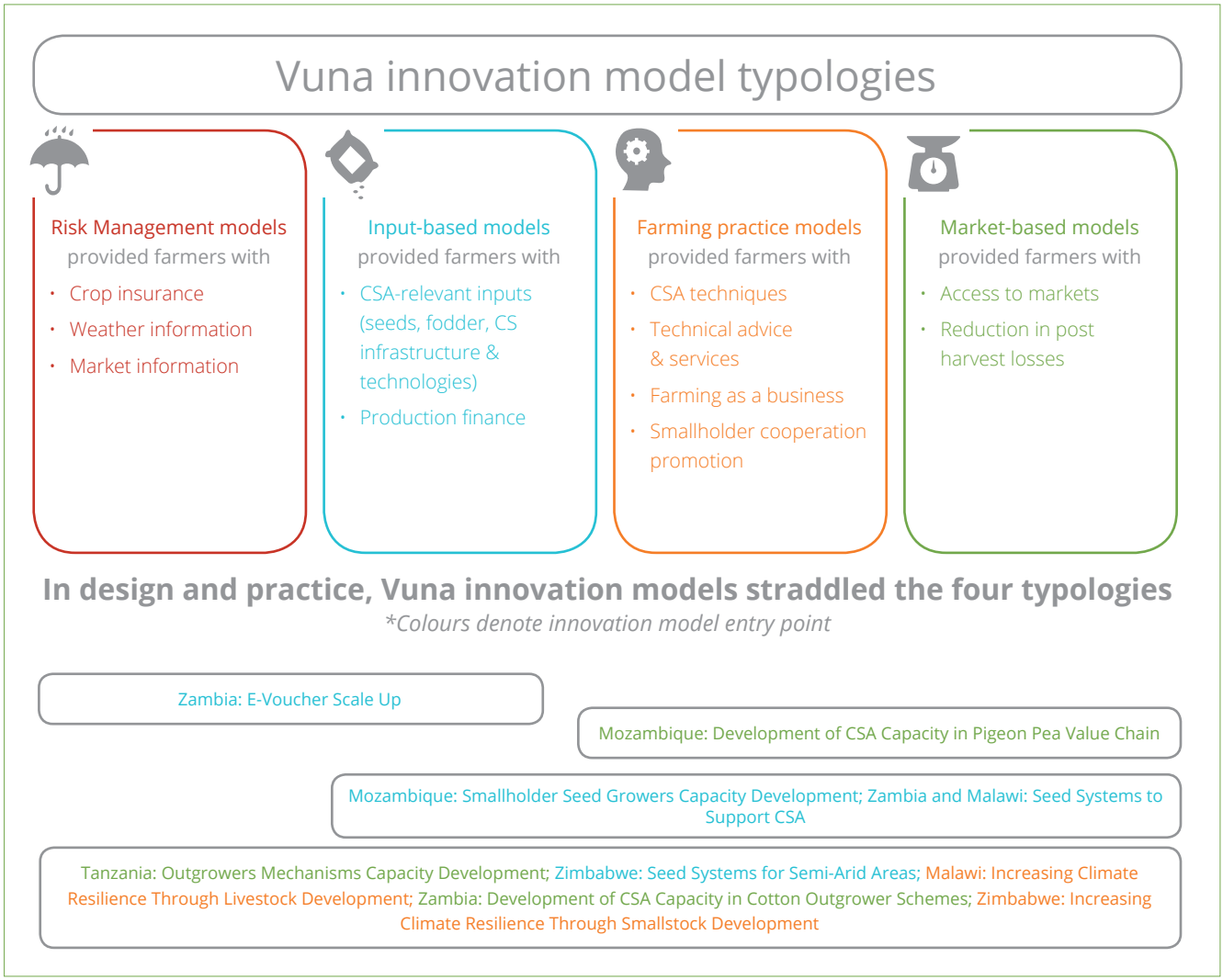
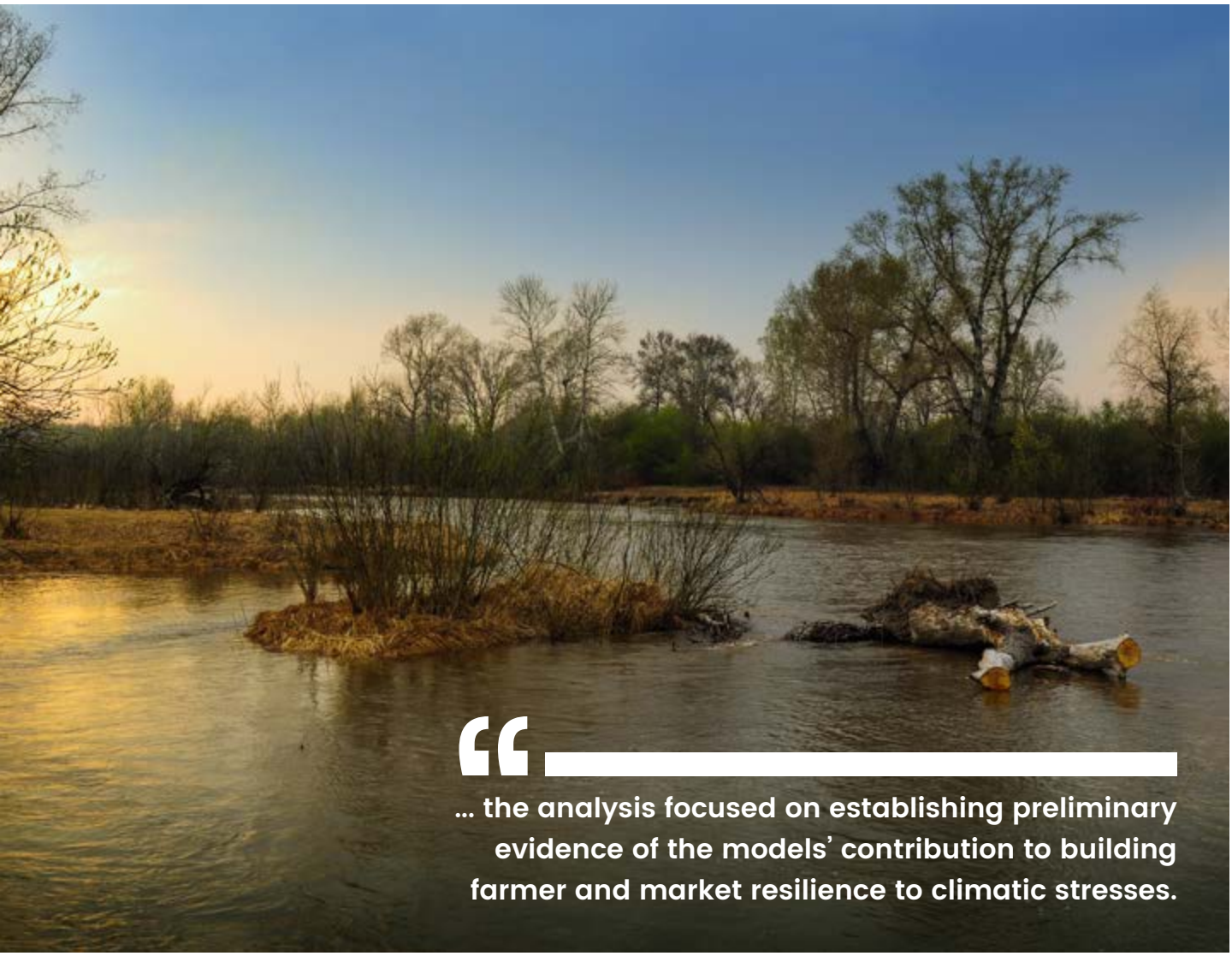


