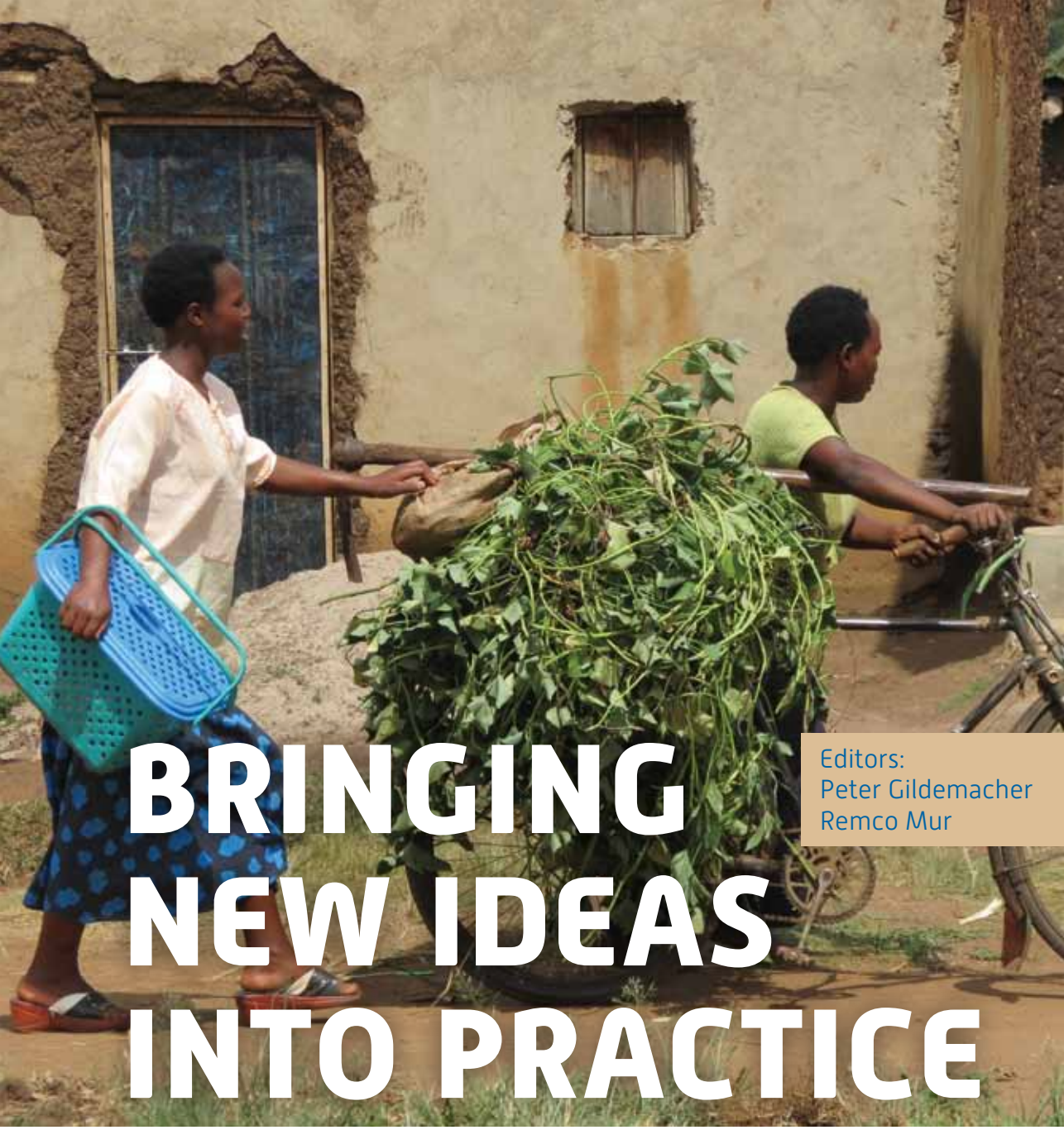

BRINGING NEW IDEAS INTO PRACTICE

Editors:
Peter Gildemacher
Remco Mur

Experiments with agricultural innovation

LEARNING FROM RESEARCH INTO USE IN AFRICA (2)

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Cover photo: Geneviève Audet-Bélanger

Publishing and distribution
Royal Tropical Institute (KIT)
publishers@kit.nl
www.kitpublishers.nl

ISBN: 978-94-6022-233-7

Correct citation: Gildemacher, P. and R. Mur. 2012. Bringing new ideas into practice; experiments with agricultural innovation. Learning from Research Into Use in Africa (2). KIT Publishers. Amsterdam.

Royal Tropical Institute

Acknowledgements

This book is based on experiences from the Research Into Use programme in five different countries. We first and foremost thank the dedicated people involved in the programmes as this book tells and analyses their stories and experiences. It is thanks to their openness, enthusiasm and commitment that we have been able to gain insight in, and draw lessons from the Research Into Use programme.

We thank the consultants and local enumerators in the five countries that assisted us in data collection and translation. We are grateful for the energy they have put in the process and we admire their flexibility. Thanks to Utiang Ugbe and his team from RIU Nigeria for taking up the responsibility to coordinate the review of the Nigerian country programme.

We are very grateful for the constructive comments of Norman Clark and Wouter Rijneveld provided on our first draft, which greatly improved the manuscript.

Brett Shapiro and Anita Simons, we would like to express our sincere appreciation for helping us making this document readable and look beautiful.

The authors would like to thank Andy Frost, Deputy Director of the Programme, for the discussions, the support and the fine collaboration from the beginning till the end. We are also grateful to Paul Coleman, Michael Packer, David Kelly and Marissa Drouillard of H2O for their interest, inputs and feedback.

The production of this book was made possible by the UK Department for International development (DFID), through its RIU programme, with co-funding by the Dutch Ministry of Foreign Affairs (DGIS).

Contents

Foreword

The DFID-funded Research into Use (RIU) Programme was commissioned in 2006 to investigate ways to scale up successful innovations in agricultural research. The RIU followed an 11-year agricultural research strategy and sought to get this research into widespread use for the benefit of the world's poor and by so doing, to learn lessons about how to do so. As such the RIU was a change in direction, in funding research on uptake rather than on the generation of new technologies. It could be argued that the relevance of the RIU is now more pertinent than the time it was designed. In a world of ever increasing challenge of avoiding food shortages in an era of climate change it is imperative that all available knowledge and know-how be put into sustainable and meaningful use for the benefit of all not least for the world's poorest.

The RIU proved to be a challenging programme to manage and in turn, to evaluate. The programme constantly sought to experiment with modes of technology development and in the period from 2009 took the step to adopt a much more private sector type approach. With this book, the Royal Tropical Institute (KIT) has evaluated five case studies from the portfolio of RIU activities in a pragmatic way so that the available evidence (both quantitative and qualitative) can be articulated in a meaningful manner. It attempts to isolate the impacts attributable to the RIU and where possible to make economic estimates of net value added. The evidence presented here is very timely as donors are asking about the value for money on their investments. They are right to do so. They need the evidence to help them justify their future funding allocations and indeed to shape the nature of how such funds should be spent.

Upon reflection as the RIU programme draws to a close, it is very gratifying to see that there have been successes albeit on a small scale for now but the foundations are well set for greater impact in the future. Some activities have not gone according to plan and it is important to stand up and state that the programme has made some mistakes also. All of the above has provided an opportunity to learn. This book attempts to pull out the important lessons that have been learnt from the RIU. It is hoped that future programmes and their respective evaluations will benefit from the RIU experience, in making best use of the good agricultural research that has already been funded, so that sustainable and meaningful change for the benefit of the world's poor can be realised.

Dr Andy Frost
Deputy Director
Research into Use Programme

Acronyms

ACDI/VOCA	Development NGO, based in Washington, D.C
ADD	Agricultural Development Districts
ADP	Agricultural Development Programmes
ADRA	Adventist Development and Relief Agency
AGM	Annual General Meeting
AGRA	Alliance for a Green Revolution in Africa
AR&D	Agricultural Research and Development
ARCN	Agricultural Research Council of Nigeria
ARM	Athi River Mining
ASF	African Swine Fever
ASWAP	Agriculture Sector Wide Approach
BA-ADP	Bauchi State Agricultural Development Project
CAB	see CABI-ARC
CABI-ARC	CAB International – Africa Regional Centre
CBAF	Community Based Armyworm Forecasting
CBEA	Community Based Extension Agent
CGIAR	Consultative Group on International Agricultural Research
CIP	Crop Intensification Programme
CODAR	Cooperative (Nyagatare district, Rwanda)
COPAMA	Cooperative (Nyagatare district, Rwanda)
CPP	Crop Protection Programme
DAP	Di-Ammonium Phosphate
DARS	Department of Agricultural Research and Services
DFID	Department for International Development
DSA	Daily Subsistence Allowance
ELDS	Development NGO (Malawi)
ESCOM	state electricity company (Malawi)
EU	European Union
FFS	Farmer Field School
FIDP	Development NGO (Malawi)
FIPS-Africa	Farm Input Promotions-Africa
GBP (or £)	Great Britain pound
GDP	Gross Domestic Product
GOR	Government of Rwanda
GSADP	Gombe State Agricultural Development Programme
ha	hectare
IAR	Institute for Agricultural Research
ICS	Inventory Credit System
IEC	Information, Education and Communication
IFDC	International Fertilizer Development Center
IITA	International Institute for Tropical Agriculture

IP	Innovation Platform
IRR	Internal Rate of Return
ISAR	Rwanda Agricultural Research Institute
JARDA	Jigawa Agricultural and Rural Development Authority
KARI	Kenyan Agricultural Research Institute
KASAL	Kenya Arid and Semi-Arid Land Programme
KDADP	Kaduna Agricultural Development Programme
kg	kilogramme
KIT	Royal Tropical Institute
KKM PLS	Kano-Katsina-Maradi Pilot Learning Site
km	kilometre
KMDP	Kenya Maize Development Programme
KNARDA	Kano Agricultural and Rural Development Authority
Kshs	Kenyan shilling (?) p. 59 (currency)
KTARDA	Kitsina Agricultural and Rural Development Authority
MAFS	Ministry of Agriculture and Food Security
MFI	Micro-Finance Institution
MINAGRI	Ministry of Agriculture and Animal Resources, Rwanda
MK	Malawian kwacha (currency)
MLICO	Mzuzu Livestock Cooperative
MOA&FS	Ministry of Agriculture and Food Security
MPPMC	Melanje Pig Production and Marketing Cooperative
mt	metric tonnes
NAERLS	National Agricultural Extension Research and Liaison Services
NAPEP	national poverty eradication agency
NAPRI	National Animal Production Research Institute
NARI	national agricultural research institutes
NGN	Nigerian Naira
NGO	Non-Governmental Organisation
NIC	National Innovation Coalition
NITR	Nigeria Institute for Trypanosomiasis Research
NPV	Nuclear Polyhedrosis Virus
nr	number
NRI	National Resources Institute
NSPRI	Nigerian Stored Products Research Institute
NVRI	National Veterinary Research Institute
NYAMIG	Nyagatare Maize Investment Group
ORINFOR	National Broadcasting Agency (Rwanda)
P4P	Purchase for Progress
PCS	Pest Control Services
PICS	Purdue Improved Cowpea Storage
RAB	Rwanda Agricultural Board
RADA	Rwanda Agricultural Development Agency
RDI	Rwanda Development Investment
RDO	Rwanda Development Organisation

RGCC	Rwanda Grain and Cereals Corporation
RIU	Research Into Use
RNNRS	Renewable Natural Resources Research Strategy
SAACO	Safe and Affordable Armyworm Control
SME	small and medium enterprises
SPAT	Strategic Programme for Transformation of Agriculture
SWOT	Strengths, Weaknesses, Opportunities and Threats Analysis
TAP	Tanzania Agricultural Partnership
T/ha	tonnes per hectare
TOT	p. 36
TZ	Tanzania
UK	United Kingdom
US$	United States dollars
USAID	United States Agency for International Development
VBA	Village Based Advisor
VEO	Village Executive Officer
WAAPP	West African Agricultural Productivity Programme
WFP	World Food Programme
WIA	Women in Agriculture
WRS	Warehouse Receipt System

PHOTO: GENEVIÈVE AUDET-BELANGER

Maize, post harvest

Summary

African smallholder farmers continuously seek to improve their agricultural enterprise, to improve their food security and to increase their income by making more efficient use of their assets. Farmers have to adapt to continuous, often unforeseen and sudden, changes in their production and marketing environments, and this requires ongoing innovation.

Research Into Use (RIU), a United Kingdom Department for International Development (DFID)-funded programme, explored different approaches for promoting innovation in agriculture. This book analyses the experiences of three RIU Africa Country Programmes, which used Innovation Platforms to facilitate innovation, and two Best Bet projects, which used a competitive funding mechanism to support private sector-driven initiatives to get research outcomes into use.

PHOTO: FEMKE VAN DER LEE

Little calf, Kenya

This review studied a selection of projects from the RIU Africa portfolio: the Nyagatare maize platform in Rwanda; the cowpea platform in Kano state, Nigeria; the pork platform in Malawi, the Farm Input Promotions (FIPS) Best Bet in Kenya, and the Armyworm Best Bet in Kenya and Tanzania. For each of the selected projects, assessments were made on how it changed the capacity to innovate, the household level poverty impact, whether the intervention offered value for money, and what were the main lessons learned. The review used a mixture of quantitative and qualitative data collection methods, tailored to each of the cases studied.

Current and Future Impact

Looking at the five cases, one can be cautiously optimistic about the overall results obtained, and the prospects for accumulating future impact. In the case of cowpea in Nigeria and FIPS in Kenya, there is a clear current impact on household income and food security, while in the case of the maize platform in Rwanda, and to a lesser extent the armyworm Best Bet, there is the promise of future impact based on the work already done. FIPS in Kenya and the Nyagatare maize platform improved the capacity to innovate and the cowpea platform improved this capacity to some extent, while the armyworm Best Bet and the pork platform did not have an effect on the capacity to innovate. The five cases studied form only a subset of the RIU programme in sub-Saharan Africa, and these results cannot be considered representative of the entire programme.

The Process of Agricultural Innovation

The linear 'transfer of technology' model of thinking about change in agriculture has been replaced by innovation system thinking. Innovation is context-specific and usually involves a reordering of relationships and interactions between stakeholders. As a consequence, successes cannot simply be 'copied'. What is lacking is a vision of how to use promising practices that have been proven in one environment in an effective manner to realize change on a larger scale.

We conclude from the five case studies that it makes sense, without resorting back to the linear transfer of technology model, to distinguish three different processes in agricultural innovation:

1. Needs and opportunity identification;
2. Experimentation;
3. Bringing into routine use.

The interaction of different, converging opinions and experiences of stakeholders can result in new ideas that would not have developed autonomously. Facilitation of such interaction should be a factor in all three components of the agricultural innovation process.

The basis of the process of agriculture innovation is the identification of needs and opportunities. The objective of a needs and opportunity assessment is to identify entry points for innovation. Needs and opportunities identification can originate from multiple sources, who may be farmers, private entrepreneurs, researchers or others, and it is meant to trigger the initiation of local experimentation with new practices.

Experimentation can focus on farming technologies, but also on new market relations, services or collaboration models. The objective is to arrive at tried and tested promising new practices. One characteristic that distinguishes experimentation from 'bringing into routine use' is that the process of experimentation is often 'pre-competitive', in the public interest, providing information and experience to a wider audience. A second important characteristic is that experimentation includes room for failure and consequently carries higher risk.

'Bringing into routine use' aims at moving from promising new practices to impact at scale. This process also requires experimentation, risk-taking and local adaptation, much like the experimentation phase, but it differs in the levels of risks that need to be taken, and the amount of room for failure. The process of 'bringing into routine use' is characterised by competitiveness, which provides the pressure needed to assure efficient use of resources and quality of production and service delivery. There is less emphasis on developing public benefit; the focus is on assuring sustainable and lasting, cost-effective or profitable service delivery and production.

Implications for Policy and Practice

Next to an immediate and measurable objective of realising impact at scale during the lifespan of a project, improving the capacity to innovate should be considered an objective of equal, or even higher, importance. Thus, an intervention programme would do well to invest in assuring impact at scale in the short run, while simultaneously investing in the capacity to innovate.

Seeking a direct linear relation between agricultural research results and agricultural development can easily lead to an unnecessary limitation of options being considered as entry points for innovation. Research is an important source of potential entry points, but not the only source. Therefore, a distinction needs to be made between funding research initiatives, which aim at enriching our knowledge through developing and testing theory, and promoting agricultural innovation. With respect to the process of agricultural innovation, it is important to acknowledge the three interrelated processes that underlie agricultural innovation: needs and opportunity identification, experimentation, and bringing into routine use. Focusing on only one or two of these processes does not necessarily mean no impact can be achieved; however, this would assume that the other functions are well taken care of. Research organisations have an important role to play in agricultural innovation, but they are not the essential drivers of the process.

PHOTO: GENEVIÈVE AUDET-BELANGER

Vegetable market in Nyagatare, Rwanda

1 Introduction

Authors: Remco Mur and Peter Gildemacher

1.1 Background

The vast majority of agricultural producers in sub-Saharan Africa are smallholder farmers, who are the basis of sustained economic growth (Salami *et al.*, 2010). Meeting the increasing demand for food, feed and fuel depends on the productivity and market access of these farmers in particular. However, smallholders are confronted with several challenges in their efforts to sustainably generate income from market-oriented agricultural production. Farmers need to intensify their production systems and adapt to continuous, often unforeseen and sudden changes in their environment, which presupposes continuous innovation (Nederlof *et al.*, 2011, p.16; World Bank, 2012, p. 7).

During the last two decades, thinking around innovation has fundamentally changed through an increased understanding of successful innovation processes. This led to a shift from linear thinking and models (transfer of technology) towards system thinking (stakeholder interaction and learning). Consequently, research is no longer at the centre of innovation processes. Furthermore, it became evident that the socio-economic context is a crucial factor for effective innovation (Wennink and Heemskerk, 2004, p. 32).