Figure 2: Vuna innovation model typologies

2 Vuna innovation model research

Vuna adopted an action research approach to generate reliable evidence on how the innovation models contributed to the increased resilience of individuals, households, and markets. Vuna's action research aimed to generate and package new evidence on effective CSA delivery models. The ultimate objective of which was to generate lessons that allowed innovation model players to reflect and improve on their models and to inform and influence potential CSA users, policymakers, and development practitioners.

This study sought to contribute to Vuna's action research agenda by surfacing insights on how a subset[17] of ADF innovation models supported resilience building and facilitated wider adoption and scale-up of climate smart initiatives. In line with Vuna's implementation approach, the study adopted a systemic resilience lens (explained in Section 2.2) that focused on assessing the extent of innovation model adoption, with a view to understanding the model's potential for sustainability and resilience building. As per the Vuna business case[18], the efficacy of the promoted technologies and practices were not assessed. Stemming from the project development process (explained in Section 1.1.1), the majority of innovation models selected for analysis had been implemented for less than one agricultural season. Consequently, the analysis focused on establishing preliminary evidence of the models' contribution to building farmer and market resilience to climatic stresses.



17 The Vuna ADF portfolio included 13 innovation models. Five of those innovation models were selected for in-depth analysis: 1) Mozambique: Development of CSA Capacity in Pigeon Pea Value Chain 2) Tanzania: Outgrowers Mechanisms Capacity Development 3) Zambia E-Voucher Scale-up 4) Zimbabwe: Seed Systems for Semi-Arid Areas 5) Malawi: Increasing Climate Resilience through Livestock Development. The research outputs of the innovation model analysis can be found in the innovation model paper series.

18 The Vuna business case focused on improving the effective implementation of CSA interventions in order "to make a significant increase in the adoption and continued use of CSA approaches, and thus lead to greatly reduced vulnerability and improved developmental outcomes." (CSAP Design Report, 2015 pp. 21)

The study output was four sets of papers:

- Five in-depth innovation research papers that explored emerging lessons with regards to model adoption and ownership by pilot partners, with a view to understanding prospects for model sustainability and scalability. The papers concluded with insights on how to improve similar innovations as well as broader insights on how interventions can contribute to building resilient smallholder farming systems in a sustainable manner.
- Three thematic papers that sought to categorise CSA innovation model typologies in the outgrower, extension, and seed thematic areas with a view to understanding the categorised typologies' relative potential contribution to sustainable and scalable resilience building. In addition, the thematic papers sought to identify the conditions under which future innovation model typologies could achieve greater impact.
- Two good practice notes on finance and livestock that intend to guide, advise, and recommend 'what works' for development practitioners and other stakeholders in designing and implementing sustainable climate smart solutions that build resilience in smallholder systems.
- One synthesis paper (this paper) that summarises the key insights from the paper series and distils lessons to guide development practitioners and programme managers when designing and implementing similar programmes in the future.

2.1 Study approach

The study involved:

- Review of relevant literature, field visits and key informant interviews at innovation model operation sites with implementing partners, influencing actors, and target beneficiaries,
- Discussions with key stakeholders on local climatic risks and market dynamics.

Research findings were bolstered by regular co-learning sessions with the Vuna team to ensure that emerging insights and lessons were informed by Vuna's long term experience engaging with grantees. In addition, the co-learning meetings provided a platform for the Vuna technical team and the action research team to exchange ideas, ensuring that the final research outputs were a collaborative effort reflecting strengths and weaknesses of design and implementation.

2.2 Conceptual framework

The selected innovation models[19] informing this paper were analysed through the lens of the Systemic Resilience Framework (Figure 2). The framework brought together three key and interrelated concepts- resilience, sustainability, and scalability- to address the study's core research questions:

- Are the innovation models contributing to building the resilience of farmers and markets, and
- Are the changes triggered by the innovation model potentially sustainable and scalable?

The Systemic Resilience Framework enabled the innovation models to be analysed through the lens of resilience and systemic change. From a resilience perspective, the framework considered the process and extent to which models contributed to reducing the sensitivity and building the adaptive capacity of smallholder farmers and agricultural market systems. By focussing on both the process and (where evident) emerging outcomes of resilience building, the analytical framework surfaced the innovation models' nascent, yet foundational, contributions to building resilient agricultural systems.

In tandem, the innovation models were analysed from the perspective of sustainability and scalability. To understand the model's prospects for achieving sustained and scalable change, the framework leveraged the "The Systemic Change Framework". The framework tracks the process through which systemic change-change which is sustainable and scalable- occurs by breaking it down into its four distinct parts: Adopt, Adapt, Expand, and Respond (or AAER).[20]

19 Refer to the five paper series on Vuna innovation models: 1) Mozambique: Development of CSA Capacity in Pigeon Pea Value Chain 2) Tanzania: Outgrowers Mechanisms Capacity Development 3) Zambia E-Voucher Scale-up 4) Zimbabwe: Seed Systems for Semi-Arid Areas 5) Malawi: Increasing Climate Resilience through Livestock Development. The research outputs of the innovation model analysis can be found in the innovation model paper series.

20 Nippard, D., Hitchins, R., & Elliott, D. 2014, March

The integration of the AAER framework ensured that the innovation models were analysed from the perspective of sustainability and scalability. The framework considered the extent to which the innovation model, be it activities or processes, were adopted by market actors- both private and public. The extent to which market actors adapted the innovation model to better suit their market and environmental context was also analysed. Finally, the extent to which the innovation model triggered changes in business models, processes, and rules within the broader system (through other market players adopting the model or variants thereof) or to the market rules or norms that sustain and support the innovation model's desired changes was also considered during the analysis. In line with our perspective on resilience building, the Systemic Resilience Framework focused on identifying the innovation models' nascent markers of sustainability and scalability.

The framework is summarised in the Figure 3.

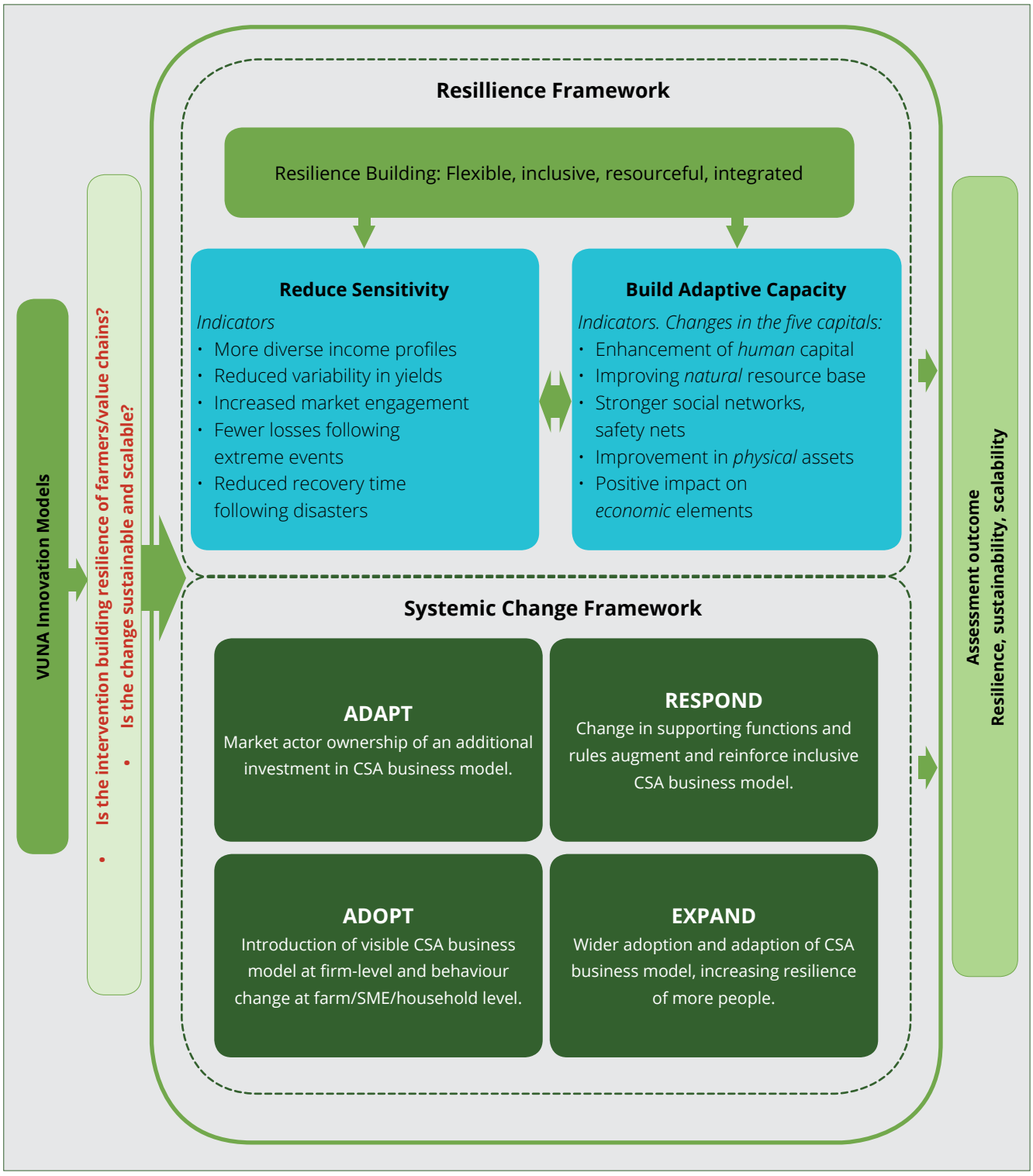


Figure 3: Systemic Resilience Framework

3 Key insights from Vuna innovation models

The portfolio of Vuna innovation models explored by the Innovation and Thematic Paper series, offer some potentially valuable insights for all those with a stake in realising a more climate smart agricultural sector across ESA. The following section addresses the central question: *What can we learn from Vuna's experience to date in promoting climate smart agricultural innovation?*

While the portfolio was at an early stage in its implementation, it nonetheless offers some emerging insights and potential lessons for CSA programming, in particular, in two key areas:

i) Common constraints facing smallholder CSA adoption and innovation.

ii) Opportunities and challenges facing those seeking to intervene to stimulate CSA adoption and innovation.

This section explores each of these topics to identify what we can draw from Vuna's experience to date.

3.1 Insights into the constraints facing smallholder CSA innovation

Vuna's programme portfolio addressed a wide range of CSA challenges across a diverse array of countries and agro ecosystems in ESA. Despite this diversity, a number of common factors emerged, which impact upon the ability of smallholders to understand and adopt improved CSA practices. Specifically:

In the core market:

- Security of market access
- Farmer-buyer relationships
- Smallholder organisation

Within supporting functions:

- Climate smart inputs
- CSA skills
- Information
- Innovation finance

In the enabling environment:

- Policy environment

3.1.1 The market system for CSA innovation

The aforementioned factors influence the effectiveness and efficiency of CSA adoption and uptake. The Vuna experience to date can support the development of a generic framework for assessing the ecosystem or market system around the demand for and supply of CSA innovation. Using the typology set out by the *making markets work for the poor* approach[21], this generic market system is illustrated in Figure 4[22].

21 The Springfield Centre, 2014

22 A market system is defined here as comprising three sets of functions: The core function where supply meets demand (uptake) for climate smart agricultural innovation; Supporting functions that enable CSA uptake to occur; and Rules and norms *that* govern and shape incentives, behaviour, practice of both the core and supporting functions