This new thinking also led to a shift from a singular focus on technological innovation towards combinations of technological, organisational and institutional innovation. The right mix of the three is often crucial for the application of new knowledge and insights (Nederlof *et al.*, 2011, p. 13). Agricultural innovation is thus complex and highly contextual in nature; experimentation and learning are required and need to be stimulated.

An important question for policy- and decision-makers and managers in the field of agricultural development is how to best invest resources to support agricultural innovation. In this study, we provide lessons from Research Into Use (RIU), an overarching programme which invested United Kingdom Department for International Development (DFID) funding in different activities in Asia and Africa. The programme aimed at stimulating rural economic development by enhancing agricultural innovation. RIU is based on the premise that agricultural innovation is very often not the result of simply transferring research products to farmers, entrepreneurs and policy-makers. More usually, research can contribute to innovation only when it is embedded in the wide set of relationships and processes that help shape ideas and put them into use.

1.2 Research Into Use

The RIU programme began in July 2006 as a follow-up to DFID's Renewable Natural Resources Research Strategy (RNRRS). The RNRRS ran from 1995 to 2006, and sought to "remove researchable constraints to the sustainable development and/or management of natural resources". Under the programme, ten research programmes were designed to generate knowledge and promote its uptake and application. The results achieved by the programmes implemented under RNRRS showed that much of the potential of the research outcomes to contribute to development impact remained unrealised, in part because of the difficulties of scaling up the research results. The first idea was to identify 30 research outcomes promising for upscaling and to support their breakthrough. (www.researchintouse.com).

PHOTO: GENEVIÈVE AUDET-BELANGER

Interview with a maize producer

It soon became apparent that this would not work. The realisation grew that adoption was not simply the next step in a linear research process and that better insight was provided by a systems approach to innovation. This triggered the RIU programme to develop an approach towards facilitating innovation for development. The RIU programme was revised following a series of reviews in late 2008 and early 2009.

As a research project, the primary aim of RIU is to accumulate, evaluate and communicate evidence on how agricultural innovation can be accelerated and how it can contribute to sustainable social and economic development. To achieve this, RIU has two objectives:

1. To attain sustainable economic development by supporting efforts to make better use of existing insights in agriculture, with a bias towards insights obtained through the RNRRS programmes;
2. To enable agricultural research and innovation interventions to be optimised.

The basis for RIU's approach is founded on *innovation system* principles. In the context of an innovation system, knowledge generation and use arises as a result of interactions between networks of diverse agents, including policy-makers, research bodies, private sector firms, and end-users. From this perspective, innovation is not simply a question of how better use can be made of the large stockpile of agricultural research products that remain on the shelf. An important research focus of RIU is the relationship between agricultural research and innovation, working towards identifying better processes to get research into use and to catalyse innovation.

Being a research programme, RIU explored variations of promoting innovation in a way that was deliberately experimental. Three distinct categories of interventions constitute RIU's operations to promote the use of research to achieve pro-poor impacts:

- Six Africa Country Programmes focused on promoting innovation related to specific themes or sub-sectors;
- A cluster of projects in Asia designed to answer specific research questions;
- Best Bets: An Innovation for Development fund to support the private sector in putting RNRRS research outcomes in use.

[from: RIU business plan, August 2009]

In 2012, the RIU management solicited the support of the Royal Tropical Institute (KIT, The Netherlands) to conduct an impact study of selected cases of the programme. The study focused on the Africa Country Programmes and the Best Bet initiatives. The study comprises five case studies: three Innovation Platforms from the Africa Country Programmes and two Best Bets. The selection was based on information and criteria provided by RIU. Criteria included the relative maturity of the initiative and the expected lessons that could be learned related to fostering agricultural innovation for impact. Hence, the extrapolation of results to the RIU programme as a whole is not possible.

Africa Country Programmes

RIU has established six Africa Country Programmes: Rwanda and Tanzania in the east, Malawi and Zambia in the south, and Nigeria and Sierra Leone in the west. The rationale for these programmes is that current mechanisms to articulate the demand for research and other information are poorly developed. The country programmes are therefore experimenting with a variety of networking approaches to establish better linkages between the research, entrepreneurial, policy and farming communities with a view to strengthening innovation capacity. The building blocks for an innovation network can be thought of as individual *innovation platforms*. Such platforms are defined by a common theme, around which a network of partners works. The premise of the innovation platform approach is that platforms deliberately enhance interactions to forge stronger linkages between stakeholders, which will result in better information exchange, and more ideas and opportunities for agricultural innovation and development. Improved interaction contributes to bringing new products, processes and forms of organisation into economic use (Nederlof *et al*, 2011). This study assesses the following innovation platforms:

Cowpea Value Chain Innovation Platform, Nigeria (Africa Country Programme)

In Nigeria, RIU initiated and established three value chain innovation platforms focusing on aquaculture, cassava and cowpea/soybean. Cowpea and soybean were combined under one platform because both are legumes and grown in the same agro-ecological zone. RIU Nigeria Country Office, which implemented the programme, was hosted by, and embedded within, the administrative structures of the Agricultural Research Council of Nigeria (ARCN), the federal agency that regulates and coordinates agricultural research in Nigeria.

The Cowpea Value Chain Innovation Platform in Nigeria is a vehicle for promoting a multi-stakeholder, private sector-led approach to enhance the uptake of agricultural research outputs, especially those funded previously by RNRRS. The platform aimed to increase cowpea production and improve productivity in target communities, to improve storage of cowpea grains and reduce post-harvest losses, and to improve the commercial management and utilisation of cowpea fodder.

Maize Innovation Platform, Rwanda (Africa Country Programme)

The RIU country programme in Rwanda aims to catalyse agricultural innovation and development in selected commodity chains by establishing and facilitating innovation platforms. Three functional platforms have been established:

- A Cassava Innovation Platform in Gatsibu district;
- A Potato Innovation Platform in Gicumbi district;
- A Maize Innovation Platform in Nyagatare district.

The Maize Innovation Platform was the first attempt to organise maize value chain actors in order to enhance the value chain. Whereas the Crop Intensification Programme's focus is mainly on productivity through improved input supply, the innovation platform is going beyond the singular aim to increase the volumes of maize production, through a more market-oriented and integrated value chain approach, emphasising farmer entrepreneurship. This represents a new way of thinking for many development actors in Rwanda, where development interventions and

policies are generally developed and implemented in a top-down manner. For the maize value chain actors in Nyagatare, the innovation platform was the first real participatory multi-actor approach to develop the maize sector as a whole.

Pig Production Innovation Platform, Malawi (Africa Country Programme)

The work undertaken by the Malawi Country Programme aimed at exploring the practical experiences of an innovation systems approach to see if this approach could create more effective and efficient integrated development interventions to enhance agricultural production and distribution. Four innovation platforms are operational:

- Fish Farming Innovation Platform;
- Cotton Innovation Platform;
- Legumes Innovation Platform;
- Livestock (Pig Production) Innovation Platform.

The platforms aimed to promote and improve information flows along the value chain. The livestock platform focused on dairy and pig production. In the Pig Production Innovation Platform, the emphasis was on improving marketing arrangements.

Best Bets

RIU Best Bets tested an innovative competitive funding mechanism in which grant aid was provided to a number of large-scale technology promotion activities that were expected to achieve developmental impact at scale. The objective of the Best Bets is to identify promising proposals that take existing agriculture research knowledge (which includes information, technologies, practices and policies) and put it into use in ways that will benefit the poor (and others) in developing countries through partnerships in which private sector actors play a major role (see also Box 1). During 2008 a call was made for submissions for an RIU African Innovation Challenge Fund. The call generated 130 concept notes from ten countries. Best Bets were selected based on their potential to have impact at scale and to generate useful lessons about putting research into use, especially through partnerships in which the private sector plays a prominent role. (www.researchintouse.com)

Box 1. Dragons' Den

The inspiration for the RIU Best Bets initiative comes from the popular BBC television programme Dragons' Den. The basic concept is that would-be entrepreneurs pitch their business ideas to a panel of wealthy and successful entrepreneurs who, subject to satisfactory due diligence, invest their own money and expertise in proposals that they find convincing, in return for an equity stake in the business.

RIU Best Bets takes the central tenets of ideas being pitched to an expert panel and due diligence, but in other aspects the procedure and principles vary significantly: the Best Bets panellists will be making recommendations as to how RIU should invest its programme money, and overall the process will be far less confrontational and more supportive and nurturing.

Source: www.researchintouse.com

Armyworm, Tanzania and Kenya (Best Bet)

The Armyworm Best Bet aims to reduce the devastating effect of the African Armyworm. The armyworm is a migratory pest that can cause severe damage to rangeland and cereal crops, particularly maize, sorghum, rice and millet. The Best Bet sought to establish a system for the production, supply and distribution and marketing of Safe and Affordable Armyworm Control tools (SAACO tools), building on earlier experiences with community-based forecasting and biological control. The three objectives of the Best Bet were:

1. To establish a supply network for registered, low-cost forecasting tools in Tanzania and Kenya;
2. To establish a virus production system in Tanzania;
3. To market SAACO tools to customers, including government services, farmers, community organisations, non-governmental organisations (NGOs), and development partners to sustain use and forecasting.

Research and development of these tools was funded by DFID as part of the RNRRS programme.

Farm Inputs Promotions Africa (FIPS), Kenya (Best Bet)

FIPS-Africa aims to broaden farmers' access to and proper use of higher-yielding farming methods and agricultural inputs. This aim is based on the premise that many smallholder farmers in Africa are food-insecure mainly because they have limited access to appropriate fertilizers and improved seed varieties, and lack information on their correct use. The strategy adopted stimulates demand for farm inputs (mainly seeds and fertilizer, but increasingly inputs for animal production, such as vaccines) by increasing farmers' awareness and experimentation. It also increases the availability of inputs through the institution of the Village Based Advisors (VBAs), and through local stockists and private sector partnerships.

1.3 Impact Assessment

The Best Bet and the Innovation Platform approaches are experimental, highly contextual and do not cater for pre-defined solutions. This study draws lessons from a selected number of cases and presents evidence at outcome and impact levels. Lessons from the RIU are captured through a combination of quantitative and qualitative assessment of interventions that were put in place through RIU and specifically assess their value in terms of development money invested. Based on this assessment, generic insights will be documented to inform future programmes addressing rural economic development through enhancing innovation.

The study largely focuses on the following overarching research questions, in order to gain an understanding of how the impact of agricultural research and innovation interventions can be optimised:

For the Africa Country Programmes

- How did the innovation platform approach accelerate and improve agricultural innovation for poverty reduction?
- What are the outcomes and the current and potential future impacts of the platforms?
- What is the value for money of the interventions in innovation systems?
- What are the lessons learned?

For the Best Bets

- How did the commercialisation of research results and services through Best Bets sustainably contribute to agricultural innovation for poverty reduction?
- What are the outcomes and the current and potential future impacts of the Best Bets?
- What is the value for money of the interventions in private sector-driven agricultural innovation?
- What are the lessons learned?

1.4 Assessment Methodology

The study is based on an evaluation approach combining qualitative and quantitative methods, and targeting multiple respondents. The evaluation was conducted by four teams, each comprising two experts from KIT and one or two local experts. The evaluation of the Nigeria Cowpea Platform was conducted by a team of experts from Nigeria. A combination of frameworks and methods were used. The frameworks are described in the paragraphs that follow.

Impact Pathways

Impact pathway evaluation is a suitable method to assess change in complex processes. It shows how interventions have been realised and have contributed (or not) to certain results and to current and potential future impacts on people's lives. Impact pathways are useful to assess the attribution of impact and outcomes to the intervention, and can show how critical events may have contributed to accelerated innovation.

Impact pathways are a practical description of the more abstract theory of change. They help to describe the intended and unintended results, to reconstruct in retrospect how change has come about, and to identify critical events. The impact pathways provide change markers that help to quantitatively assess results and impact, facilitating further qualitative data gathering on how the innovation accelerated agricultural productivity for poverty reduction.

Based on a document review, the team of evaluators reconstructed the impact pathways of the different cases. The impact pathways were validated during a workshop with stakeholders of the different cases. Based on the validated pathways, questionnaires for qualitative and quantitative analysis were prepared.

Household Surveys

Household surveys were conducted to assess the changes in practices and the impacts on households resulting from RIU activities. The surveys aimed to quantify the changes identified through the impact pathway exercise. For each case, a random sample among RIU beneficiaries was taken. The sample size differed according to the case study. The surveys were also conducted among control groups. In most cases, baseline data were lacking. Hence, the evaluations aimed to collect data for both the current (end-of-intervention) situation and, in retrospect, the baseline situation.

Qualitative Research

Interviews, focus group discussions and mini-workshops involving key informants were conducted. The focus of these activities was on the processes through which change and innovation occurred. Important elements included:

- Critical events and decisions that influenced the innovation process;
- Interaction among stakeholders within the innovation networks;
- The sustainability of changes;
- Spin-off effects;
- The capacity to innovate: the sustained capacity of stakeholders to interact and to identify and address opportunities for agricultural innovation.

Various participatory tools were used during data collection, including the Actor Interaction Analysis (matrix and maps), timelines, and priority and pair-wise ranking.

Cost Benefit Analysis

The study assesses the value for money invested for those interventions for which such an assessment is possible and relevant. It estimates costs of intervention activities and relates these to the current and future impact estimates. Impact is measured in terms of increased household income and based on income change estimates by project beneficiaries, compared to estimates by a control group. Where there is no measurable impact on household income, this analysis has not been done.

1.5 This Report

In the five chapters that follow, each of the selected cases will be presented. Each chapter starts with a description of the background and context of the intervention, followed by additional information on the evaluation methodology. Then a description of the intervention is given, followed by a detailed description of the impact pathways, including a discussion on the attribution of the results to RIU and a cost benefit analysis. In the last chapter, an analysis of the cases is provided and lessons are drawn, providing valuable recommendations for policy- and decision- makers involved in promoting agricultural development.

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PHOTO: RIU

Training on use of triple bagging, Nigeria

2

Cowpea Value Chain Innovation Platform, **Nigeria**

Authors: Alphonse Emechebe, Utiang Ugbe, Adunni Sanni, Grace Jokthan and Patrick Philemon

2.1 Introduction

Nigeria, Africa's most populous country, has an estimated population of about 167 million people, of which about 70% derive their livelihoods from agriculture and related enterprises and services. The main food crops produced in Nigeria include roots and tubers (e.g. cassava and yam), cereals (e.g. maize, rice, sorghum, millet) and legumes (cowpea, soybean and groundnuts).

RIU established three innovation platforms in Nigeria, for cassava, aquaculture, and cowpea value chains. Innovation platforms were proposed as mechanisms to enable multi-stakeholder participation in addressing constraints relating to increased farm productivity, post-harvest value addition, and institutional learning and change.

Cowpea is the most important food legume crop in the country. Apart from its use as a food crop, cowpea is also grown in Nigeria to generate fodder for livestock. Nigeria is the world's largest producer of cowpea, accounting for about 58% and 61% of the global and African production,

respectively. The national annual cowpea output in Nigeria is about 3.5 million metric tonnes, valued at about GB£ 1.6 billion. Most of the intra-national and regional (West African) trade on cowpea is conducted through informal arrangements and not captured in official national statistics. Consequently, the available data on cowpea trade are only estimates. Despite Nigeria's global pre-eminence in cowpea production, the country's share of the world market for cowpea grains is believed to be less than one percent (1%).

Most of the cowpea produced in Nigeria is processed into various forms of food and consumed across the country; indeed, Nigeria is a net importer of cowpea grains from neighbouring countries such as Niger and Cameroun. This implies that the country is not self-reliant in cowpea. Cowpea yields in Nigeria are relatively lower than in countries such as Brazil and the United States of America (which account for about 17% and 3% of world production, respectively). The national average yield in Nigeria is about 250 kg per hectare, although average yields in dry savannah zones can reach more than 600 kg per hectare.

Cowpea is produced mainly in the dry savannah agro-ecological zones of northern Nigeria. Its production is rain-fed and occurs in both mono- and mixed cropping systems. Nigeria's potential in cowpea production is constrained by both biological and biophysical factors. The biological factors include pests and diseases that damage the crop in the field and in storage. The biophysical factors include poor soil fertility (due to both inherent low soil fertility and little or no use of either organic or inorganic fertilizers) and inadequate rainfall (both in amount and distribution).

Huge post-harvest losses are a disincentive to cowpea production, thereby aggravating household food insecurity and income poverty. Bruchid infestation in post-harvest storage results in the loss of about 30% of all stored cowpea grains (IITA 2011), and most of this loss is due to poor methods of storage. Furthermore, traditional methods of cowpea fodder management result in wastage and poor nutritional value of the fodder. There is currently no national policy document spelling out strategic objectives for research, extension, competitiveness and development of the cowpea sector. Hence, current innovation efforts at both research and value chain development are occurring in a policy vacuum.

Demand for cowpea by consumers from across the country gives rise to many entrepreneurial opportunities involving bulk purchase, storage, transportation, processing, product diversification, value addition, wholesale and retail activities in the sector. Many of these activities are carried out informally and by women.

A 2007 Country Assessment commissioned by the RIU Programme recommended cowpea as one of the crop sectors for RIU intervention. The cowpea sector was recommended for various reasons, including:

1. It is an important component of the crop-livestock integration production system in Nigeria;
2. It is a crop produced by the poor and its value chain activities are predominately by women – hence it is regarded as a woman's crop in northern Nigeria;
3. In the context of renewable natural resources, cowpea is a legume that fixes atmospheric nitrogen into the soil to restore soil fertility.

The RIU-Nigeria Country Assessment Report (2007) recommended the formation of the Cowpea Value Chain Innovation Platform as a vehicle for promoting a multi-stakeholder, private sector-led, enhanced uptake of agricultural research outputs, especially those from the previously DFID-funded RNRRS.