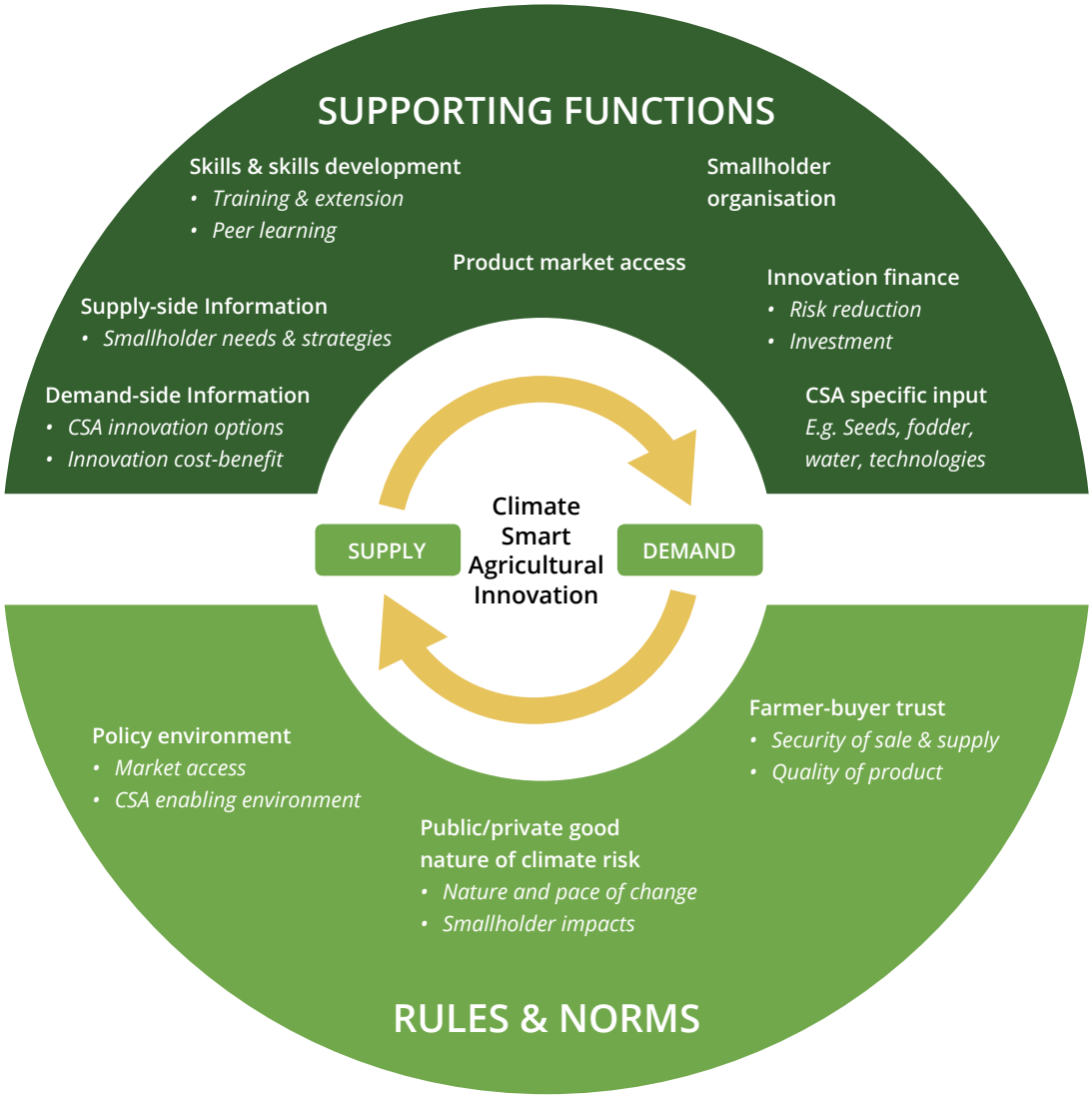


Figure 4: The market system for climate smart agricultural innovation

This emerging market system construct can be used to guide future and ongoing CSA innovation intervention design. It offers a potentially useful framework for guiding analysis of the key functions that can be expected to impact upon CSA innovation, focusing research and diagnostic efforts, and subsequent intervention strategies, toward those issues most likely to affect CSA innovation efficacy and uptake. The following section presents the analysis used to inform the development of the proposed generic market system around the demand for and supply of CSA innovation.

3.1.2 In the core market

Security of market access

Smallholder livelihoods are invariably dependent upon their access to markets for their products. The ability to sell at a fair and reliable price is the primary driver for most, if not all smallholders. This security of market access is no less the case-arguably even more so-for those smallholders exposed to significant climate-related risks.

Vuna's experience demonstrates the symbiotic relationship between smallholder CSA responsiveness and the strength of market linkages for offtake resulting from more climate smart practices. The positive CSA response of seed multipliers in Zimbabwe[23] or outgrowers in Tanzania[24] is closely linked to the guaranteed market access each model offers. Where market links falter, as with the Mozambican pigeon-pea market in 2017 smallholders rapidly consider reverting to previous cropping patterns.

23 For additional information on the seed multiplication model in Zimbabwe, refer to the Innovation Series paper "Inclusive Seed Systems for Semi-Arid Areas: Insights from ZSS"

24 For additional information on the referenced outgrowers refer to the Innovation Series paper "CSA Capacity Development in Out-grower Schemes: Insights from Musoma Food Company Ltd and G2L Ltd in Tanzania"

Importantly, CSA innovations that, due to wider market dynamics, depend on fragile linkages, risk increasing smallholder vulnerability. Arguably this is a potential risk for Malawi dairy producers participating in the Lilongwe Dairy Limited and Malawi Milk Producers Association led innovation model[25]. The fresh milk market on which these dairy farmers depend is faced by a growing threat from powdered milk imports. Although the innovation model attempts to address this threat by improving milk productivity and quality, these efforts might not be sufficient to mitigate the risk participating producers' face from powdered milk sales. Their investment in CSA innovations promoted by the project may increase their economic vulnerability should powdered milk imports continue to threaten fresh milk sales. However, adequate local production of good quality milk at comparable prices present solid grounds for a policy shift towards protecting an emerging local industry against well-established international competitors.

For CSA practices to become the norm among smallholders, access to secure markets is critical. Effective CSA innovations will be those that involve the participation of offtakers capable of absorbing climate smart products produced by smallholders. The potential of CSA initiatives to actively strengthen market linkages to increase smallholder economic vulnerability should be a primary consideration in project design and risk assessment.

Farmer-buyer relationships

As noted above, end market access is a critical driver of CSA adoption and the willingness of both smallholder farmers and buyers to engage and invest in CSA innovations. The Vuna experience clearly demonstrates that the strength of linkages to markets lies in inherent trust between buyers and sellers. The outgrower models in Tanzania and Mozambique highlight that while formal contracts are important in terms of setting out the nature of expectations on each party, as legal documents they are in practice largely unenforceable. In particular, the legal costs and reputational risk for buyers or processors to seek redress with defaulting smallholders are prohibitive.

It is, therefore, in the building of less formal relationships and trust between farmers and buyers that the foundations for successful outgrower CSA innovation lies. CSA models need to prioritise trust building. Intervention design should take due account of historical relationships and challenges to those relationships when identifying partners and establishing formal and/or informal contracts between market players.

25 For additional information on the Lilongwe Dairy Limited and Malawi Milk Producers Association partnership refer to Innovation Services paper, "Building climate resilience for dairy farmers, through climate smart solutions: Insights from the Malawi smallholder dairy sector"

Smallholder organisation

Smallholder agriculture in ESA is characterised by large numbers of fragmented, smallscale production units, many disadvantaged by inaccessibility in terms of distance to and from markets and/or poor transport infrastructure. The transaction costs inherent in accessing smallholders are high and varying levels of farmer organisation and coordination are integral to most Vuna innovation models.

A variety of "farmer organisation" approaches were leveraged by Vuna innovation models, some subject to the specific model needs (e.g. outgrower models, seed multiplication networks), and others building on prevailing structures (e.g. milk bulking groups) in specific locations. While evidence of the relative efficacy among these models is not possible to discern, it is obvious that those offering the greatest economic returns to farmers, and their greater potential to sustain themselves, are most appropriate to support CSA innovations. Despite some weaknesses in the conditions of outgrower contracts, these models offer clear signs of sustainability since they are grounded in a commercial 'contract' between producers and buyer.

Other models may bear greater risk of dependency on external mobilisation. Although existing structures such as milk bulking groups or lead farmer seed growers networks have the potential to sustain themselves, many are nonetheless an historic product of donor investment and as such their sustainability and/or replicability needs to be considered with care. For instance, the Zambian seed grower farmer groups continue to benefit significantly from investments of donors and to a lesser extent, the national government. Unless the private sector improves its capacity (e.g. through better working capital raising and improved seed marketing networks) to utilise these networks and provide consistent offtake opportunities to farmer groups, their continued existence is doubtful.

Irrespective of the organisational approach employed, smallholder CSA innovations need to incorporate viable mechanisms for farmer organisation where these are key drivers of functions or services central to the CSA model (e.g. extension delivery, input or output aggregation etc.). Where farmer mobilisation is the foundation for CSA uptake and adaptation, innovation models need to incorporate both the provision and cost of that mobilisation process.

3.1.3 Within supporting functions

Climate smart inputs

In all the Vuna cases, CSA innovation has required more than just practice change. It has entailed the adoption of new, improved, and climate resilient inputs and/or investment in CSA technologies and infrastructure. Perhaps not surprisingly, CSA is rarely a matter of minor adjustment but rather entails significant changes to production practices, input use and farming systems. Growers in Malawi, Mozambique, Tanzania, Zambia, and Zimbabwe require access to improved seed varieties provided through the usual networks of suppliers and dealers; dairy farmers in Malawi and goat farmers in Zimbabwe need access to improved fodder seed, animal genetics, other technologies, and finance.

Implicit is the need for CSA innovations to consider the functionality and efficiency of these prevailing systems for input or technology supply (whether that be extension, information or technology inputs) where they are integral elements of CSA adoption. Where the nature of CSA inputs has suited prevailing supply systems (e.g. improved seeds, fertiliser, pesticides etc.) those systems and distribution networks have readily supported Vuna innovations and required relatively minimal engagement as, for example, has been the case with agro-dealers supporting the Zimbabwe Super Seeds (ZSS) model. More significant CSA technology innovations such as solar power units or biogas digesters in the Malawi dairy model have exposed the fragility of prevailing service systems (e.g.construction, maintenance, finance) upon which the long term supply of those technologies depends and, moreover, encouraged Vuna's intermediary partners to take increasingly significant and unsustainable roles in input delivery.

In future,design of CSA innovation projects must be particularly cognisant of the strengths and weaknesses of wider service or technology delivery mechanisms and, where necessary, be prepared to intervene accordingly to strengthen the sustainability and independence of all those 'systems'.

CSA skills

Building the skills and capacities of smallholders and extension providers to improve CSA practice and adoption is a central feature throughout the Vuna portfolio. This is to be expected but is no less critical. Although the Vuna time frame prevents assessment of training outcomes, smallholder adoption of new practices can always be expected to require new skill sets. Active and ongoing training and skills development is, therefore, the acknowledged norm-utilising, but not relying solely

on, demonstration models and activities. While different mechanisms for skills transfer are utilised-group and lead farmer networks; private, public, non-government and specialist providers-common themes emerge.

In all projects, skills development is delivered through multi-provider mechanisms or partnerships. The implication is that no single provider offers the quality and outreach required to sustain CSA skills development services. In some instances, innovative approaches to forging effective and collaborative partnerships were promoted, such as the financial and non-financial incentives offered to public extension personnel by Musoma Food Company Limited[26] (MFCL). Nevertheless, the importance of pluralistic extension strategies appears well established[27].

It is evident that the need for ongoing skills development is acknowledged. The dynamic nature of climate change requires that the provision of quality skills development services be equally dynamic. Implicitly, delivery mechanisms need to be flexible and sustainable and Vuna's experience offers more mixed experience in this regard. The emerging business model of ZSS provides for sufficient margins from seed multiplication to fund extension in partnership with the Zimbabwean Government extension services department (Agricultural Technical and Extension Services: AGRITEX). Outgrower partnerships with the Export Trading Group (ETG) in Mozambique and G2L Company Ltd (G2L)in Tanzania have, however, struggled to embed extension provision in their respective business models and skills development remains donor dependent for both.

In all Vuna portfolio projects, it is clear that there is a critical role for Government extension services but their lack of financial and human resource capacity hinders their effectiveness. Innovation is required to energise and leverage the available capacity within the vast state funded extension system. Although some Vuna supported agribusinesses are pioneering performance-based approaches to energise the government extension systems, it remains necessary to develop and institutionalise frameworks that guide agribusinesses on how these could be formalised and applied more consistently and transparently.

Given the critical nature of continued access to quality extension and training for CSA uptake among smallholders, effective CSA innovations must incorporate a realistic mechanism(s) and valid business case for sustaining extension services to project participants. This is particularly pertinent in the absence of an effectively resourced public extension system. While specific provision of models will vary, effective CSA innovations must include a credible and achievable vision for who provides and pays for extension delivery. In geographies where functional public extension systems operate, pluralistic public-private extension delivery mechanisms that generate system-wide benefits are feasible. However, in geographies that lack functional systems, private sector partners must be prepared to shoulder a higher burden in the provision of extensions services. Given a clear case for the public good nature of extension to drive CSA adoption, both bilateral and multilateral funding mechanisms should be deployed in cases where national governments lack the capacity, particularly to offset high upfront investments in extension, in a manner that complements and crowds-in private investment.

Information

Information flow in support of CSA innovation is a critical complement to skills development, but also goes beyond awareness around climate smart practices and technologies. A key dimension of Vuna's innovations is raising awareness of the challenges posed by climate change and the opportunities available to mitigate against those among smallholders and private sector market players. Information plays a key role in many of the models as a means of helping disparate market players (farmers, processors, agro-dealers) recognise common interest in CSA. The existence of shared interests may be clear to some, but Vuna's experience demonstrates this is by no means always the case and active advocacy and dissemination forms an integral part of many of the innovations.

Particularly important is the value of information on the commercial costs and benefits of CSA improvements as a critical catalyst of response. Both crop and livestock farmers within the projects have responded to clear signals of the productivity benefits of CSA practices compared to the costs of adoption. Demonstrating the business case for CSA lies at the heart of model uptake by farmers and other partners alike. Equally, where such information is either not forthcoming or indicates unrealistic payback periods- as with some of the larger dairy model investments in Malawi- partner response has been measurably weaker and model replication hard to predict.

26 For additional information on the Musoma Food Company business models refer to the Innovation Series Paper, "CSA Capacity Development in Out-grower Schemes: Insights from Musoma Food Company Ltd and G2L Ltd in Tanzania."

27 For additional information on pluralistic extension strategies see the paper in the Thematic Series Paper titled, "Private Sector Driven Extension Models for Smallholder Farmers: Insights from Vuna Innovation Models in East and Southern Africa."

Supply-side information is also important. The e-Voucher input subsidy scheme in Zambia[28] highlights selective uptake of CSA inputs under the voucher scheme. Much can and should be gleaned from smallholder response to this scheme as to where the strongest demand for CSA lies and what other CSA relevant inputs may need additional promotion or marketing. The Zambia case also demonstrates the risk of misunderstanding consumer preferences in the insurance market. Its focus on premium prices in the development of crop insurance products did not align with consumer interests in payout values and, ultimately resulted in limited uptake.