This chapter evaluates the Cowpea Value Chain Innovation Platform. The scope of evaluation covers RIU innovation interventions targeting establishment and functioning of the cowpea innovation platform, cowpea production, post-harvest storage of cowpea grains, and the management and utilisation of cowpea fodder.

PHOTO: RIU

Cowpea

2.2 Evaluation Methodology

The Nigeria impact assessment was conducted in May 2012. The evaluation was conducted by a core team including the Kano Agricultural and Rural Development Authority (KNARDA), the Kano Station of the International Institute of Tropical Agriculture (IITA), agricultural extension agents and invited resource persons from the Ahmadu Bello University, in Zaria.

The focus of the evaluation was on only one state, rather than across all six states where the RIU programme was implemented. Kano State was selected as the focus state for household surveys and focus group discussions for the following reasons: 1) it is the leading cowpea producing state in Nigeria; 2) it is the headquarters of the RIU-assisted Cowpea Innovation Platform; and 3) it is the location for the IITA Cowpea Station. Conclusions from the evaluation cannot be directly extrapolated to the other states, although the process and activities have been similar.

Within Kano State, 25 villages were randomly selected from among the group of 200 communities where RIU-assisted project activities were implemented, while 8 control villages were selected after consultations with project partners, namely, IITA, Kano-Katsina-Maradi Pilot Learning Site (KKM PLS) and KNARDA. Within the selected RIU-targeted villages, 200 households were randomly sampled for the household survey. In each of the 8 control villages, 100 households were randomly selected as a control group.

Focus group discussions were conducted in different communities. A total of 23 men and 25 women participated in the discussions in the project communities while 17 men and 15 women participated in the control communities. The participants in the project communities

were selected based on their involvement in the RIU-assisted interventions while those in the control community were randomly selected.

A total of 31 representatives of partner organisations which participated in activities under the RIU-assisted Cowpea Innovation Platform were interviewed. The partner organisations were involved in the innovation platform activities for various lengths of time, ranging from one to three years. The outcomes of the evaluation were compared with the baseline situation, established in 2009.

2.3 Intervention Description

RIU Nigeria conducted a Country Assessment, which identified cowpea as one of the crop sectors, and a Stakeholder Survey, which short-listed relevant organisations, communities, groups and individuals that were involved in the cowpea value chain. At the commencement of programme implementation, RIU conducted a follow-up analysis of the short-listed stakeholders, and identified actors who were subsequently invited to the inaugural meeting of the Cowpea Innovation Platform. Membership was drawn from agricultural research and extension agencies (state, national and international), farmers and farmer groups, NGOs, agro-allied private sector organisations, financial institutions, and policy-makers at national, state and local levels.

The RIU-Nigeria Country Assessment Report (2007) identified cowpea as having a strong potential to alleviate poverty among a large number of low-income participants in the sector. However, a number of constraints were identified as opportunities (entry points) for RIU intervention in the sector. These included:

1. Low farm productivity due to use of low-yielding local varieties, lack of effective field pest management, and poor agronomic practices;
2. High post-harvest losses due to poor storage methods for cowpea grains;
3. Poor management and utilisation of cowpea fodder (a protein-rich crop residue);
4. Poor access to credit and other inputs, such as fertilizer, improved seeds and agrochemicals.

The RIU Nigeria programme was designed to build upon DFID's past and current research achievements in renewable natural resources, in particular on DFID's RNRRS success stories, while at the same time exploiting the full-impact potential of many other successful research outputs available to farmers. RIU's specific intervention strategy in the cowpea sector in Nigeria was to establish and support the Cowpea Innovation Platform, to promote multi-stakeholder networking to address sector constraints and opportunities, and to encourage private sector participation in agricultural innovation. The platform brought together diverse actors from six states, who had not been working together previously, to jointly address specific constraints and opportunities in the sector.

The Cowpea Innovation Platform aimed to: (1) increase farm production among targeted farmers; (2) reduce post-harvest losses resulting from weevil infestation for the participating farmers and merchants; (3) bring about improved efficiency in the management and use of cowpea fodder as a livestock feed; and (4) initiate sustainable institutional changes which support overall development of the cowpea value chain in Nigeria.

The RIU Cowpea Innovation Platform intervention took place across six states – Bauchi, Gombe, Jigawa, Kaduna, Kano and Katsina – covering 200 rural communities in each state (a total of 1200 communities in all six states). A total of 600,000 cowpea farmers were targeted in all the states, which included 100,000 for Kano State – i.e. 500 participants in each of the 200 communities. For the reasons detailed above, this report focuses on the results in only one of these states: Kano.

2.4 Establishing the Cowpea Innovation Platform

Effective implementation of the innovation platform approach involves specific efforts to strengthen the capacity of stakeholders to perform their respective roles. The Nigeria Cowpea Innovation Platform was set up as a multi-stakeholder approach to promote relevant research results from RNRRS and other research institutes. Hence, capacity enhancement focused on creating capabilities and mechanisms to disseminate these practices and technologies. This included capacity building through training and extension, new institutional arrangements to link input and service suppliers to producers, financial support and subsidies. The impact pathway of the Cowpea Innovation Platform is presented in Table 2.1.

Table 2.1 Impact Pathway of Cowpea Innovation Platform

Input	Results and Impact			Spin-Off
Facilitating the establishment and development of the Cowpea Innovation Platform Assessment of needs and priorities of platform members Democratic election of leaders of the platform Training on management of innovation platform	Cowpea sector stakeholders participate in the cowpea platform Cowpea platform officially inaugurated by ARCN Needs and priorities of various sub-groups known and translated into concrete activities Training conducted on recordkeeping	Suitable practices and technologies identified, based on needs and opportunity assessment	Improved income and food security for members of low-income groups affiliated with the cowpea platform activities Better quality of life for members of participating groups	ARCN adopted innovation platform model in West African Agricultural Productivity Programme (WAAPP) National Agricultural Research Institutes (NARI) have been directed by ARCN to adopt innovation platform approach in their Agricultural research for development (AR&D) activities Agricultural Development Programmes (ADP) emphasizing partnership with private sector to embed innovation activities within the market and ensure sustainable outcomes Federal Ministry of Agriculture has announced inclusion of cowpea as one of the national priority crop sectors to be transformed through increased funding for research and value chain development

A total of 39 corporate organisations participated in the cowpea platform activities, including:

- 1 international NGO
- 5 national agricultural research institutes
- 8 state-owned or local government agencies
- 11 private sector companies
- 14 community-based organisations

(See also Table 2.2).

Table 2.2 Cowpea/Soybean Platform Member-Organisations (six states)

CGIAR[1]	Publicly-Funded Agencies		Private Sector	Non-profit
	Federal	**State & Local**		
International Institute of Tropical Agriculture (IITA), Ibadan	Agricultural Research Council of Nigeria (ARCN), Abuja (research management) Institute of Agricultural Research (IAR), Zaria (cereals mandate) National Animal Production Research Institute (NAPRI), Zaria (livestock mandate) National Agricultural Extension Research & Liaison Services (NAERLS), Zaria (extension mandate) Nigerian Stored Products Research Institute (NSPRI), Ilorin (post-harvest storage mandate)	Bauchi State Agricultural Development Programme Gombe State Agricultural Development Programme Jigawa State Agricultural Development Programme Kaduna State ADP Katsina State ADP Kano State Agriculture and Rural Development Authority Agriculture Department of Garko Local Government Council, Kano State	Feed Masters Nigeria Ltd (animal feed producer) Grand Cereals Nigeria PLC (animal feed producer) Rebson Feed Co. (animal feed producer and researcher) Lela Agro Nig Ltd (maker of jute and plastic bags) Seed Project Co. Ltd (producer and marketer of certified seeds) Premier Seed Nig Ltd (producer & marketer of certified seeds) Candel Agro-Chemicals (agro input supplier) Jubaili Agro-Chemicals (agro input supplier) Nigerian Agricultural Coop & Rural Development Bank United Bank for Africa Wetlands Associates Ltd (agricultural engineers, equipment fabricators & input suppliers)	Women in Agriculture (WIA) Cowpea Marketers Association, Kano State Cowpea Farmers & Seed Producers Association, Kano State Hikima Women's Forum, Kaduna State Dararafe Women MP Coop, Kano State Miyatti Allah Cattle Breeders Association, local branches Soybean Farmers Association, Kaduna Gonin Gora Women MP Coop Vegetable/Edible Oil Millers Association Gamariya Women MP Coop Poultry Farmers Association of Nigeria Tofa Seed Breeders Association (Kano State) Kausani Seed Breeders Association (Kano State) Garko Women Farmers Association, Kano State Abanbeke Dev't (Widows) Association

[1]Consultative Group on International Agricultural Research

RIU convened and funded the inaugural Cowpea Innovation Platform meeting in Kano City in March 2009. Innovation platform members convened subsequent meetings, sometimes with RIU in attendance. Decisions of meetings were communicated to RIU and other members for necessary follow-up. At the platform meetings, the cowpea stakeholders validated the constraints and opportunities and agreed to work together in order to achieve innovations leading to improved farm productivity, reduced post-harvest losses of cowpea grains, and improved management and utilisation of cowpea fodder, as well as making inputs to institutional learning and change.

The Cowpea Innovation Platform was managed by an elected committee, comprising a chairperson, co-chairperson, secretary and public relations officer. Two representatives of each member organisation and farmer group attended platform meetings; however the Cowpea Innovation Platform had no involvement in the internal governance of the member organisations and farmer groups and did not determine the representatives to the platform. There was free entry and free exit of membership, depending on the perceived interest of member organisations. The Cowpea Innovation Platform was essentially informal and therefore transitory in organisational structure, operational objectives, membership and priorities. However, the decision-making process within the innovation platform was structured and involved identifying, discussing, prioritising and delegating responsibility, based on consensus.

The targeted farmers in Kano State were supervised and monitored by 20 trained rural agricultural extension agents, seconded to the programme by KNARDA and supervised by a designated RIU Desk Officer at KNARDA. Each extension agent was responsible for training and monitoring in 10 communities, thus covering a total of 200 villages in Kano State.

The Cowpea Platform methodologies adopted by RIU Nigeria to deliver the intended outputs are shown in Table 2.1.

Table 2.3 Intended Outputs and Objectives of RIU-supported Cowpea Platform

Objectives	Intervention Strategy
1 **Increased cowpea productivity**	Promote widespread adoption and cultivation of medium-maturing, high-yielding and *Striga*-resistant varieties of cowpea by farmers
2 **Improved storage of cowpea**	Introduce and promote the use of non-chemical (hermetic) methods of cowpea grain storage to minimize losses due to bruchid infestation
3 **Better management and utilisation of cowpea fodder**	Develop, produce and promote a simple technology for compacting cowpea fodder into bales and subsequent use of the bales in feeding ruminants

Spin-off

For three years, the RIU Nigeria programme was embedded within ARCN, the national agency mandated to regulate agricultural research. After working closely with RIU and observing the workings of the innovation platform approach, ARCN started a new World Bank-funded project (the West African Agricultural Productivity Programme – WAAPP), which is designed as an agricultural research for development project, for which innovation platforms would constitute the hallmark.

In 2010, ARCN directed all 18 national agricultural research institutes (NARIs) in Nigeria to integrate the agricultural research for development approach in performing their respective mandates. Such a high-level commitment to agricultural research for development has helped to strengthen the national agricultural innovation capacity across the spectrum of agriculture, and can be expected to generate enormous positive multiplier effects in future years.

In 2012, the Federal Ministry of Agriculture announced the inclusion of cowpea among the crop sectors that have been earmarked for 'transformation', meaning that there would be increased federal funding for research, farm productivity, post-harvest processing and value addition, and increased national share of the world market.

2.5 Improving Cowpea Productivity Impact Pathway

A major objective of the Cowpea Innovation Platform was to enhance production. This was done through the introduction of medium-maturing, *Striga*-resistant, dual-purpose cowpea varieties. The impact pathway is shown in Table 2.4.

Table 2.4 Impact Pathway of Cowpea Production and Farm Productivity

Input	Results and Impact			Spin-Off
Brokering relations among Cowpea Innovation Platform members Technical training of farmers, extension and demonstrations Subsidised improved seeds and inputs in affordable packages available through local suppliers Training of community-based extension workers Brokering relations between cowpea farmers, seed producers, and input and service providers	Improved capacities of farmers on the use of improved varieties and agronomic practices Improved availability of seeds in affordable and appropriate quantities Enhanced capability of extension service providers to provide adequate services related to cowpea production Brokered business interactions among different stakeholders Cowpea farmers linked to seed producers and input and service providers	Increased use of improved varieties and recommended agronomic skills Increased yields for farmers Decreased crop losses due to pests and diseases	Improved household income and improved household food security	Seed companies investing in provision of advisory services to farmers on improved seeds Non-platform farmers adopting improved cowpea varieties and agronomic practices on cowpea production

RIU organised and funded two centralised training-of-trainers workshops in Kano City targeting 70 people (farmer group representatives and extension agents). Subsequently, the people who received the training conducted 12 training sessions on improved agronomic practices in various district-level locations across the state. These included training on the best planting time for the new varieties, appropriate spacing, improved methods of field pest management, infor-

mation on access and use of fertilizer, and improved harvesting methods for both the grains and the fodder. In addition, trained extension agents conducted 280 village-level demonstrations. Through this approach, a total of 80,000 farmer households were reached through village-based demonstrations in Kano State.

RIU introduced seeds of improved cowpea varieties to representatives of cowpea farmer associations. The improved varieties were IT277-2 and IT97K-499-35 (which are dual-purpose, *Striga*-resistant, early-maturing, high grain- and fodder-yielding varieties). These varieties are popularly referred to as 277 and 499, respectively, and were recommended to the innovation platform by two agricultural research institutes (IAR and IITA) because the agronomic characteristics of these varieties addressed the needs expressed by the farmers.

Through the platform, RIU facilitated contacts between cowpea farmers and seed companies (Premier Seeds Ltd and Seed Project Ltd), who are also members of the innovation platform. This led to a seed supply contract under which the companies packaged the seeds in 2 kg bags (instead of in 5 kg bags) to suit the preference of individual smallholder farmers. Packaging the seeds in 2 kg bags made the seed packets affordable to low-income farmers, who paid for them on a cash-and-carry basis at the cost of N220 per kg. As a result, 10.2 metric tonnes, worth GB£ 5 million, were acquired by 380,000 farmers, sufficient for 547,200 hectares of arable land. This resulted in a production of 307,000 metric tonnes of cowpea grains, valued at GB£ 13 million and 80,000 metric tonnes of fodder, valued at GB£ 1.8 million.

Household survey results indicate that awareness about the existence of improved varieties of cowpeas was at the level of 35% in the control communities and 100% in project communities; this contrasts with an awareness level of 30% during the baseline survey. The corresponding figures for adoption of the improved varieties are 15% for control communities, 96% for project communities and 10% for baseline.

Farmers reported a preference for the 277 variety because 499 is more difficult to process, and 499 also has a black eye that darkens the cooking broth, thereby reducing the visual appeal of the meal. Respondents also reported that 277 had a higher market demand and its fodder was reported to be preferred by the animals. However, for cash crop purposes, the farmers expressed preference for 499 because its larger grains enabled them to fill more bags with the same weight of grain. Due to these characteristics of the 499 variety (black eye and difficulty in processing), the farmers have not entirely abandoned their local varieties *(Kananado, Yarkaka)* but still allocate about 50% of their cowpea farm plots to cultivating them (Table 2.5).

Female and male producers allocated approximately equal farm size to cowpea production. However, the male producers grew other crops for food security and income while the females mostly cultivated cowpea as a cash crop. The yield for the improved variety in intervention communities was slightly higher for male-owned farms (573.7 kg/ha) than for female-owned farms (548.1 kg/ha, or about 4.5% less). For the local variety, the differences were larger, with males producing almost double the yields of female producers. The female respondents attributed the difference in yield to more timely application of agronomic inputs among the male farmers. Female farmers depend mainly on male labour for these activities. In control

villages, the difference in yields for the improved variety was larger than in innovation platform-targeted villages (397.9 kg/ha for women and 527.2 kg/ha for men).

Table 2.5 Cowpea Farm Size, Grain and Fodder Yields for Control and Intervention Communities

	Sex	Cowpea farm size (ha)			Grain yield (kg/ha)			Average production per household (kg)	Fodder yield (kg/ha)
		Improved	Local	Mean	Improved	Local	Mean		
Control	Female Male	1.10 1.42	0.73 1.23	1.25	397.9 527.2	228.7 335.0	463	579	233.5
IP targeted	Female Male	1.32 1.68	1.01 0.79	1.44	548.1 573.7	212.9 390.0	561	808	269.0
Baseline		Avg. Cowpea farm size		1.21	Avg. yield (kg/ha)		301	364	-

These results suggest that the combined effort of the RIU-assisted Cowpea Innovation Platform and local government agricultural officers was effective in raising awareness in the project communities, and also resulted in an increase in the adoption rate for new technologies (improved seeds). The adoption of improved varieties is thought to have contributed to the yield increase observed in project villages, from 301 kg found in the baseline to 561 kg found in the current survey. However, yields in the non-project villages also increased substantially, to 463 kg/ha, although only 15% of farmers adopted improved varieties. The difference in yield between the control group and the innovation platform-targeted farmers is 98 kg/ha, which can be attributed to the RIU intervention. The average cowpea farm size of the RIU-assisted farmers increased slightly, from 1.21 ha to 1.44 ha for pre- and post-intervention communities, respectively (Table 2.2). The focus group participants reported that the number of households that adopted the 277 variety was higher than those that adopted 499. Pair-wise ranking showed that the desirable characteristics of 277, in order of importance, were high yield, early availability of food in the season, high income from sales of cowpea, and early maturity. Other benefits reported were availability of cash at the peak of the season, high fodder yield and conservation of soil moisture. The high income was also attributed to access to improved methods of storage, which motivated producers to store until the market price was high.

2.6 Improving Cowpea Storage Technology Impact Pathway

RIU Nigeria partnered with the IITA, a Nigeria-based member of the Consultative Group on International Agricultural Research (CGIAR), to promote the use of an improved storage method for cowpea grains. The method involves storing the cowpea grains in airtight, triple-layered bags to effectively prevent bruchid infestation. The concept of triple bagging as a research output was proposed by scientists at Purdue University in the United States of America, based on their field research and adaptation of a local method of storage in a rural community in Cameroun. Backed by funding from the Bill & Melinda Gates Foundation, Purdue was mandated to promote the technology across cowpea-producing countries in sub-Saharan Africa, of which Nigeria is the leading producer. The Purdue Improved Cowpea Storage (PICS) project was implemented in Nigeria by the IITA and the partnership between RIU and PICS-IITA enabled both programmes to support each other's goals to achieve impact at scale and greater operational cost-effectiveness due to economies of scale.

PHOTO: RIU

Bruchid-infested cowpea and Bruchid-free cowpea

Table 2.6 Improving Post-Harvest Storage of Cowpea Grains

Input	Results and Impact			Spin-Off
Sensitising stakeholders to dangers of pesticide use and the benefits of triple bagging Mass campaign using radio, TV and community theatre to promote the use of triple bagging Conducting village-based demonstration workshops on triple bagging Training extension agents, ADP desk officers and private marketers on use of triple bagging Contracting bag manufacturing companies for production and distribution of triple bags	Farmers, marketers and other stakeholders aware of advantages of triple bagging and capable of applying the technology Extension agents, ADP desk officers and 14 bag dealers capable to train farmers on triple bagging Triple bags produced and available through the supply chain under RIU-assisted Cowpea Innovation Platform	Increased sales of triple bags Farmers and marketers use triple bagging/ Increased individual capacity to store cowpea Increased volumes of stored and traded cowpea grains Reduced storage losses Higher prices for stored cowpea in the off-season	Increased income to cowpea farmers and grain marketers Benefits to bag manufacturers Reduced cases of food poisoning from polluted cowpea	Manufacturing companies competing to produce and supply quality and affordable triple bags Microfinance operators showing interest in lending to triple bag distributors ADPs integrating triple bagging into their Technology Monitoring Review Meetings Federal Ministry of Agriculture including Cowpea on the Agriculture Transformation Agenda

The ADPs across the six RIU partner states (Bauchi, Gombe, Jigawa, Kaduna, Kano and Katsina) reported reaching a total of 16.6 million people through Information, Education and Communication (IEC) activities (Table 2.7). The IEC activities included radio and TV talk shows, jingles and special public service announcements, community theatre events, and mandated village square announcements by village heads or religious leaders.

Table 2.7 Estimated Number of People Reached through Mass Communication of RIU's Partner-ADPs

Name of Partner-ADP	Number of People Reached by the IEC Activities
Bauchi State Agric Development Project (BA-ADP)	2,000,000
Gombe State Agric Development Programme (GSADP)	1,000,000
Jigawa State Agric & Rural Dev. Authority (JARDA)	600,000
Kaduna State Agric Dev. Project (KD-ADP)	5,000,000
Kano State Agric & Rural Dev. Authority (KNARDA)	5,000,000
Katsina State Agric & Rural Dev. Authority (KTARDA)	3,000,000
Total number of IEC beneficiaries	16,600,000

The use of IEC tools by both RIU and KNARDA could have accounted for the awareness about triple bagging in Kano State.

One hundred and twenty extension agents, six ADP desk officers and 14 bag dealers were trained across the six partner states. Each trained extension agent conducted training and demonstrations in ten communities, for a total of 1,200 villages. At least 500 cowpea farmers and marketers participated in each village-based sensitisation workshop in the 1,200 rural communities across the six states. According to RIU figures, 200 villages and approximately 100,000 farmers were directly reached in Kano State.

Based on negotiations with the manufacturers, RIU paid for 5,100 triple bags for use by field extension agents in village demonstrations in 200 communities in Kano State. Each triple bag has a storage capacity of about 100 kg of grains. Monitoring reports by field staff showed that farmers and marketers in RIU-assisted villages in Kano State ordered and paid for about 42,000 additional triple bags through their respective representatives. The bags were sourced from distributors and retailers who were part of the supply chain affiliated with the Cowpea Innovation Platform. Some distributors and retailers also established outlets in various villages, under an arrangement with the community or religious leaders.

As a result of raised awareness on triple bagging among cowpea farmers and grain marketers, RIU convinced two new bag manufacturers to enter into the production of triple bags, adding to the sole manufacturer commissioned to produce the bags by the IITA-PICS project, thereby making three companies in all. This was part of a market development strategy aimed at introducing competitive production and pricing of triple bags in the country.

The household survey result shows that 14% and 94% of respondents in control and project communities, respectively, were aware of the triple bagging method of cowpea storage. None of the respondents in the control communities had acquired or used triple bags, while 71% in the project communities reported use of triple bags. The results further showed that 62% of the project producers delayed sale of their grains for 4-6 months after harvest, thereby taking advantage of higher prices in the off-season. The selling price immediately after harvest was

NGN 5,000 per 100 kg bag; 4-6 months after harvest the price increased to NGN 12,000 per 100 kg bag (app. GB£ 47).

The introduction of a non-chemical storage method – the triple bagging technique – was considered to be a very significant intervention in the community. The pair-wise ranking of benefits of RIU-assisted triple bag intervention revealed that the ability to store cowpea for a long time without loss was the most important benefit (Table 2.8). The other perceived benefits, in decreasing order of importance, were: higher rate of germination of stored cowpea seeds; higher income from cowpea sales after storage and decrease in post-harvest losses; improved quality of stored cowpea; safety of stored cowpea as food; and reduced cost of storage.

Table 2.8 Pair-wise Ranking Matrix of Benefits of Triple Bagging Method

Benefits	1	2	3	4	5	6	7	Total	Rank
1 **No storage loss**								2	3rd
2 **No food poisoning**	2							2	3rd
3 **Reduced storage expenses**	1	3						1	7th
4 **Increased income from cowpea sales**	4	2	4					2	3rd
5 **Improve quality of stored cowpea**	1	5	5					2	3rd
6 **Increased rate of germination of stored cowpea**	6	6	6	6	6			5	2nd
7 **Cowpea can be stored for a long period**	7	7	7	7	7	7		6	1st

2.7 Improved Management and Utilisation of Cowpea Fodder Impact Pathway

RIU Nigeria invited an agricultural equipment fabrication company, Wetland Associates Ltd, to develop, produce, review, and test-run a fodder compactor in selected communities in Kano and Kaduna states. The compactor was designed under the RNRRS programme to produce 5 kg and 9 kg bales, which are easy for farmers and merchants to transport or store in limited spaces. Getting the fodder compacted into defined weights also enabled livestock farmers to practise feed rationing in combination with concentrates, based on the body weight of the animals, thereby reducing waste. Unit cost of the compactor was about NGN 56,000 (£250), fitting into the required start-up capital range for sole-proprietorship microenterprises in Nigeria.

Table 2.9 Impact Pathways for Improved Management and Utilisation of Cowpea Fodder

Input	Results and Impact			Spin-Off
Introduced RNRRS output on compacting cowpea fodder to Wetlands Associates Ltd Provided orientation for Wetlands Associates Ltd on cowpea value chain and use of fodder Commissioned production expert review of a prototype compactor Sensitised cowpea fodder producers, traders and buyers on compression of fodder into measured weights Scouted and recruited young entrepreneurs in selected cowpea-producing communities to engage in fodder baling Sourced for private company (Provalue Associates Ltd) to sponsor the fodder supply chain	Prototype produced, reviewed, modified and validated after field testing Compactors available for use by young micro-entrepreneurs in target villages Investor interest generated among actors on commercial viability of the fodder compactor Fourteen units of compactors valued at N884,000 (approx. £4,000) produced and installed by Wetlands Associates Increased funding found for compacted fodder supply to the two major markets New relationships and business transactions developed among actors within the cowpea platform	Better storage and higher nutritional value of baled fodder New product line for Wetlands Associates Ltd Increased market demand for baled and weighted cowpea fodder among livestock farmers in target areas Reduced need for seasonal migration of livestock herds Reduced cases of conflict between livestock herdsmen and crop farmers over damaged crops during dry season when cattle migrate Increased volume of baled cowpea fodder traded	Improved income among fodder producers Improved income among compactor owners (youth) Improved livestock feed security Improved livestock productivity	The combined use of fodder with concentrates among livestock farmers has created a new market for concentrates which are produced by a company that is a member of the cowpea platform Farmers are now seeking to plant cowpea in off-season just for the fodder market Formerly unemployed youth now own and operate fodder compactors in some villages Brokered linkage between fodder suppliers Nigeria S.O.S. (Tsetse Control) Project in partnership with the Nigeria Institute for Trypanosomiasis Research (NITR) and National Veterinary Research Institute (NVRI)

Subsequently, about 20 village-based youths in Kaduna State acquired 12 compactors through a locally-arranged credit facility. Two compactors were acquired by the Garko Local Government Council in Kano State for the purpose of sensitising, demonstrating and training the cowpea farmers and fodder merchants. The commercialisation process occurred faster in Kaduna because of two big supply contracts from grazing reserves. Kano plans to start promoting the compactors on a commercial basis in 2012/2013.

The youths earn income by charging a fee for baling the fodder. The cowpea and livestock farmers in the target villages reported their ability and willingness to pay for the use of the compactors in baling their cowpea fodder, because of the perceived advantages of the compacted bale, including easier handling and transport, more transparent price setting and higher demand among livestock farmers.

Due to the limited scale of this intervention in Kano State, the adoption and impact are still limited. No respondent in the control villages was aware of the use of a fodder compactor to improve the management of cowpea fodder. On the other hand, 15% of respondents in the

sampled project communities were aware of the technology, and 7% had benefited from it. The relatively low level of awareness and adoption rates for fodder compactors in project communities was due to the fact that RIU interventions on the design, fabrication, field trials and initial commercialisation of the technology were done in Kaduna State, rather than in Kano State where the evaluation was carried out. The technology was developed in response to farmers' demand, and is still in the early stages of commercialisation and adoption. Hence, some of the respondents had heard about the technology but had never seen or used it in their community. The experiences in Kaduna State look promising for other states.

The perceived benefits of the fodder compactor, in order of importance, were:

1. Fodder is neatly compacted and visually appealing;
2. Compacted fodder conserves storage space, and is easy to handle and transport;
3. Compacted fodder can be stored for a longer time without degradation.

PHOTO: RIU

Fodder retailer in Kano, Nigeria

2.8 Attribution to RIU

The most important constraints to increased cowpea production at the start of the intervention, as perceived by farmers, were:

1. Field pests and diseases;
2. Lack of credit facilities to increase farm size and purchase inputs;
3. Low yields;
4. Inadequate supply of production inputs;
5. Poor access to extension services.

With the intervention of the RIU-assisted Cowpea Innovation Platform, problems such as low yield, inadequate supply of fertilizer, poor access to extension services and damage by storage pests, became of less importance to the farmers. However, as with most development interventions, RIU intervention gave rise to some new issues, such as:

1. High costs of fertilizers;
2. Inadequate supply and high cost of triple bags;
3. Non-availability of fodder compactors in some neighbourhoods;
4. Increased expenditure on crop protection chemicals.

This illustrates the view that socioeconomic development is an endless spiral, given a dynamic world in which every solution tends to lead to the emergence of new issues, which in turn necessitate the search for new solutions.

Farmers' perceptions on *'major general changes'* that had occurred in the cowpea sub-sector as a result of RIU-assisted interventions and interactions among the diverse actors under the cowpea platform, were also examined. The most important changes that had occurred in the agricultural sector over the last five years were perceived to be:

1. Efficiency in fertilizer application as a result of training on improved application method;
2. Pest management and agronomic practices;
3. Use of improved seed varieties;
4. General household food security;
5. Higher market prices for cowpea grains;
6. Improved storage of cowpea grains.

Most of the households in the community perceived (strong) positive changes in all the above-listed attributes. The interventions that were perceived to have brought about the changes in their livelihoods were training, demonstrations of relevant technologies, and access to improved seed varieties, all of which were ranked as very significant.

Specific perceived changes in the cowpea sector were the introduction of an improved storage method (triple bags), and access to improved cowpea varieties. However, farmers also reported high incidence of field pests and diseases associated with the newly-adopted cowpea varieties

(277 and 499) which were thought to be more susceptible to field pests and diseases, and thus required more frequent pesticide spraying to obtain the optimal yields.

After the sensitisation and demonstrations on use of triple bags by the RIU-assisted Cowpea Innovation Platform, farmers reported that they had adopted the use of triple bags for storing their cowpea grains, and had stopped applying chemicals to prevent bruchid infestation.

Table 2.10 Attribution to RIU

	Baseline	Control Group	IP-targeted Households
Increase in cowpea productivity	301 kg/ha	53%	86%
Storage of cowpea (adoption rate)	0%	0%	71%
Fodder compactor (utilisation rate)	0%	0%	7%

All these changes occurred within the last three years and had an impact on over 50% of the households in the community. The extent of impact, particularly on women, youth and the socially excluded was perceived as high. About 40% of the participants in the intervention communities were women.

Results show a clear difference between households in communities that were targeted by the Cowpea Innovation Platform and households in villages that did not benefit from the activities initiated by the Platform. This applies for interventions related to increasing productivity, as well as those related to improved storage and fodder utilisation (see Table 2.10). The increase in productivity among platform beneficiaries was higher than among non-beneficiaries. Triple bagging has not been adopted in other villages, even though the IEC campaign also used mass media such as radio and television. It appears that the availability of seeds, inputs and bags, combined with direct interaction (farmer-to-farmer and extension agent demonstrations) has been an effective approach for upscaling research results.

The introduction of fodder compactors has been done on a relatively small scale and is still in the stage of experimentation. Once their use has been proven to be effective, upscaling to other villages and districts will become a priority.

RIU-Nigeria programme worked through key partner organisations at national, state and local levels as well as in the public, private and non-governmental sectors. The contributions of these partners appeared crucial for the success of the interventions. However, their inputs still had to be managed and coordinated by RIU. Prior to RIU intervention, RIU partner agencies had expressed the need for developing agricultural innovation capacity in the country. RIU was among the first of the development programmes to actually initiate a multi-stakeholder approach to agricultural extension in the country.

ARCN was established in 2007, when the RIU's Country Assessment exercise was just beginning; it was a fortunate coincidence that ARCN had a mandate to build partnerships for strengthening agricultural innovation capacity in the country. Hence, ARCN and RIU had a shared vision of promoting private sector participation in agricultural innovation through the mechanism of multi-stakeholder value chain innovation approaches. The thematic affinity between ARCN and RIU encouraged ARCN to buy into the RIU programme, and to use its national influence to enable RIU to build important alliances across the sectors and states, thereby enabling the programme to achieve impact at scale with limited resources.

2.9 Investments / Cost Benefit Analysis

A total of about £169,000 was invested by RIU to establish the Cowpea Innovation Platform, and support the development of innovation capacity in Kano State for cowpea production, post-harvest storage and the management and utilisation of cowpea fodder. Of this total, about 13% (£22,000) was invested in the formation and facilitation of the Cowpea Value Chain Innovation Platform activities, and about 22% (£37,000) in increasing farm productivity of cowpea. About 45% (£76,000) was spent on promoting an improved method of cowpea storage (triple bagging) and about 20% (£34,000) on developing, field testing and promoting improved management and use of cowpea fodder (Table 2.11).

Table 2.11 RIU-Nigeria's Financial Investment in the Cowpea Value Chain in Kano State

Cost Centre	FY2009-2010 (GB£)	FY2010-2011 (GB£)	FY2011-2012 (GB£)
Cowpea field operations	17,936	40,883	27,839
Travel & subsistence (staff and consultants)	5,394	6,302	6,607
Salaries & fees (staff & consultants)	10,772	13,058	14,271
Other overhead costs	8,646	8,646	8,646
Sub-totals	42,748	68,889	57,363
Total	**169,000**		

To calculate the financial value for money of RIU investment in Kano State, data from a total of 10,000 adopters were used. The relative numbers of new adopters in years 1, 2 and 3 were 1,000, 3,000 and 6,000, respectively. The net income per hectare for year 1 was obtained by subtracting the costs of production (plus prorated totals for loan servicing and fixed costs) from operating revenue (from sales of cowpea grains and fodder). The total net income is the product of the net income per hectare, the average farm size (1.44 ha) and the number of adopters for the year.

The values were then converted to GB£. For realistic comparison, the same estimates were generated for the control group using the same (projected) number of individuals as in the project site. Based on these calculations, the difference between the total net income of the project participants and the control group is the indicative measure of actual financial impact

of innovations (i.e. technology adoptions due to RIU investment). All calculations were based on the cumulative number of adopters (10,000) and were later adjusted to the relative number of adopters for the year.

In addition to sales of cowpea grains, the estimated income for years 2 and 3 also included income from sales of fodder and the value of prevented post-harvest losses in cowpea grains as a result of the adoption of innovation in cowpea storage (i.e. the use of triple bags). All other calculations were the same as in year 1 with no changes in the average costs, income from grain sales and farm size.