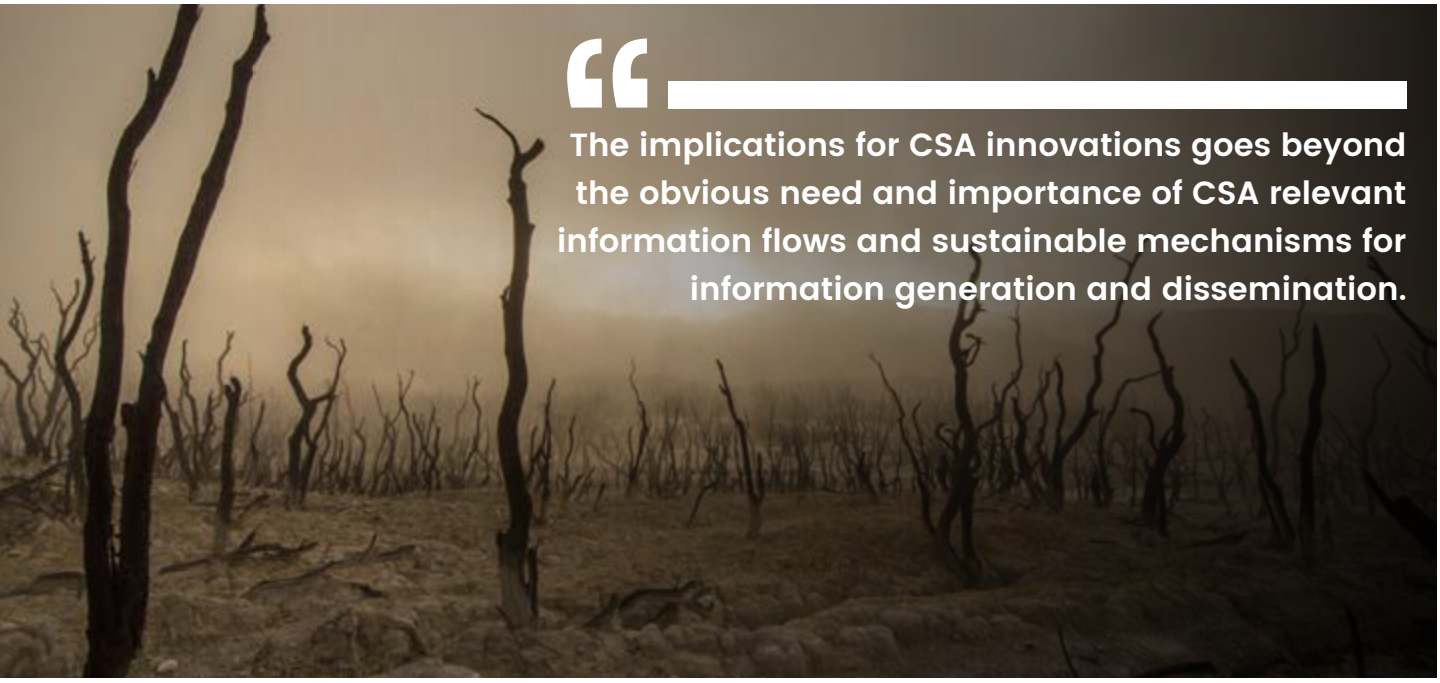
The implications for CSA innovations goes beyond the obvious need and importance of CSA relevant information flows and sustainable mechanisms for information generation and dissemination. This is important, but equally so are the types of information needed to stimulate CSA uptake and behaviour change. Both smallholders and private players respond more readily to the commercial incentives, and hence information that supports the commercial business case for CSA is most critical. While some stakeholders respond to messages around climate change and mitigation, it is the farm- and business-level commercial implications of those changes that are the key drivers of behaviour change. Thus,CSA innovations need to establish a commercially compelling a priori and a posteriori business case for CSA innovation if they are to achieve real and sustained impact on adoption. For instance, the 75% increase in milk yield in Malawi due to adoption of hydroponic fodder production systems, coupled with information on how the systems can be adapted to suit the farmers' resource endowments is driving relatively rapid adoption of the technology despite the need to purchase materials such as the greenhouse plastics.

Innovation finance

Finance is an often cited constraint by those working with smallholders, particularly among poorer and more disadvantaged smallholders. For Vuna, it is too early to observe differential uptake among smallholders as a result of finance related factors. However, early experience does highlight the potential role of finance in reducing perceived risks of innovation among smallholders and thus stimulating more rapid early adoption.

The Zambia e-Voucher input subsidy scheme demonstrates the potential for leveraging innovations such as information communication technology (ICT) and voucher mechanisms to cost-effectively increase access to financial services at scale. Insights from the e-Voucher project indicate that agricultural subsidies, as a financial product, have the potential to drive CSA adoption. Additional insights also indicate that the sustainability of subsidy driven CSA adoption requires that farmers have access to off-take markets for CSA commodities

The Malawi dairy innovation model also demonstrates the importance of financing when greater CSA investments are needed such as in solar power, biogas or hydroponic technologies. These larger capital investments require access to formal finance either individually or through groups. However, there are no clear strategies in place to facilitate long term capital financing once the project support ends.



28 For additional information on the integration of CSA inputs into the Zambian e-Voucher input subsidy scheme refer to the innovation series paper, "Integrating Climate Smart Agriculture into E-Voucher Farmer Input Subsidy Programme: Insights from Zambia"

3.1.4 Within the enabling environment

Policy environment

The Vuna experience, even at this early stage, highlights the influence of the policy environment upon CSA innovation and uptake. In particular, two areas of policy impacted significantly on Vuna projects during the implementation period. Firstly, domestic and international policies affecting key markets had a direct impact in both Mozambique and Tanzania. In Mozambique, an external policy decision by the Indian government to impose import restrictions on pigeon peas had an immediate and significant impact on both demand and prices for pigeon pea and led the Vuna partner, ETG, to limit procurement. In Tanzania, a domestic policy decision to impose restrictions on the export of food crops (including maize, sorghum, millet, rice, wheat, beans, cassava, potatoes, and bananas) also had implications for CSA uptake. Specifically, the oversupply of maize in 2017 and subsequent price falls provided additional momentum for farmers diversifying into more climate smart crops such as beans. Currently, as a primarily domestic market crop, beans remain unaffected by export bans. Nevertheless, such policies where they affect specific crops will influence CSA adoption particularly for export-oriented crops.

A second area of policy impact is apparent from the success of the Zambia e-Voucher input subsidy scheme in stimulating CSA uptake. Notwithstanding potential sustainability issues, the case demonstrates the potential impact on CSA uptake possible through appropriate and targeted CSA policy.

The case experience underlines how important the policy environment is to CSA adoption and innovation. While some (international) market policies may be impossible to influence, other (domestic) policies do offer opportunity for engagement and influence as was the case in Zambia. In either case, effective CSA innovations must be cognisant of policy trends and risks in order to address and/or mitigate those risks to CSA uptake.