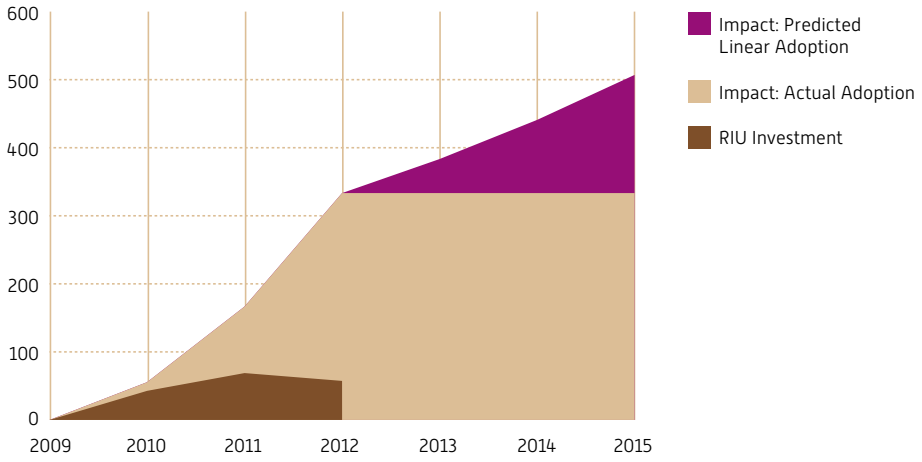
Two scenarios are provided. The first scenario caters for the current adoption rate, assuming that adopters continue the improved practices. The second scenario is based on a spin-off to other producers, assuming an additional adoption of 15% for the following three years.

Table 2.12 RIU Investment and Estimated Financial Impact

	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
RIU Investment	42,748	68,889	57,363	-	-	-
Impact: Actual Adoption	55,509	166,679	333,358			
Impact: Predicted Linear Adoption 15%	-	-	-	383,361	440,865	506,995

On average, every GB£ invested by RIU in supporting the development of innovation capacity in the cowpea sector in Kano State generated GB£ 3.28 of financial impact among the adopters that worked directly with extension agents under the RIU-assisted Cowpea Innovation Programme (Figure 2.3).

Figure 2.3 Current and Estimated Furture Financial Impact of Technology Adoption in Cowpea Sector



2.10 Lessons and Concluding Remarks

The RIU-assisted Cowpea Innovation Platform provides a number of valuable lessons related to promotion of agricultural innovation.

Bringing Existing Technologies to Scale

The approach adopted for the Cowpea Innovation Platform can be characterised as a multi-stakeholder approach to bringing to scale existing technologies and (partly RNRRS-created) research results. Although it was merely supply-driven, it has indeed led to high adoption rates.

The key outcomes of the RIU-assisted Cowpea Innovation Platform have included the following: improved farmers' access to seeds of improved cowpea varieties and other inputs/services; improved capacities of cowpea farmers and marketers to acquire skills and technology to improve storage of cowpea grains; and enhanced skills of farmers and youth in the management and utilisation of cowpea fodder. While these processes generated significant collateral benefits to low-income farmers, these innovations primarily addressed practical needs. They involved little experimentation and were merely supply-driven.

Both the production (new varieties) and storage-oriented (triple bagging) interventions were merely initiatives to upscale technologies already proven to be successful. Both interventions required a multi-stakeholder approach, involving private and public and private stakeholders. This included the development of new institutional arrangements (e.g. linkages between private sector suppliers and farmers), as well as capacity development.

PHOTO: RIU

Cowpea traders at the local market

The fodder management intervention involved more experimentation than the production or storage intervention; hence its scale was relatively limited (only 7% adoption rate). The design and testing of appropriate baling equipment, in combination with institutional arrangements and capacity building, was an inherent part of the process.

Platforms as Mechanisms for Enhancing Interaction between Value Chain Actors

The innovation platform approach provided a channel for linkage, interaction and networking among stakeholders in the cowpea sub-sector; this led to improved access to agricultural technologies, input-output markets and market information. Building partnerships with existing structures, such as the state-run ADPs and other relevant governmental and non-governmental agencies and private sector organisations, made it possible to upscale the adoption of research outputs that had proven their value in practice within a relatively short period of time. Triple bagging is a good example. Without these structures the activities of RIU would have been on a much smaller scale.

Farmers as Receivers Rather Than as Agents

Because bringing effective practices to scale was the major objective of the cowpea platform, the approach did not allow for active farmer participation in decision-making on the platform level. Through the existing state extension system, a total of 100,000 producers were directly reached in an effective way. Although farmers' organisations and cooperatives were represented in the platform, the total number of producers represented by these organisations was limited. But the role of farmers is restricted to being receivers of a specific extension service rather than active actors, exercising agency in an innovation process.

Embedding in National Institutions

Embedding the RIU programme within ARCN enabled faster institutional learning and change as evidenced by ARCN's directive to research institutes to apply agricultural research for development, and the use of the innovation platform model in the WAAPP. It also saved RIU significant overhead costs (e.g. office rent), and facilitated easier access to agricultural research policy-makers.

However, institutional change is often a gradual process, requiring sustained, long-term commitment. For example, although ARCN directed NARIs to adopt innovation platform approaches in the implementation of agricultural research for development activities, the impact would not be apparent for a long time. In addition, the effect of integrating the innovation platform approach into the WAAPP is not likely to be evident in the near future.

The Role of the Private Sector

Private enterprise responds to business opportunity. Its role in realizing impact at scale involved seeing the needs of farmers as creating new markets for the supply of seeds, crop protection chemicals, fertilizers, triple bags, fodder compactors and credit. The mass adoption and use of these technologies led to impact at scale, as well as to sustainable future input and output markets. Private sector participation in the RIU Nigeria-assisted cowpea platform brought about sustainable changes in the sector.

Triple bagging is a good example of how business opportunities were linked to development objectives. The private sector plays a crucial role in the production and distribution of the bags, which will contribute to the sustained use of the triple bagging practice in Kano State. The same applies for the other interventions, which are focused on improved production and fodder management.

Sustaining the Capacity to Innovate

Public resources were used to achieve impact at scale by investing in the replication of successful experiments, promoting public-private synergies, developing markets and ensuring the availability of effective technologies for mass adoption.

RIU has been successful in promoting a multi-stakeholder approach to upscale promising agricultural practices. It is likely that the successful practices will be more widely promoted and adopted. The ARCN directed all 18 NARIs in the country to integrate the approach into their research and development activities. ARCN has also integrated innovation platforms into the design and implementation of the WAAPP, a World Bank-funded programme managed by ARCN.

However, it is questionable whether the approach has contributed to sustainable improvements in the capacity to innovate among the stakeholders of the cowpea sector in the targeted states. Most interventions were supply-driven. The RIU country team played an important role in the facilitation of the programme, but has invested relatively little in building the capacity of local actors to innovate, i.e. to jointly identify and address opportunities for sector improvement through a process of experimentation followed by upscaling. Hence, it is not very likely that the platform will initiate new activities for sector improvement without the facilitation of RIU. In this sense, the platform merely functioned as a mechanism to bring to scale certain practices and technologies, rather than as a sustainable mechanism to address constraints and opportunities in the cowpea sector.

References

- Nigeria Country Assessment Report (2007) **Research Into Use Programme**

PHOTO: RIU

3

African Armyworm

Armyworm Best Bet

Authors: Peter Gildemacher and Ellen Mangnus

This chapter describes and evaluates the Best Bet initiative 'Safe and Affordable Armyworm Control (SAACO) Tools for Poor Farmers in East Africa' project, hereafter called 'Armyworm Best Bet', a project that ran from 2010-2012 in Tanzania and Kenya.

3.1 Background of the Intervention

Armyworm

The Armyworm Best Bet aimed at reducing the devastating effect of the African Armyworm. African Armyworm, hereafter called simply armyworm, is a migratory pest that can cause severe damage to rangeland and cereal crops, particularly maize, sorghum, rice and millet. Outbreaks occur following an annual pattern, but vary greatly in intensity from one year to another (Scott, 1991; Njuki *et al.,* 2004). The occurrence of serious outbreaks is highly erratic and largely unpredictable (Haggis, 1984, 1986).

The armyworm life cycle includes four stages: egg, larva (5-6 instars), pupa and moth. The full cycle from egg to migrating moth takes about 30 days, depending on the temperature. An outbreak occurs when, as a result of wind patterns around thunderstorms, flying armyworm moths congregate and land in high numbers to lay eggs. For successful oviposition the moth requires a humid environment and the presence of young green grass, including young maize, sorghum and rice plants. The young larvae feed themselves by scraping the surface of the

Geographical distribution of the African Armyworm

leaves, causing relatively little damage, and these stages often go unnoticed. After the third or fourth instar, however, they start to cause more damage (Brown and Odiyou, 1968). When the larvae are crowded, they become 'gregarious', i.e. they change behaviour and become more active and very destructive, moving together in a swarm in the same direction through vegetation, resembling a marching army eating every succulent green plant in its way. After the fifth or sixth instar the larvae pupate into moths and disperse, thus leaving the area. Depending on the speed of the winds, the flying period and the rainfall, the moths can travel hundreds of kilometres. Because the caterpillars appear and disappear unexpectedly, they're often regarded as mysterious.

It is suspected that the armyworm survives the dry season in the Kenyan and especially the Tanzanian coastal territories in places where grasses remain green throughout the year. Most outbreaks can be traced back to initial outbreaks in these territories. From these primary armyworm outbreaks the pest spreads over the sub-continent of Eastern and Southern Africa. The areas most affected are central and northern Tanzania and coastal and central Kenya. Severe outbreaks can spread from southern Tanzania to Burundi, Malawi, Zimbabwe and South Africa, and from northern Tanzania and Kenya to Ethiopia, Somali and Yemen (Haggis, 1986). In May/June 2008, outbreaks of armyworm were reported in 24 districts in Kenya – damaging 10,324 ha of crops and 41,435 ha of pastureland. Between 2006 and 2009 Tanzania recorded outbreaks on crops covering 233,000 ha (www.researchintouse.com). The SAACO Armyworm Best Bet proposal claims that about 30% of districts in Kenya and Tanzania, estimated to include around 2.1 million households, are at risk of armyworm damage.

Armyworm Control Strategies

Research literature suggests two main strategies to control the armyworm. Strategic control aims at eliminating infestations early in the epidemic, to avoid the spread from primary outbreaks to new areas further afield. It is based on the premise that major outbreaks originate from a number of primary outbreak areas, and that controlling these early outbreaks can reduce the chances of a full-blown regional epidemic of armyworm. Due to logistical and financial constraints, however, this strategy seems to be more a theoretical suggestion than a mainstream practice. Direct control aims at avoiding damage to crops by locally controlling armyworm swarms that are about to attack a field. A wide range of pesticides is effective against armyworm. A survey in 1991 revealed that most farmers in Tanzania could not spray pesticides due to financial constraints (Scott, 1991).

Despite its being recognised as a pest of major importance, little reliable information exists on yield losses and economic effects of armyworm. Scott (1991) estimated losses of up to 30% in affected households and the costs of replanting exceed the costs of chemical control.

Earlier Work

In response to the threat of armyworm outbreaks, national and regional forecasting services have been developed in East Africa since the 1960's (Betts and Odiyo, 1968). These were government services, often supported by international research institutes and donors. Moth catches using light traps, recordings of outbreaks and meteorological charts were used to make broad predictions of armyworm outbreak risks. With the development of a synthetic female armyworm moth pheromone in the 1970's, light traps could be replaced by pheromone traps, which are cheaper and much easier to use, as they specifically catch the male armyworm moth. Both in Kenya and Tanzania, a crude network of these traps was operated by extension officers who reported the data to a central migratory pest control unit, which was responsible for recording incidences and predicting risks.

The forecasts were thought to be useful for national level decision-making with regard to keeping pesticide stocks and being able to respond to outbreaks. However, the prediction failed to be useful to producers at farm level for two reasons. In the first place, the forecasts referred to the chances of moth outbreaks for large regions, a level of precision that does not mean much for decision-making by individual producers whose crops are at risk. Secondly, although the data on flying moths were collected locally, they were processed centrally, after which information had to be communicated back to the particular areas considered to be at risk, resulting in belated warning for the outbreak. Day and Knight (1995) suggested the development of different types of forecasts for different decision-makers; however, it was not until 2001 that the idea of local armyworm forecasting was seriously considered (Knight, 2001), when a programme to pilot community-based armyworm forecasting (CBAF) was elaborated.

The aim of the programme was to empower farm communities to forecast armyworm outbreaks so that they would be informed more quickly and be able to prepare for control adequately. The programme emphasis was on farmer sensitisation, training and organisation, and provision of equipment. The approach was first piloted in Kilosa District, Tanzania, and was introduced in

2007/2008 in four northern districts in Tanzania, as well as in a single district in Kenya[1]. The programme ran for three years and each year the number of villages was expanded, reaching a total of 144 in the last year. To achieve scale the programme used a staggered training system, in which trainers were trained in a central workshop and then provided training and support to local forecasters at district level.

Research on biological control options of armyworm had also been conducted, specifically on the use of a naturally occurring disease of armyworm, caused by a Nuclear Polyhedrosis Virus (NPV). The research efforts resulted in the development of an experimental formulation of NPV as a biological pesticide, called Spex-NPV, based on NPV harvested from naturally occurring armyworm outbreaks.

Problem and Opportunity Statement

The CBAF pilot had shown that local armyworm forecasting worked in northern Tanzania. Remaining challenges were: upscaling the approach to cover the main armyworm-affected areas in Kenya and Tanzania; assuring a constant supply of pheromone lures to the community-managed traps; and improving the access of farmers to effective control measures, to assure an adequate response to positive armyworm forecasts.

3.2 Impact Assessment Methodology

Early in the process of designing the methodology, it became apparent that the SPex-NPV production facility was not yet fully functional. The production facility had been established, but no Spex-NPV had been produced or tested. Therefore, the decision was made to focus on collecting data from the CBAF component of the project.

The impact assessment methodology was based on three components:

1. Household surveys in CBAF intervention areas;
2. Resource person interviews;
3. CBAF stakeholder workshops.

Household Surveys

A household survey was implemented in the CBAF project intervention areas in Kenya and Tanzania. Based on information provided by the respective ministries of agriculture involved in the project, communities were sampled that had reported armyworm outbreaks in 2011 and had participated in the CBAF project. Close to each CBAF village, a non-CBAF village that had also suffered from armyworm was selected to serve as a control.

Thirty households within each selected village in Tanzania and 45 households in each selected sub-location in Kenya were sampled randomly. Enumerators walked in different directions in the selected village, sampling every third household. In villages where households were farther apart they reverted to selecting every second household.

[1] This last programme was implemented by CAB International - Africa Regional Centre (CABI-ARC), Natural Resources Institute (NRI), Desert Locust Control Organisation and Pest Control Services (PCS) of the Ministry of Agriculture and Food Security (MAFS) in collaboration with the Moshi District Council.

Table 3.1 Number of Households Surveyed

	CBAF villages	# households	Control villages	# households
Kenya		**262**		**255**
Machakos	Kaathi Mikuya Lower Kiandani	32 42 44	Kimutwa Katheka kai Katelembo	45 39 43
Matungulu	Katine Mukengesha Kyeleni	45 46 53	Kituluni Koma Kyaume	34 50 44
Tanzania		**167**		**172**
Dodoma	Ilindi Mpamantwa	29 21	Ibihwa Mindola	26 24
Kongwa	Magasene Kinangali	25 30	Matongoro Mkoka	30 30
Morogoro	Milama Wami Dakawa	31 31	Luhindo Mgudeni	30 32

The household survey contained questions relating to preferred food and cash crops, armyworm knowledge, monitoring and control practices and maize yields and perceived damage over the last two years.

Resource Person Interviews

In addition to the household survey, key resource persons who were involved in the project in Kenya and Uganda were interviewed. The national coordinators, district and frontline extension staff, local administrators and forecasters were interviewed to assess their opinions and experiences with the CBAF project.

Stakeholder Workshops

In each of the sample districts short stakeholder workshops were organised in which the performance of, and the relationships between, armyworm forecasting stakeholders were investigated. Forecasters, local extension staff, input dealers, local administrators and maize farmers participated in these meetings.

3.3 Intervention Description

Two proposals on armyworm were submitted to the Best Bet competition, one focusing on forecasting of armyworm outbreaks, as a follow-up to the CBAF pilot described above, the other on a biological control technology, aiming making biological armyworm control operational, using Spex-NPV. Both were judged to be promising initiatives, especially when combined, and RIU asked that the two proposals be merged. In 2009 the resulting partnership[2] and proposal were selected for funding within the Best Bet scheme.

[2] Eco Agri Consultancy Services Ltd, (Tanzania), Ministry of Agriculture and Food Security (Tanzania) Ministry of Agriculture (Kenya), Natural Resources Institute (UK), Lancaster University (UK), Desert Locust Control Organisation for Eastern Africa, Tropical Pesticides Research Institute (Tanzania), Bajuta International (Tanzania), Juanco SPS (Kenya), Ministry of Agriculture and Rural Development (Ethiopia), CABI Africa (Kenya).

Intervention Objective

The aim of the new project was to establish a system for the production, supply, distribution and marketing of SAACO tools, building on earlier experiences with community-based forecasting and biological control using Spex-NPV.

In summary the three objectives of the Best Bet were:

1. To establish a supply network for registered, low-cost forecasting tools, to meet the full needs of Tanzania and Kenya;
2. To establish a virus production system (for Spex-NPV) in Tanzania capable of producing at least 10,000 ha worth of product per annum, with the ability to expand to meet the regional need of >100,000 ha per annum;
3. To promote the use of SAACO tools by government services, farmers, community organizations, NGO's, and development partners, in order to sustain use and expand to all affected countries in eastern and southern Africa. This included establishing forecasting in 120 villages (40 villages in Tanzania and 80 villages in Kenya) and applying the virus on up to 1,000 ha.

Methodology (Spex-NPV, CBAF Mainstreaming)

The steps for setting up the SAACO tools distribution system and the production of Spex- NPV were proposed as follows:

CBAF:

1. Training of trainers from district offices in a national workshop;
2. Election of farmers at village level to be trained as forecasters;
3. Training of forecasters and first season implementation of community-based forecasting under close monitoring and control;
4. Official registration of the armyworm pheromone in collaboration with the pharmaceutical industry;
5. Establishment of linkages between pharmaceutical industry, distributors, and government and international pest control bodies;
6. Set-up of a durable pheromone lure and trap supply system.

Mothcatcher

Spex-NPV:

1. Mass harvesting of Spex-NPV from field outbreaks to build raw material stock;
2. Procurement of equipment and consumables for Spex-NPV production;
3. Establishment of a Spex-NPV production plant, including staff recruitment and training;
4. Processing and production of Spex-NPV;
5. Training and demonstration for farmers on the use of Spex-NPV.

Project Partnership Configuration

The main project administrator was CABI, a not-for-profit international organization aiming to improve people's lives by providing information and applying scientific expertise to solve problems in agriculture and the environment. The execution of the CBAF component in Kenya and Tanzania was entrusted to the relevant pest control services within or affiliated with the respective ministries of agriculture. In Kenya the public agricultural extension services fall directly under the line ministry, while in Tanzania they depend largely on the district administration.

Within the intervention villages (Tanzania) and sub-locations (Kenya) the same basic division of roles for armyworm monitoring and forecasting was initiated:

Table 3.2 Community-based Armyworm Forecasting (CBAF) Actors and Their Roles

Person	Roles
Village forecaster	• Counting moth catches • Communicating moth counts to local extension officer
Local extension officer	• Trap servicing • Analysing trap data • Communicating armyworm alert to local and central administration
Village level administrator	• Communicating armyworm alert to local community through multiple channels
Pest control services of ministry of agriculture	• Assuring distribution of required tools for armyworm forecasting

Based on daily moth catches and rainfall data collected by the village-based forecaster, a weekly positive or negative forecast is made by the local extension officer. In the case of a positive forecast, the local administration has the responsibility of spreading the message through churches, mosques and schools. The main responsibility of the ministries of agriculture was organising district level training of the village forecasters, extension staff and administration, as well as supervision and servicing of the traps.

The Spex-NPV production and service unit development was the responsibility of Eco-Agri Consultancy Services Ltd. Technical support was available through the NRI.

Registration of the pheromone in Kenya involved the Pest Control Products Board, as well as pharmaceutical companies and the Desert Locust Control Organisation of Eastern Africa, the current supplier of the pheromone lures.

Project Intervention Scale

In Kenya, 120 government employees were trained on CBAF and the use of pheromone traps was introduced in 80 sub-locations. The sub-locations in the coastal and eastern provinces, comprising an estimated 80,000 people, were selected based on the history of outbreaks. In Tanzania, forecasting was introduced in an additional 40 communities in the central zone.

The Spex-NPV project component aimed to establish large scale production facilities in northern Tanzania, with the objective of responding to international demand, predominantly in Tanzania and Kenya, but ultimately in all eastern and southern African countries suffering from armyworm.

Inputs

Table 3.3 shows that the resources invested in the CBAF system were fairly modest, especially given that the investment was meant to assure the set-up of the system in 80 sub-locations in Kenya and 40 sub-locations in Tanzania, including other activities of creating a supply system, as well as advocating for the system at national level.

Spex-NPV received a more generous proportion of the RIU Best Bet grant, especially considering that the main activity was to build a laboratory facility and test Spex-NPV at a very modest scale.

Table 3.3 Inputs into the Armyworm Best Bet Programme (GB£)

Item	Investment Tanzania	Investment Kenya
CBAF	83,900	170,600
Spex-NPV	257,860	

3.4 Impact Pathways

Table 3.4 Impact Pathways Armyworm Best Bet

Input	Results and Impact			Spin-Off
Training of forecasters, farmers Funds for running CBAF Advocacy for CBAF system Laboratory facilities for Spex-NPV production	Trainers, forecasters and farmers trained Forecasters equipped Community-based forecasting system initiated Public-private collaboration model introduced Spex-NPV production capacity achieved	Availability of affordable and functional products Functioning and accurate forecasting system Effective and affordable local armyworm control capacity Reduction in the use of harmful pesticides	Higher income through reduced yield losses Improved food security through reduced yield losses Reduced costs of forecasting and control system Reduced exposure to toxic insecticides	Commercial capacity to develop community-based crop protection systems Registration procedure for bio-pesticides adapted Change in local and national government policy and programmes on community-based forecasting and control and bio-pesticides Spill-over to other countries

The expected pathway from input to impact is presented in Table 3.4. The most important ultimate goals were an improvement of food security and grain crop-based income in armyworm-prone communities in Kenya and Tanzania. At the same time, a reduction in exposure to toxic insecticides was desired. As explained earlier, there were two main components to the Army-

worm Best Bet, the development of CBAF and the production of Spex-NPV as an alternative control product to chemical pesticides.

The impact pathway reflects the rationale behind the project, showing the assumed logic of result-effect relationships that should lead to the desired end-result of the project. Project results are assessed on the basis of this impact pathway.

Are Crops under Attack by Armyworm Important for Income and Food Security?

The first basic assumption underlying the proposed impact pathway is that armyworm damage has a negative effect on household income and food security in the intervention zones. The CBAF was expected to improve household income and food security through reducing losses that result from armyworm in farmer crops.

The perceived losses have been measured in the assessment through a change in maize yield. Although the armyworm also attacks sorghum and rice, maize yield was chosen as the proxy for household level impact because maize is the crop most widely grown most widely across the intervention areas and because the damage from armyworm is more severe in maize than in sorghum.

Based on the individual interviews, between 41% (Dodoma) and 96% (Kenyan districts) of the population in the sample districts indicated maize as the main food security crop (Table 3.5). Except in the Dodoma district, maize was also a prominent cash crop (Table 3.6).

The figures indicate that armyworm epidemics do form a potential threat to both food security and income in the sampled districts. The areas where the RIU programme intervened and where armyworm is a problematic pest coincide with areas of food insecurity in both Kenya and Tanzania.

Table 3.5 Most Important Food Crop per District

District	1st most important food security crop (% responses)		2nd most important food security crop (% responses)	
Tanzania				
Dodoma	Maize Millet Sorghum	41 35 18	Maize Millet Groundnut	35 21 20
Kongwa	Maize	91	Maize Groundnut Sorghum	26 23 20
Morogoro	Maize Rice	75 25	Rice Maize	62 36
Kenya				
Machakos	Maize	96	Beans	91
Matungulu	Maize	96	Beans	90

Table 3.6 Most Important Cash Crop per District

District	1st most important cash crop (% responses)		2nd most important cash crop (% responses)	
Tanzania				
Dodoma	Groundnut Sesame	55 27	Groundnut Sesame Sunflower	37 29 13
Kongwa	Maize Sunflower Groundnut	49 37 12	Sunflower Groundnut	38 35
Morogoro	Sunflower Maize Rice	14 34 50	Maize Rice Sunflower	39 29 22
Kenya				
Machakos	Maize	74	Beans	70
Matungulu	Maize Coffee	58 21	Beans	64

The estimated maize yields of farmers in Kenya and Tanzania are presented in Table 3.7. The yields estimated by the producers are far below the national averages provided by the respective ministries of agriculture (Table 3.8), which indicates that the armyworm-prone areas selected for the intervention are indeed vulnerable areas with regard to food security. In addition, in both central Tanzania and in Ukambani in Kenya the years 2010 and 2011 have not been good years in terms of rainfall and therefore yields of maize have suffered greatly.

The figures have to be interpreted with caution, however. Especially in the Bahi and Kongwa districts in Tanzania, the rural population regularly receives food aid. As a result, according to the local extension staff, the farmers may be reluctant to disclose their actual yields out of fear of receiving lower rations. The low yield estimates in the sample district in Kenya can be further explained because intercropping maize with beans or cowpeas is very common, reducing the yield per hectare of maize. The survey specifically asked producers to estimate losses as a result of armyworm and drought. Additional reasons for yield losses mentioned by farmers were the use of poor seeds, other pests and diseases and, in Kenya, frostbite as a result of night frost.

Table 3.7 Average Estimated Maize Yields in Sampled Districts in 2010 and 2011

Year	# Responses	Estimated Yield (tonnes/ha)
2010	**1386**	0.70
Tanzania	352	0.68
Kenya	1034	0.71
2011	**1386**	0.74
Tanzania	352	0.72
Kenya	1034	0.74

Table 3.8 Average National Maize Yields in Kenya and Tanzania

Country	Yield	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Tanzania	(t/ha)	3.14	2.57	0.75	1.00	1.04	1.33	1.27	1.25	1.12	1.44	1.49
Kenya	(t/ha)	1.70	1.51	1.62	1.93	1.64	1.72	1.81	1.39	1.29	1.60	1.62

Source: faostat.fao.org; 01-07-2012.

Estimating Armyworm Damage

Farmers interviewed in the survey were asked to indicate the severity of armyworm for the past four seasons, and the corresponding loss of yield they estimated to have suffered as a result. The estimated damage, corresponding to different perceived severities of armyworm is presented as averages for Tanzania and Kenya in Table 3.9.

Table 3.9 Yield Contrasts between Different Armyworm Severities

Perceived armyworm severity	% of Total Responses	Yield estimate (t/ha)	Estimated yield loss[3] %
Tanzania	100	0.7	21
None	29	0.6	13
Little	19	0.7	18
Medium	22	0.8	21
Much	17	0.8	25
Very much	13	0.6	33
Kenya	100	0.7	25
None	45	0.8	3
Little	15	0.7	24
Medium	17	0.8	36
Much	12	0.6	42
Very much	11	0.7	49

The figures in Table 3.9 show that armyworm is perceived as a damaging pest, especially when a severe outbreak is experienced. In Tanzania and Kenya yield losses were estimated at 21% and 25%, respectively. In 13% of the cases in Tanzania and 11% of cases in Kenya, farmers indicated they had experienced a severe armyworm attack, and estimated this had cost them 33% and 49% of their yields, respectively.

This seems to indicate that armyworm outbreaks occur often and that, when they occur, they result in substantial damage, ranging from roughly 20% of the yield in a less severe attack, to 30-50% of yield in the case of a very severe attack. Surprisingly, however, these percentages do not correspond to the actual estimated yields. When comparing the actual estimated yields over the different severity categories, there is no visible trend of lower yields resulting from higher armyworm attack severity. Either the armyworm damage is perceived by producers as larger than the real damage, or the estimated losses are consistently exaggerated by the respondents. The latter is a realistic possibility. Producers were specifically asked to estimate how many bags

[3] Yield loss as % of Yield+ Yield loss.

of maize they thought they had lost as a result of armyworm damage. Estimating their actual realised yield is already hard, let alone estimating how much yield they would have had in the absence of armyworm. It is quite likely that in this estimate farmers also included other possible factors contributing to the gap between their actual realised and expected yield.

In 70% and 55% of the cases in Tanzania and Kenya, respectively, the sampled farmers indicated having had some armyworm occurrence. During the stakeholder workshops in Kenya, however, it became apparent that much confusion existed on the part of the farmers with regard to the distinction between different types of caterpillars attacking their crops. The assessment intended to focus specifically on armyworm incidences, disregarding attacks by other caterpillars, but this was not easy and only partially effective. An additional problem was that in the local language no distinction is made between armyworm and another similar caterpillar, most likely the African Bollworm.

In spite of the discrepancy between the perceived armyworm damage and the estimated actual yields, it is still likely that armyworm does contribute to the overall poor yield in the sampled areas, especially as the stakeholder workshops and individual interviews with resource persons indicated that the sampled seasons were not major armyworm seasons. Considering the vulnerability of food security in the intervention areas, a better control of armyworm could contribute to a reduction in food insecurity, and possibly contribute to better income of maize producers.

What has to be kept in mind, however, is the erratic and highly localised occurrence of the armyworm. Although Table 3.9 shows significant damage as a result of armyworm, care must be taken when extrapolating its importance beyond the specific communities in which the CBAF intervention has taken place. The CBAF intervention has specifically targeted those communities which are considered to be at high risk, based on historic data. Furthermore, the impact assessment team specifically sampled areas within the CBAF intervention area where there have been problems with armyworm since the CBAF was introduced.

Community-based Armyworm Forecasting: Output to Impact

The CBAF project aimed to better prepare farmers against armyworm attacks so that, when they occur, timely and effective control by individual producers would be possible, while as a last resort the public pest control services would be better able to respond:

Effective forecasting
→ **Armyworm alerts**
→ **Prepared producers and government**
→ **Effective control**

Effective Forecasting

The forecasting system is operating fairly well, currently without project support. Communication between the different actors involved in forecasting has improved over time. No complaints have been made with regard to the spread of false positive armyworm alarms. Earlier research established that in 80% of the cases a forecast was followed by an outbreak (20% false positives), and in 7% of the outbreaks no forecast had been made (false negatives).

The forecasters who were trained and equipped through the project were dedicated to their task. The dropout rate among forecasters appeared minimal. It is possible that the fact that forecasters are not remunerated could cause a problem in the future, although there was no evidence of this at the time of the survey. The forecasters frequently indicated a need for small equipment, such as umbrellas or bicycles, to facilitate their work. Local extension staff also indicated a need to invest their time to keep the forecasters motivated. To assure that forecasters stay motivated to execute their tasks, additional training or organising simple exchanges between them could help.

Forecasting Tool Supply

One specific objective of the project was assurance of the supply of simple inputs required to keep the CBAF system running. In Kenya the project has resulted in reliable and timely servicing of the pheromone traps, during as well as after the project. Forecasters, as well as ministry of agriculture staff, have indicated that there were no constraints in the supply of the minimal materials required. The Kenyan Pest Control Services disburses the required budget to assure that the minimum inputs required are purchased and distributed in a timely manner.

Maize

PHOTO: GENEVIÈVE AUDET-BELANGER

In Tanzania, however, the supply of pheromones to service the traps has been haphazard and unsatisfactory. The forecasters and extension staff in Dodoma district indicated that no pheromones had been distributed in 2012 until May, while stocks obtained through the project ran out. For the 2011 rainy season a number of forecasters received the pheromones in March rather than in January. Without pheromones the traps will not function. Some forecasters indicated resorting to continued use of the pheromone capsules from the previous year.

The pheromone capsules continue to be supplied through the Desert Locust Control Organisation for Eastern Africa in both Kenya and Tanzania. The project hoped to arouse the interest of private importers of agro-chemicals in making the armyworm pheromones part of their product portfolios. Agro-chemical companies – Juanco in Kenya and Bajuta in Tanzania – did partner with the project, but only in the area of assuring faster registration of semiochemicals with the Kenyan Pest Control Products board. In Kenya the project has collaborated effectively with the private sector, the pest control board and the pest control services of the ministry of agriculture to develop a specific light licencing system for pheromones. The pheromones used for monitoring alone are no longer subject to in-country testing, but only to a simple registration of importation. Pheromones used for direct control of insect pests can now be registered through a light registration process, whereas both had previously been subject to stringent testing before registration, similar to pesticides. In Tanzania, a similar registration process was not necessary, as pheromones are easily imported into the country.

The proposed solution of involving the private sector for a more effective supply and distribution of traps and pheromones to the villages where they are needed has not been realised. During implementation of the project it became clear that the small volume needed is unlikely to provide a lucrative business opportunity for an agro-chemical distributor. Even the importation of traps and pheromones at the order of the Kenyan or Tanzanian ministries of agriculture does not provide for a very significant quantity. The only reason agro-chemical companies would be interested in providing this service would be to build relations with the same ministries for supplying other chemicals as well.

Armyworm Alerts

A positive forecast of armyworm risk triggers an armyworm alert in the CBAF system. The armyworm alert is to be communicated to the community at risk through the local administration and through gatherings occurring within the community, such as Friday prayer in mosques, church services and village meetings, and through schools. The assessment has not focused on establishing the accuracy of forecasting as this was already done earlier. Since the initiation of the CBAF in Kenya and Tanzania, however, forecasters have been recording the moth catches and communicating these to the district offices of the ministries of agriculture in both countries. Their training has been effective and the supervision has been sufficient to assure continued monitoring of the imminent risk of an armyworm infestation.

An armyworm alert is only useful if it reaches the intended beneficiaries. The qualitative data collection (resource person interviews and stakeholder workshops) showed satisfaction among those directly involved in the system with regard to the spread of the message after an alert. The data from random farmer interviews, however, show a different picture. Only a few people in the project

intervention areas actually indicated hearing about armyworm through the church, mosque, school or village meeting. The majority indicated learning about armyworm outbreaks through neighbours (Table 3.10). The table shows only a modest difference between CBAF and non-CBAF villages with regard to information on imminent armyworm outbreaks, as the proportion of respondents indicating they didn't receive any information was 26% in non-CBAF villages and 15% in CBAF villages.

The forecaster was not once mentioned as the source of information, which is in line with the CBAF strategy in which the local administration and the extension officer take responsibility for communicating armyworm alerts. The fact that family members and neighbours are mentioned as the most important sources is not surprising. The system of spreading armyworm alerts through churches, schools and mosques will not reach everyone in a village; the word-of-mouth spread of the alert within the village will remain essential. In addition, in the survey it was difficult to make the distinction between an armyworm forecast and information about the actual occurrence of armyworm. This means that any improved timing of information about armyworm outbreaks is obscured, which makes it less likely to detect any difference between the CBAF and the non-CBAF villages.

Table 3.10 Source of Information about Armyworm Outbreaks in Kenya, 2010–2011

Information source	Non-CBAF village % respondents	CBAF village % of respondents
No information	33.2	15.4
Family member	23.1	24.7
Neighbour	16.6	20.1
Extension officer		4.9
Forecaster	1.0	1.2
Church/Mosque/School	8.5	9.0
Radio	4.1	2.0
Other	13.2	21.2

Improved Preparedness of Farmers and Public Pest Control Services

The impact pathway assumed that, as a result of forecasting of imminent armyworm outbreaks, both farmers and the public pest control services would be better prepared, should an actual outbreak follow. At the producer level, a major issue that emerged in the workshops and resource person interviews was timely availability of pesticides. The assumption made by the project was that, in the event of an armyworm alert, farmers would have more time to assemble the resources required to buy pesticides, and agro-dealers would have the opportunity to assure an ample supply. If this were the case, more farmers in the project village would have been able to spray against armyworm in the event of an outbreak.