3.2 Insights into the challenges and opportunities of CSA innovation design and implementation

The performance of the Vuna project portfolio is as yet too early to assess with any degree of certainty. Nevertheless, rapid feedback loops are the hallmark of good programme management practice. The following section seeks to draw out, where possible, tentative lessons emerging from Vuna's pilot experience that can inform ongoing and future intervention and activity. Specifically, it identifies and elaborates upon intervention experience in the following areas:

- Innovation model definition
- Verifying the business case
- Analysis-led and multi-faceted intervention design
- Sustainable vision building
- Partner identification and selection
- Partnership negotiation and management

3.2.1 Innovation model definition and pathway to change

The term 'innovation' is used broadly within the Vuna portfolio to capture a wide range of CSA pilots. Commonly, the term refers to creating more effective businesses, processes, products, and ideas. In the context of CSA, this could mean adopting a new business model, implementing new CSA practices, creating more climate responsive products or improving existing agricultural practices and/or services. This broad definition provided a working and flexible framework for Vuna when identifying and targeting CSA innovation. At its core, however, innovation implies a business, process or product that is 'different' and offers a tangible improvement on current business models, processes or practices.

Within the Vuna portfolio, each innovation model was underpinned by a specified pathway to change. This pathway to change was illustrated in the form of a project-level results chain. This specification was critical, as it underpinned the rationale for each innovation, the agricultural practices it sought to change, and those market players and partners with critical roles to play. It also provided the basis for monitoring and measuring innovation performance, uptake, and impact.

Vuna's experience in extension service provision underlines the value of clearly defining the innovation and pathway to change. In Zimbabwe, the ZSS extension model encompassed an innovative partnership with AGRITEX, the government extension agency. The partnership was underpinned by a clear change strategy that included enhanced collaboration on the development of CSA training materials, joint delivery of extension, and innovative means of incentivising AGRITEX outreach. ZSS's clarity as to the nature and impact of the change supported innovation ownership, and thus innovation efficacy.

3.2.2 Verifying the business case

The importance of a credible business case for CSA has been noted in the preceding analysis. A key objective of any pilot intervention should be to verify and document the business case for innovation as it affects each key partner. This is critical to proving the efficacy of the innovation as well as driving wider uptake.

In Zimbabwe, ZSS has strived to establish that business case and set out a commercial model on which to base its smallholder seed multiplication operations and services such as extension that are critical to it. In Malawi, the project has likewise sought to establish a clear return on investment calculation for its biogas digester technology. In both cases this information is invaluable. It demonstrates the commercial viability of the ZSS model in Zimbabwe, while challenging the feasibility of smallholder investments in the biogas technology.

Generating the evidence with which to verify the business case for CSA innovation requires projects to put in place robust measurement frameworks around pilot activities. Effective and adequately resourced measurement frameworks should be integral to the design and funding of all CSA initiatives.

3.2.3 Analysis-led and multi-faceted intervention design

The Vuna portfolio demonstrates the value of rigorous analysis in underpinning intervention design and focus. The complexity of climate change and its impacts on different environments and farming systems is widely acknowledged and the breadth of analysis supporting the Vuna portfolio reflects this. Importantly, the portfolio highlights the need for analysis

to go beyond immediate climate impacts and technologies, to understand the wider functions and systems affecting CSA results and uptake.

Vuna's projects all comprise multiple interventions seeking to address wider market system challenges alongside climate specific constraints. Improved CSA inputs are the focus of the majority of cases studied, but each comprise a portfolio of interventions addressing an array of supporting services and functions including input quality assurance, extension and information provision, insurance products and market linkages. This multi-faceted approach was a key strength of many projects. In Malawi, for example, both skills development and construction services are key complements to the provision of biogas and solar power technologies although, arguably, the project has not yet adequately addressed finance as a critical supporting function.

In keeping with growing recognition within the development field in general, effective CSA intervention necessitates rigorous understanding of the wider context or system (see Figure 3 above) around CSA innovation, and should anticipate the need to intervene in multiple aspects of those systems in support of CSA uptake.

3.2.4 Sustainable vision building

While the Vuna portfolio remains at a very early stage, experience suggests that the foundations for sustainability are laid in those early stages of intervention and piloting. Signs of sustainability and potential barriers to it are, therefore, already emerging.

In Zimbabwe, strong partnerships are emerging between ZSS, smallholders, and AGRITEX based on well-defined responsibilities for each partner and mechanisms for covering the costs of each partner. In Tanzania, one[29], though not the other[30], outgrower scheme shows signs of embedding a more active extension service into its model. In Mozambique, while the quality of Solidaridad CSA extension provision has improved and is impacting on public services, it is less clear how that service will be paid for in the long term. Similarly, in Zambia, use of the e-Voucher subsidy mechanism has led to temporary CSA uptake but indications are that this will not be sustained if subsidies are removed and demand for CSA crops is insufficient. Finally, in Malawi, the sustainability of investments such as solar power systems and biogas digesters remains unclear in terms of where initial investment may come from and how those technologies will be managed and maintained over time.

	FUTURE PICTURE	
FUNCTION/RULE	WHO WILL DO?	WHO WILL PAY?
Core function		
Supporting functions		
Rules (formal/informal)		

Box 1: Who does/who pays

29 The Musoma-led model

30 The G2L-led model

If there is a common theme, it is in the variability emerging as to the specificity and tangibility of long term vision. Where positive signs of sustainability are evident, as in the case of Zimbabwe, this is based on more explicit identification of who will do and pay for respective activities, functions and services required of the model. Where those roles and responsibilities are less well-defined, as in Malawi, the risks posed to sustainability are increased. This is particularly the case where there is a lack of clarity over who will, in the long term, pay for key tasks such as extension or technology installation and maintenance.

Inevitably, the sustainability of CSA innovation models is fundamental to their efficacy, outreach and impact on smallholder resilience and livelihoods. Effective CSA innovations are those that build an explicit and credible long term vision for innovation delivery. That vision should be explicit about who will do and who will pay for each and every service or function critical to the innovation (see Box 1[31]).

3.2.5 Partner identification and selection

Vuna worked with an array of different partners and players (i.e. producers, processors, traders, extension providers, financial service providers etc.) across its portfolio. These partners were, unsurprisingly, critical to the success of those projects and the innovations they seek to promote. Identification and selection of the 'right' partners is, therefore, a critical part of project design and implementation. This is particularly true in thin markets, where there are fewer (and often relatively weaker) market players.

The case studies upon which this analysis is based do not provide detailed information as to how different projects identify and select partners. In some cases, Vuna contracts directly with market players such as ZSS, ETG, G2L, and MFCL. Their selection has been based on information provided in applications for Vuna grants, and the criteria used by Vuna for that selection.

The importance of careful selection is illustrated by experience in Tanzania, where two different firms were selected to pilot a similar, improved smallholder outgrower mechanism. While one partner (MCFL) has demonstrated the capacity and willingness to maintain and internalise that model and the enhanced extension services entailed, the other (G2L) appears to be struggling to do so.