Table 3.11 compares armyworm control behaviour in project villages with that in non-project villages. The table convincingly shows that the control behaviour by farmers in CBAF villages

is no different from in non-CBAF villages. The percentage of farmers not responding in case of armyworm attacks is the same in CBAF as in non-CBAF villages.

Table 3.11 Control Behaviour in Project and Non-project Villages in Tanzania & Kenya

Control Strategy	Non-CBAF village % of responses	CBAF village % of responses
None	35.4	36.5
Pesticide	39.6	46.4
Ashes	3.5	1.2
Neem	0.0	0.3
Other local method	0.3	0.3
Other	1.3	0.9
No response	16.1	11.3
	100.0	100.0

The ultimate objective of the CBAF programme was to reduce the losses that result from armyworm outbreaks. The quantitative data collected allow different ways of assessing whether such a reduction in losses has been realised. Table 3.12 presents the estimated losses of maize in CBAF villages compared with non-CBAF villages. In spite of the large sample size, no significant difference in estimated armyworm damage could be demonstrated between non-CBAF and CBAF villages. Also, when examining the contrast in estimated yields between non-CBAF and CBAF villages, no difference could be observed (Table 3.12).

Table 3.12 Average Estimated Maize Yields (T/ha) and Damage per Armyworm Attack Severity Category in Project and Non-project Villages

Armyworm attack severity	Estimated average maize yield		Estimated armyworm damage	
	Non-CBAF	CBAF village	Non-CBAF	CBAF village
Kenya	**T/ha**	**T/ha**	**T/ha**	**T/ha**
None	0.73	0.51	0.1	0.1
Little	0.72	0.74	0.2	0.1
Medium	0.69	0.78	0.2	0.3
Much	0.79	0.79	0.2	0.3
Very much	0.82	0.53	0.5	0.2
Tanzania			0.2	0.2
None	0.76	0.69	0.0	0.0
Little	0.83	0.71	0.2	0.2
Medium	0.71	0.71	0.4	0.5
Much	0.77	0.77	0.5	0.4
Very much	0.56	0.62	0.8	0.6

Several reasons could lie behind the lack of a yield difference between CBAF and non-CBAF villages. In the first place, the damage incurred as a result of armyworm that was reported by producers may not be as important as assumed in the project design. Secondly, Table 3.11 seems to suggest that the change in preparedness by producers in the CBAF villages was only modest. Thirdly, even when preparedness could have improved, this does not seem to have led to a change in control behaviour, which is essential for the realisation of household level impact.

Development of Spex-NPV as a Biological Control Method

The Spex-NPV component of the Best Bet project was not mature at the time of the study. The laboratory facility to process the virus formulation to be used as a biological pesticide was reported to be ready; however, it had not been put to use. Since the facility had become operational, there had not been the major outbreak of armyworm necessary to put the bio-pesticide production in motion. A large outbreak is needed in order to infect many caterpillars with NPV, and the caterpillars succumbing to the virus need to be collected as a source of NPV for the production of large quantities of the Spex-NPV product.

Given that this component of the project was not mature, the study was focused on the CBAF component. Therefore, only limited information is presented here on the Spex-NPV component. Its potential is discussed later in the chapter, based on interpretation of information from stakeholder interviews and literature. As no pilot at scale has been implemented with the product, no further data could be collected.

3.5 Sustainable Systemic Changes and Spin-offs

Semiochemical Registration Procedure in Kenya

The impact pathway shows a number of expected spill-over effects. A first spill-over effect was an adapted registration procedure for bio-pesticides. This has proven to be necessary in Kenya. Importation of the pheromone was illegal, strictly speaking, as it had not been approved by the pest control board. For the course of the project the importation was done under the pretext of research but formalising the status of the pheromone was considered desirable. Rather than registering the pheromone as a pesticide, the decision was made to advocate for an adapted procedure for the registration of semiochemicals such as pheromones. As a result of the project these are now recognised as a specific group of products, with two possible registration procedures. For pheromones used for monitoring alone, it is enough to declare importation with the pest control board. For pheromones used for direct control purposes, a light registration procedure based on existing research data has been developed. These adapted procedures are now approved by the pest control board and are currently in the process of being gazetted. These improved procedures were necessary to legalise the importation of the armyworm pheromone; however, the effects of adapting these registration procedures are much wider. They facilitate importation by agro-chemical companies of other semiochemicals used commercially in horticulture and floriculture, which are important sub-sectors in Kenya.

Commercial Capacity to Develop Community-based Crop Protection Systems

Another hoped-for spin-off from the project was the commercial capacity to develop community-based crop protection systems. The combined use of armyworm forecasting and Spex-NPV as a control measure was intended to provide an example of a crop protection system, in which the main driver for sustainable functioning of the system would be profit for a commercial company.

This desired spin-off has not materialised, primarily because the Spex-NPV production has not matured. Furthermore, it is doubtful whether production and distribution of Spex-NPV as a bio-pesticide will be commercially viable as a stand-alone activity. A possible route for commercialisation would be the contracting out by the Kenyan or Tanzanian government of the full armyworm control programme, including all the necessary services for running the community-based monitoring system, strategic control and support to producers to protect their crops. These services are now delivered, with mixed success, by the public extension system of the two countries.

It can be concluded that the expected spin-off of a commercial company delivering innovative pest control services has not been realised. Considering the short length of the project – effectively 18 months – this is also not surprising, and probably the project was over-ambitious.

Use of Farmers as Service Providers

Possibly the most important spin-off of the project is the improved collaboration between farming communities and the public pest control services in both Kenya and Tanzania. As a result of CBAF the public extension service has piloted close collaboration, with farmers serving as resource persons. Although the services asked from the forecasters are narrowly defined, this is a major shift in approach from having extension staff as the sole providers of agricultural advisory services.

The experience with the farmer forecasters opens the way for additional innovative ways to include farmers in the agricultural advisory system. As clearly indicated during the stakeholder interaction workshops, a major complaint of all stakeholders, including the public extension officers themselves, is that they are too few in number to provide the services that are expected of them. The use of community-based local resource persons may assist the public extension services to better fulfill their mandates.

The local administration, especially in Tanzania, has a strong presence. As a result of the project the local administration has become more involved in armyworm control, and may also be more susceptible to advocacy for further important resource investment in armyworm control and crop protection in general. This may have a positive effect on the public sector support through the district level government structures to producers to avoid crop losses as a result of pests and diseases. A closer involvement and modest budgetary allocation from the district administration is required, as the national level lacks the resources and human capacity.

Improved Focus of Government Services on Armyworm Control

An important result of the project has been national and international attention for the problem of armyworm in Kenya and Tanzania, through the general communication efforts of the RIU programme. Especially in Kenya, current services provided by the ministry of agriculture, through its pest control services, have been improved. The community-based armyworm control project has resulted in a stronger focus on armyworm control. Currently the services in Kenya are at a point that the Machakos and Matungulu district levels do get timely, adequate support from the national office, which is at least partly attributable to the CBAF project.

3.6 Lessons That Can Be Derived

Importance of Armyworm: Was the Intervention Justified?

Although armyworm is potentially devastating for individual farmers, it is hard to establish the exact level of economic damage it causes. The pest only occurs irregularly, and when it occurs it is only in specific areas, and even within these areas the problem is often very localised. The actual total economic damage as a result of this pest may not be as catastrophic as argued by armyworm specialists.

When asked, farmers do acknowledge armyworm as a problem in their maize farming but, considering their monitoring and control behaviour, it is not clear that improved armyworm control features high on their priority list. Because of its sporadic and patch-wise occurrence, and the variability in damage depending on the stage of the crop when the pest occurs, it is understandable that armyworm control as a stand-alone problem is not the major preoccupation of maize farmers.

For this reason, the approach of specifically focusing a project on armyworm control alone is questionable. From the point of view of the farmer it would have made more sense to focus more generally on improved pest control services, with armyworm monitoring featured as a component. This would have better answered the needs of producers, and increased the chances of delivering a longer-term impact on household food security and income. Another option would have been to focus on specifically improving maize production, post-harvest management and marketing, thus aiming for improved food security and higher income in a more integrated manner.

CBAF was developed because the existing forecasting practice at national level did not provide a useful service to producers. The project was designed on the premise that armyworm forecasting was the solution to an existing priority problem. The assumption was that, once an imminent armyworm attack could be predicted longer ahead, producers would have ample time to prepare, and be better able to reduce losses.

The quantitative data, however, show that forecasting alone does not improve the preparedness by farmers to an armyworm attack. Especially in Tanzania, producers do not have the inclination to act upon an armyworm attack, and this can hardly be expected to change as a result of forecasting. To change the response of producers to an attack, awareness of and access to control options would be required.

The Spex-NPV component of the project was meant to address this requirement. However, it is debatable whether Spex-NPV would even be the control strategy of choice by farmers. Spex-NPV lacks the immediate knock-down effect that a farmer likes to see when he invests in a pesticide. It also takes a number of days for the product to take full effect, making it most useful during the early stages of armyworm life-cycle, which is a stage not recognised by farmers. Effectively convincing farmers to use such a control strategy would involve training producers in the armyworm life-cycle and demonstrating the effectiveness of the bio-control option. Therefore, it appears that, in the short run, Spex-NPV will not deliver on the promise of cheap and safe armyworm control. The project would have been better designed if capacity building of forecasters, extension staff and farmers on control options had also been included.

PHOTO: GENEVIÈVE AUDET-BELANGER

Harvested maize

The Spex-NPV component of the project seems to have resulted from the search for a useful application of the technology on which much research had been done. This component can be interpreted as seeking a use for a known technical option, rather than looking for the best possible solution of an identified problem. It is an example of research supply push, rather than client-oriented service provision.

Public Investment in Private or Public Service Provision?

The sustainability and effectiveness of public services are subjects of much debate, with good reason. The Tanzanian public crop protection service clearly falls short of providing effective services in relation to armyworm control. The inability to deliver pheromones to the right place at the right time, which disables the core of the CBAF system, is a clear indicator of the ineffec-

tive services. An important reason for the poor functioning of the public pest control services related to armyworm is the incentive system within the ministry of agriculture. Rather than focusing on performance and effective service delivery, the main incentives are related to participation in field work and training. This results in high overhead costs for distribution of the limited, although inexpensive, inputs required for the CBAF system.

This could be used as an argument for the need to find a more effective alternative. An alternative could be the contracting out of the armyworm control services to a private enterprise. Such an enterprise could provide all the armyworm control-related services such as trap servicing, training forecasters, providing control advice to producers and organizing. Paid with public resources, this approach could become more effective than the public services.

Achieving such an outsourcing of services by the government is not very realistic, however. Although it is probable that a private company would perform better, using the same amount of resources, there is a disincentive at the level of the ministry of agriculture to consider such an option and it is unlikely that it would take such a step without an external funder providing the resources required, along with strict and specific guidelines for outsourcing the armyworm monitoring and control services. This would make the system vulnerable and non-sustainable, because when such external funding was withdrawn, the ministry would be likely to revert to managing the resources itself.

Compared with Tanzania, the CBAF system appears to function better under the ministry of agriculture in Kenya. There the project can be considered successful, as the ministry of agriculture has taken full responsibility for the CBAF activities post-project. The district level staff commended the national level for their support and responsiveness, which is a very different situation from the relationship in Tanzania between the local and national levels. This may be related to the resources the ministry makes available for the CBAF system. In Kenya, the national coordinator indicated that the resources are ample to assure the required services. Furthermore, the district offices of the ministry of agriculture fall directly under the line ministry, assuring a direct relationship of hierarchy and responsibilities between the district and national level. In Tanzania, however, the national level line ministry has some responsibilities, with a limited budget, but the main executive budget is decentralised to zonal and district levels, where it is the responsibility of the local governments. In this arrangement the ministry of agriculture has limited influence on the distribution of the budget earmarked for agriculture. That responsibility belongs to the district level administrations, where preventative pest control services compete with investments in food for relief and other agriculture-related expenses. In addition, the physical distance between the pest control service headquarters in Nairobi and the project area in Kenya is shorter than the distance between Dar es Salaam and the project area in central Tanzania.

National coordination and expertise in Tanzania used to be centralised in the armyworm unit in Tengeru, near Arusha. The national mandate for forecasting was there, as well as for supporting control efforts and coordinating research. With decentralisation of the budget to local governments, and a reduction in the national level budget in Dar es Salaam, the armyworm unit in Arusha no longer has a national mandate, but only a zonal mandate, and does not have the resources necessary to maintain its expertise and provide relevant services.

The fact that the system is functioning fairly well in Kenya provides some counterweight against the argument that it is best to outsource such pest control services. In addition, the routine volume of work related to armyworm monitoring and control is not very high. In the case of an outbreak, however, suddenly much local manpower is required. In such a case, the ministry of agriculture mobilises all its local staff members to contribute to reducing the damage caused by an outbreak. It is difficult to see how such a service could be contracted out to a private company that would have to maintain a constant intervention capacity, even though there is a high fluctuation in the volume of work.

As outsourcing to a private service provider has not been tested, however, it is difficult to go beyond speculation and provide a definite answer. As the services in Tanzania are currently below par, a follow-up project to pilot outsourcing could be considered.

Strategic Control of Armyworm Outbreaks

Spex-NPV would be of importance for what is called strategic control, the spraying of large areas infected with armyworm, thus preventing their next migration, to avoid later damage elsewhere. Strategic control is often mentioned in research papers as a method to assure that larger epidemics do not occur. It is based on the knowledge that epidemics usually can be traced back to a limited primary outbreak (Njuki *et al.* 2004). The rationale is that if such primary outbreaks can be controlled, no further serious outbreaks will take place. This sounds logical in theory, but the current practice is still one of controlling crop damage, rather than strategic control to avoid sizeable outbreaks.

The main difficulty is that the most important feeding grounds for armyworm are not crops, but grasslands. It is unlikely for an outbreak in crops to go unnoticed but in grasslands large outbreaks can easily go unnoticed, or be noticed but not reported. The grasslands in national parks and pastoralist areas are vast in Kenya, and even more so in Tanzania, where the primary outbreak areas are usually found. The feasibility of keeping such vast areas monitored and then responding effectively to the occurrence of armyworm outbreaks is currently low. Possibly in Kenya, which has increasing pressure on land for both crops and livestock, it may become more feasible to respond effectively to armyworm infestations in grasslands. For Tanzania, this strategy still seems highly impractical, especially in light of the current inability to effectively supply the CBAF with the limited resources that it requires. However, such a strategy is necessary, in addition to crop protection measures, because the armyworm multiplies predominantly in pastures.

Forecasting Alone is Not Enough

This project was largely focused on community-based forecasting. Any needs related to improved control were supposed to be covered through the Spex-NPV component. However, as the Spex-NPV technology was far from mature, control of armyworm, which was an essential component in the impact pathway, was ultimately not well covered.

The training of forecasters and extension staff and the implementation of CBAF all focused predominantly on the forecasting system and on effective communication of an armyworm alert. Actual effective control of armyworm once it manifests itself received less attention. At best, control strategies have been covered in the training of the forecasters, extension staff and

local administrators. However, the actual target audience for improved control should be the individual farmer, who has the responsibility to protect his own crop.

The training efforts have focused especially on the middle level, through the training of trainers and the training of forecasters and local administrators. The training of fairly large numbers of trainers in particular may not have been that useful as the training has not been replicated at local levels. The same resources could probably have been better utilised to provide simple training at farmer level to allow producers to early armyworm recognition.

The rationale behind forecasting, as well as the actual existence of a forecaster, was not commonly known among the farmers. The existence of a forecaster was communicated through a village *baraza* (public meeting) in Tanzania and a chief's *baraza* in Kenya. In the stakeholder workshops producers complained that they did not know about the forecasting system, while the extension staff, forecasters and local administration complained of limited attendance at meetings. Clearly, the communication of armyworm-related information through a *baraza* alone is not sufficient. Furthermore, such a meeting is not focused on training, but only on conveying a simple message. To improve the control capacity by producers more is required.

Forecasting alone does not reduce crop losses. Considering the response of producers to armyworm outbreaks, there seem to be more significant requirements than forecasting of outbreaks. Farmers do not have access to effective control measures. The concern for farmers is not whether an armyworm attack is imminent or not. Their main concern is that they do not have the capacity to respond to an attack. This lack of response capacity has a number of elements. In the first place, there is the lack of available cash to buy the required pesticides. Secondly, there is an assumed problem of dependency. The farmers are reluctant to use their own limited cash to buy a product to protect their crop, when they see it as the responsibility of the government services to intervene, which would not cost them anything. The offices of agriculture in Kenya, and especially in Tanzania, keep this expectation alive by providing pesticides to farmers, but given that their budgets are limited, the amounts are always insufficient. Thirdly, the agro-dealers do not have the required products in the low volume packages that farmers need for the small areas in which they have armyworm attacks. Finally, especially in Kenya, producers complain of adulterated chemicals, or of being sold the wrong product by agro-dealers.

To effectively improve the control of armyworm, interventions are required to resolve the problems which constrain the capacity by producers to respond to armyworm attacks. Solutions for these problems can be sought simultaneously through better collaboration between agro-dealers, forecasters and agricultural extension, applied research to optimise the formulation of home-made products to combat armyworm and a better awareness by farmers of the early stages of the pest so they can intervene earlier.

Value of Proximity of Pest Control Services

The presence of a forecasting station and a forecaster is much appreciated by those who know about it. The extension officers appreciate the continuity in data collection. Information is much more accurate and consistent than information from the earlier system, which was collected through a limited number of moth traps in hotspots throughout the country. An additional

problem of the old system was the fact that locally-generated information did not reach the communities directly around the traps, because the information was communicated only to the national level forecasting, where it would be interpreted and made into fairly generic alerts. These alerts would have to be fed back to the intended beneficiaries, the local extension staff and producers. This process did not function effectively. Local data collection and interpretation assure that more exact predictions can be made and that the right people receive the armyworm alerts.