Vuna's experience highlights the importance of undertaking rigorous due diligence when selecting project partners. Although not entirely foolproof, CSA initiatives need to assess with care both the capacity and the willingness of partners not only to be part of project pilot efforts but to commit to long term investment in those CSA innovations that prove viable.

31 The Springfield Centre, 2014

3.2.6 Partnership negotiation and management

Assuming the selection of appropriate and committed partners, the nature of partnership agreements is equally important to the success and replicability of CSA innovations. Specifically, the level of support provided and the reciprocity built into the partnership are significant determinants of whether partner behaviour change will be sustained. Evidence suggests a direct correlation between innovation ownership and the level of contribution (often, but not exclusively, financial) made by partners.

Regarding levels of support, Vuna's experience in realising genuine partner ownership of different innovations is variable. In Tanzania, comparable levels of support have been provided to the two outgrower partners. This support has led to signs of sustained behaviour change in MCFL- the larger of the two partners for whom the support was presumably less commercially significant. For the smaller of the two firms, G2L, project support is proportionately more significant; however, signs of sustainability are less apparent. This highlights that weaker players will often require higher, tailored, and long term support to integrate CSA innovations into their operating models.

Partner commitment and reciprocity need not be in the form of direct financial investment. While one may cite extenuating circumstances in ETG's inability to buy pigeon pea following the collapse of the Indian market, the experience nonetheless exposes the fact that ETG was under no obligation to buy offtake. Secure market access was, however, the primary driver and incentive for smallholder partners and their expectations were clearly raised that ETG would honour its obligation to buy their product. Secure market linkages need to be a stated component of outgrower dependent CSA innovations. Secure market linkages can be underpinned by an explicit social contract or written partnership agreement between smallholder farmers and the buyer. The nature of the contract along the spectrum of verbal social contracts to written contracts is dependent on the maturity of both the partnership and the value chain it is situated in.

For CSA initiatives, as with any development support, the type and scope of support provided to partners must reflect the nature and risk profile of the innovation as well as the capacity and incentives of individual partners. Importantly, the type and level of support needs to develop and catalyse genuine behaviour change rather than to distort market signals and, potentially, undermine long term partner commitment and ownership.

ANNEX 1:

Glossary[32] of terms

Glossary

Attribution	The degree to which an observed change was caused by a specific project/programme intervention (as opposed to exogenous factors)
Climate change	Change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and / or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. In accordance with the aforementioned, the Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: 'a change of climate, which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods'.
Climate resilient (Farmer)	To have resilience to the effects of climate, usually meaning climate change and climate variability
Climate smart agriculture	Climate Smart Agriculture (CSA), as originally defined by FAO at The Hague Conference on Agriculture, Food Security and Climate Change in 2010, contributes to the achievement of sustainable development goals by jointly addressing food security and climate challenges. It is composed of three main pillars: (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change; (3) reducing and/or removing greenhouse gases emissions, where possible.
Design phase	A two-month phase of Vuna's work beginning 25 May 2015 ending 24 July 2015
Farmer (subsistence / emerging / commercial)	Someone who cultivates and produces agricultural crops. Subsistence farming-for use by the farmer and her / his family, with little or no sale into the cash economy. Emerging-sometimes or frequently selling into the cash economy (but often not every year / harvest). Commercial-largely or entirely selling into the cash economy.
Holistic approach (to CSA)	An approach to the application of CSA, which includes most or all of the main factors that affect a farmer's ability to be "climate resilient".
Impact	The change engendered by the programme and its interventions on poor and disadvantaged farmers and smallscale entrepreneurs. Impact normally refers to positive changes but can include negative (unintended) consequences. Note that an observed change cannot be classified as impact until plausible attribution has been established. Impact can be direct (brought about through players directly targeted by the intervention) or indirect (brought about through copying or crowding-in).
Implementation phase	A 30-month phase of Vuna work beginning 2 January 2016 ending 31 March 2018. Activities included: project development, project procurement and implementation, project and programme closure
Inception phase	A three-month phase of Vuna work beginning 21 September 2015 ending 11 December 2015.

32 Glossary for this section has been largely drawn from the Vuna Inception Report (Vuna, 2015)

Innovation model	Innovation model refers to a combination of interventions-technological and organisational-adopted by Vuna implementing partners (grantees) in the delivery of climate smart agricultural services, practices, or products to farmers and/or other value chain actors.
Intervention	A defined package of temporary activities designed to improve a function or rule/policy within an intervention area.
Market player	Organisations or individuals participating in a market system who are either directly involved in or influential to the core function (supply/demand), the rules function (formal and informal rule-setter, shapers), or any number of supporting functions that impact upon the core exchange involving the smallholder farmers. This may include organisations in the private and public sectors as well as non-profit organisations, representative organisations, academic bodies and civil society groups. Also called market actors or system actors.
Market system	The multi-player, multi-function arrangement comprising three main sets of functions (core, rules, and supporting functions) undertaken by different players (private sector, government, representative organisations, civil society, etc.) through which exchange takes place, develops, adapts and grows.
Market system change	Changes in the incentives, capacities or relationships between market players.
Multi-faceted intervention	The term multi-faceted intervention refers to interventions that are comprised of multiple components that individually or collectively address the varied climatic and market risks of the targeted intervention beneficiaries.
Resilience	The United Kingdom's Department for International Development defines resilience as, "The ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses—such as earthquakes, drought or violent conflict—without compromising their long term prospects"[33]. Aligned to the DFID definition, this paper defines resilience as the capacity of individuals, households, organisations or systems to anticipate, prevent (where possible), prepare for and respond to acute shocks or chronic stresses emanating from environmental, economic, or political systems.
Scalability	Scalability is the potential of an innovation to be deliberately adapted, expanded, or replicated in different places, over time, so as to benefit more market actors.
Scoping phase	A one-month phase of work of Vuna beginning 20 April 2015 ending 22 May 2015.
Smallholder farmer	The definition of smallholder farmer differs between countries and between agro-ecological zones. In favourable areas of smallholder subsistence agriculture with high population densities, smallholders often cultivate less than one hectare of land, whereas they may cultivate ten hectares or more in semi-arid areas or manage up to ten head of livestock[34].
Sustainability	Sustainability is the capacity and willingness of implementing partners to sustain the delivery of CSA innovation services and products to targeted beneficiaries beyond the funding period and the continued willingness and capacity of targeted market actors to uptake the promoted services and products delivered.
System	A core market or policy arena in which Vuna is attempting to stimulate systemic change. These can be agricultural (e.g. inputs, farming systems, natural resources management, output markets etc.) or policy (climate finance, education etc.) systems.
Systemic change	Change in the underlying causes of system performance-typically in the rules and supporting functions-that can bring about more effective, sustainable and inclusive functioning of the market system.
Target countries	Vuna worked in five target countries – Malawi, Mozambique, Tanzania, Zambia and Zimbabwe
Value chain (Food)	The full range of farms and firms and their successive coordinated value-adding activities that transform raw agricultural materials into food products that are sold to final consumers and disposed after use.

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