In a number of workshops the desire to have more traps was expressed. Through discussion it became evident that this desire was related to having additional forecasters as resource persons and liaisons with agricultural extension in the vicinity, rather than to having more actual traps. From a technical point of view, it is unclear whether an increase in the number of traps would improve the accuracy of forecasting. Agricultural extension staff could run into difficulties if they had to supervise more forecasters than are currently operating.

In the current system the forecaster has a very limited mandate: counting the moths in the trap every morning during the armyworm season, filling in the weekly form and interpreting from the form whether the number of moths should trigger an alert. In case of an armyworm attack alert the local administration and the extension officer are informed and they are responsible for spreading the message. Forecasters are powerless if producers come to them for help in relation to armyworm, or other types of attacks on their crops.

Forecasters would benefit from a slightly wider mandate. In the first place, they could be more involved in the spread of an armyworm alert, rather than giving this responsibility exclusively to the local administration and the extension staff. Furthermore, the forecaster could become the main resource person to assist farmers to act for armyworm control. Finally, as suggested earlier, it would make more sense for the forecaster to be the main resource person for a wider range of important pests and diseases, and the main liaison with the agricultural extension staff.

Short Project Duration

A major difficulty of the project has been the very short time span in which activities were to be executed. The Spex-NPV component, in particular, was impossible to achieve in this short time frame. It was also not possible to accurately monitor the effect of community-based forecasting, and the response to the situation evolving as a result of this forecasting. Comments made in relation to the design and to the pitfalls identified through the assessment need to be seen in the light of an unreasonably short intervention.

In Kenya this has not prevented the successful adoption of the CBAF method into the operations of the Ministry of Agriculture. In Tanzania this adoption has not been achieved and it is possible that a somewhat longer project could have helped to assure that the limited resources required for CBAF functioning were routinely budgeted for at decentralised level.

Another major constraint on evaluation is that during the short duration of the project no major outbreaks of armyworm have taken place in Kenya or in Tanzania. For the system to really prove itself, it needs to be challenged by a high pest pressure.

Quantification of Results Challenging

It was difficult to quantify the results of the intervention. The project aimed at reducing crop damage but measurement of damage that was avoided as a result of the intervention is difficult. Furthermore, the damage caused by armyworm can be confused with drought damage. Producers tend to replant their crop after an armyworm attack. According to the extension staff involved, this replanted crop will suffer from drought at the end of the growing season, and perform poorly. In addition, producers confuse the damage as a result of armyworm with damage by other caterpillars that attack maize. Yields are also highly variable as a result of the unreliable rainfall and the occurrence of other pests, as well as the poor quality of seeds and, in the case of Machakos district, the possibility of frostbite. In a system with such a high variation in yields, resulting from a multitude of factors, it is extremely difficult to convincingly show a difference in yield as the result of better management of a single element. This is true especially when this element – armyworm – occurs in a geographically patchy manner and only results in massive damage every few years.

PHOTO: RIU

African Armyworm

The Role of Local Administration

The project has been particularly attentive to the role of local administration in the implementation of the CBAF system. This has led to a strong buy-in by these local administrators at district level, and specifically at village or sub-location levels. However, whether local administrators had to be trained in exactly the same manner as the extension staff and forecasters, or whether a shorter briefing would have been enough, thus reducing costs of the capacity building programme, remains an open question.

In some instances the joint training resulted in confusion about mandates. Because they were trained together with the forecasters, some local administrators believed that they also had a forecasting role; however, their role is to assure effective communication of forecasts. For this, the local administrators are key players, especially in Tanzania where the involvement of

the Village Executive Officers (VEO) has resulted in co-opting the whole local administration system, which provides a good network for dissemination of information. Still, it has to be kept in mind that the local administration is only one of several communication channels. It would be advisable to provide the forecaster with the mandate to trigger the spread of the message through additional channels, such as farmer groups, women's groups and announcements at local markets.

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PHOTO: FRED ZAAL

Farmer in his field with maize and sweet potato varieties

4 Best-Bet **Farm Input Promotions-Africa** (FIPS-Africa)

Authors: Fred Zaal, Femke van der Lee and Ben Mwongela

4.1 Background

Kenya's economy is built on its agricultural sector. Over 70% of its 40 million people derive their livelihoods from farming and farming-related activities. Kenya does have a relatively well-developed export-oriented agricultural sector, with high productivity in sub-sectors such as tea, coffee and horticulture. At the same time, however, the agricultural system is largely smallholder- based. Over 75% of national agricultural output is produced by small farmers (IFAD, 2011). Smallholder farmers focus on the dual objectives of satisfying their own subsistence needs, while selling surplus production for income. Their farmed areas typically range between 0.2 and 3 ha (Republic of Kenya 2010). As land is increasingly growing scarce and soil depletion is becoming more common, farmers are faced with stagnating productivity and production (IFAD 2011). Farmers lack the necessary resources to invest in inputs needed for intensification, which hampers further productivity increase. Income derived from selling of surpluses after satisfying the household subsistence needs is often rather small, resulting in acute cash shortages for smallholder farmers, and as a result there is a limited cash re-investment in the farm enterprise, as no resources are left after satisfying basic needs such as health care and education. As a

consequence, farming in rural Kenya remains largely extensive, and Kenya has a poverty rate of up to 49%, while one third of the population is undernourished (FAO 2011).

Access to agricultural advisory services for smallholder producers is poor (Muyanga & Jayne 2006). In spite of the recently re-emerging donor attention to the improvement of agricultural advisory services, the extension system in Kenya remains largely inadequate. The current public extension system has insufficient capacity and resources to provide all small-scale farmers with adequate agricultural advice[1]. Public extension officers are supposed to cover vast areas but they are inadequately trained, equipped and supported, and poorly remunerated, which keeps them from doing their work properly. Furthermore, a top-down approach is still common practice in the Kenyan extension system. Technologies are transferred to farmers in a conservative manner, rather than developed in collaboration with farmers (Muyanga & Jayne 2006; Kibett et al. 2005).

This chapter discusses the RIU-supported Best Bet initiative, Farm Input Promotions-Africa (FIPS-Africa), which has developed an alternative agricultural extension system, based on Village Based Advisors (VBAs), who both provide advisory services and sell agricultural inputs on a commercial basis. FIPS-Africa was registered in January 2003 as a non-profit company. It aims to assist farmers in the introduction of appropriate technologies for intensification of smallholder farming to improve productivity, increase incomes, and assure food security.

RIU started supporting FIPS-Africa in 2010. In addition to supporting an increase in the number of intervention districts, the concept of the VBA was developed. This study will examine this organisational innovation and its impact on smallholder farming practices, production and income. Since 2010, DFID has not been the only funder of FIPS Africa, as other donors have supported or continued to support FIPS-Africa. However, each donor contribution is linked to the intervention of FIPS-Africa in particular districts, while the attribution of RIU-funded activities is linked to the VBA concept in general, and to the activities of FIPS-Africa in certain districts in particular.

This study focused on Siaya, Vihiga and Kakamega districts in Kenya's Western Province. Western Province is the most highly populated province of Kenya, after the urban province of Nairobi, with an average of 518 people per square kilometre (Kenya Population Census 2009), As a result land pressure is high. Still, farming in the districts is characterised by low productivity and little cash income, in addition to problematic marketing as the area is relatively remote, and poorly connected to the major urban centres of the country, including Nairobi and Mombasa, the major urban markets.

4.2 Description of the Intervention

Introduction

FIPS-Africa has been working in the agricultural sector in Kenya since 2003. It has focused on the parallel provision of agricultural advice and inputs, and has tried to do this in a commercially

[1] With a total of 1464 field workers, one individual government extension field officer has to cover about 18,000 farmers (www.worldwide-extension.org, accessed June 13, 2012). This means that in practice a limited number of farmers receive advisory services – and smallholder farmers, especially, receive limited attention from the government extension officers (Muyanga & Jayne, 2006).

viable, and at the same time inclusive, manner, aiming to provide access to both less- and better-endowed farmers. Over time FIPS-Africa has gradually expanded its range of technologies being tested and promoted, the number of partner organisations that supply inputs, the total number of districts and overall area served, and the number of funding agencies contributing to the effort. In addition, FIPS changed its focus from the promotion of access to inputs to a more inclusive approach, aiming at improving access to inputs as well as access to advisory services, through the introduction of the VBA system. The project started working in in Kirinyaga and Embu Districts. Currently it is operating in 20 districts in Kenya and in several districts in Tanzania and is exploring the possibility of starting similar activities in Nigeria.

PHOTO: FEMKE VAN DER LEE

VBA providing extension service

The objectives presented in the business plan submitted to RIU in the FIPS-Africa application for funding still guide the work of FIPS-Africa:

1. Further develop and implement an innovative methodology to put research into use to improve the food security of smallholder farmer families.
2. Establish, in co-operation with private sector companies, networks of village-based agricultural advisors to deliver, on a sustainable basis, new fertilizer blends and crop varieties, and information on improved crop and livestock management practices to smallholder farmers.

The principal intervention strategy of FIPS-Africa is to broaden farmers' knowledge, as well as their access to and proper use of higher-yielding farming methods and inputs. The underlying assumption is that many smallholder farmers are food-insecure because they are unable to obtain appropriate inputs (fertilizers, improved seed varieties, livestock production inputs) and also lack information on the correct use of these inputs (through tillage, plant spacing, water and nutrition management).

The strategy adopted could be described as a private agricultural extension system. As service providers, the VBAs receive a fee for their services or a margin on the sale of inputs delivered to farmers. FIPS-Africa headquarters facilitates the work of the VBAs through identifying promising technologies, connecting with the input supply industry and, where needed, re-packaging agricultural inputs in small quantities appropriate for smallholder producers and supplying these inputs to the VBAs who sell them to farmers. In addition, VBAs are trained through FIPS on new technologies and the proper use of inputs.

VBAs are farmers with a willingness to serve as providers of inputs and knowledge. Their advisory services cover a wide range of technologies (see below), and are delivered using a diversity of methods, including visits to individual farmers, field days and demonstration plots on the VBA's own field or in the village. The ultimate aim is to have farmers seek the services and inputs from the VBAs for a fee, so that the VBAs obtain an income, thus allowing them to continue to provide their services in an economically sustainable fashion.

Besides providing access to inputs and advisory services, another explicit role of the VBAs is to guide and facilitate local experimentation. The VBAs are encouraged and supported by FIPS-Africa to experiment to adapt technologies to local circumstances, both through their own experimentation and by supporting farmers in doing small-scale trials themselves, to promote local adaptation and adoption of improved technology.

The VBAs thus serve as intermediaries between smallholder farms and the agricultural input industry and agricultural research, with the FIPS-Africa office playing a strong coordinating role.

Broad Range of Technologies

FIPS-Africa focuses on improved varieties of maize, beans, cowpeas, pigeon peas, vegetables, sweet potatoes and cassava, and on appropriate fertilizers for some of these crops (primarily maize). The improved varieties have traits such as drought tolerance, disease resistance, higher productivity and market demand. They are being sourced by FIPS-Africa through input providers and research stations.

Beyond the introduction of improved varieties and assuring the local availability of its seeds in small packages, FIPS-Africa furthermore demonstrates innovative farming practices through the VBAs such as: soil fertility management; improved tillage; tied ridging and other water management techniques; seed/seedling placement; fertilizer and manure/compost application; and disease and pest control, both during crop growth and post-harvest.

FIPS-Africa has also initiated advisory services on livestock production. The VBAs have introduced improved chicken breeds and cockerel servicing, the use of vaccines, drugs and management practices to control poultry diseases. In addition, the use of improved chicken feed, which improves egg and meat productivity, was demonstrated and promoted. VBAs also advised farmers on rabbit and pig rearing. Furthermore improved breeds of cattle have been introduced. Spraying against ticks is a service now provided by VBAs which provides them with income while serving their clientele.

FIPS-Africa has put much effort into assuring the availability of inputs in easily affordable small packages to facilitate access for smallholder producers. This is assumed to reduce the threshold for producers to experiment with new input-based technology.

Some input suppliers have themselves started to package in small quantities for the smallholder retail market. Athi River Mining (ARM) has developed small packages of compound fertilizer with FIPS-Africa, while Leldet has developed small packets of high quality seeds that can be bought for 10 and 20 Kenyan shilling (Ksh.), which is what the poorest farmers have available to buy inputs.

4.3 Evaluation Method

This study of FIPS-Africa was executed between April 22 and May 13, 2012. From all the RIU intervention areas, Siaya, Vihiga and Kakamega districts in Western province were purposely selected for a number of reasons. In the first place, the FIPS intervention there was deemed mature enough to have reached results. Secondly, the intervention was RIU-supported and thirdly, the area is representative of Kenya as it does not have very high potential in terms of commercial agricultural production.

Mixed methods (household interviews, stakeholder workshops, resource person interviews and documentation review) were used to verify the assumed impact pathway constructed at the start of the study in collaboration with FIPS. The following data collection activities were implemented:

- Individual interviews were conducted with FIPS-Africa headquarters staff.
- A kick-off workshop was held with FIPS staff, during which the prepared impact pathway was verified and further developed, and the timeline of the organisation, activities and policies was discussed.
- District and regional coordinators were interviewed regarding the practice of organising VBA networks, implementing the programme, and their insights into the role FIPS-Africa is playing as private extension service provider in an area where the public extension service is inadequate.
- At the VBA level, individual interviews were held and one-day workshops were organised that were attended by groups of VBAs from the various districts to participate in discussions of their work, offer their insights into the benefits and drawbacks of the approach, and report on their development as entrepreneurs, including their earnings.
- At the farmer level, there were discussions with individuals and small groups in the field.
- In addition, a survey was implemented among randomly selected farmers in a number of villages in the three selected districts. Two villages with RIU-funded activities had been

selected in Siaya District (Tula and Kakan villages), one in Kakamega (Ivole village) and one in Vihiga (Chango village). Three villages had been active with FIPS-Africa for about two years; this was their fourth agricultural season. One village (Ivole village), hereafter called the 'old FIPS village', had been active for four years, and was selected to provide a view of possible scenarios for the future of FIPS-Africa in these and similar areas. One village, Oyombe, in Siaya district, was selected as a non-FIPS control village. Farmers were interviewed about their current and pre-FIPS farming practices, access to services and production levels.

- Also at the farmer level, structured focus group discussions were organised to assess trends in the area, and the perception of the farmers about the history of interventions in agriculture, and the role of FIPS within this history. A validation at the end of the period of study was used to check on results and to fill in data knowledge gaps still remaining.

4.4 Impact Pathways

Introduction

The impact pathway presented below was initially based on document review. Subsequently, it was verified and adapted on the basis of discussions with staff of FIPS-Africa, and used to derive change markers (criteria) that help to quantitatively assess outcomes and impact, facilitating further qualitative data gathering on how the innovation accelerated agricultural productivity growth for poverty reduction.

Table 4.1 Impact Pathway FIPS-Africa

Input	Results and Impact			Spin-Off
Financing from donors to FIPS-Africa head office Fertilizer and seeds from companies and research institutes Training for VBAs on technologies and practices, and on business development Set of tools and materials to start work as VBA, depending on local conditions Travel allowance and other cost (re)covering allowances and contributions	Better equipped head office of FIPS-Africa with specialists and adequate systems and methods Network of VBAs in selected districts with a FIPS district coordinator linking VBAs to farmers Trained VBAs able and willing to experiment and offer new technologies and services Establishment of test/demo plots on VBAs' fields and multiplication plots at various places in the village Effective supply system of farm inputs and knowledge from companies and research institutes to VBAs through FIPS	More effective head office of FIPS-Africa that can expand and increasingly influence its environment Farmers having access to services (according to demands/needs) Effective VBA entrepreneurs who provide services and inputs Farmers applying/using (testing and adapting) new technologies and practices	Improved productivity and production at farmer level Reduced risk through improved varieties and diversification Increase in income for VBAs Improved food security for farmers Increased income and economic gains for farmers	Increased uptake of the approach in other companies, governments, countries

Inputs

RIU funding has been used to:

1. Employ staff at headquarters to strengthen the process of technology identification, and to scale up the processes of introducing these technologies to farmers, monitoring and evaluating progress, and developing business skills and business plans for further development of self-sustaining networks of VBAs.
2. Employ regional and district coordinators to identify farmers in the various villages who can take up the role of VBA, and assist them in establishing the supply chain of inputs from input providers, via FIPS-Africa headquarters, through regional and district coordinators to these VBAs.
3. Identify and train VBAs and organise them into peer-support networks. Through a set of regional and district coordinators (VBAs from an earlier phase who have shown exceptional ability to organise), networks of VBAs have been established. Each of these regularly visited between 15 and 50 farmers initially, later expanding to larger numbers of farmers. A group of about 120 VBAs has been organised with support of the RIU funding arrangement. The VBAs are trained by the district coordinators on the application of new technologies and in entrepreneurial skills. New VBAs continue to be taken on and trained. The more experienced VBAs provide services commercially and sustainably, so they are no longer depending on FIPS to continue their work. They become established entrepreneurs, providing commercial agricultural and veterinary input, and also advisory services providers, at the level of the villages and farms. At first VBAs were provided with starter sets of inputs free of charge, and a basic allowance was paid as an incentive. This system was later abandoned, as it was realised that this provided the wrong incentives, and resulted early on in too much dependency of the VBAs on FIPS-Africa. Instead, travel allowances are now funded through RIU, as are some other basic costs to the VBAs.
4. Identify new promising technologies and practices and facilitate local testing and adaptation by VBAs and farmers. On their own farms, VBAs established demonstration fields with small (5x5 metre) plots of improved varieties. In addition, alternative crop husbandry and soil fertility management practices were tested both on VBA farms and by farmers in 'farmer learning plots'. Furthermore, cassava and sweet potato multiplication plots were established in the village as part of the supply system of improved varieties.
5. Source inputs on credit at partnering agricultural input companies, to be retailed by the VBAs for a margin.
6. Collect information on the results of these activities so as to learn whether the VBA approach is indeed a self-sustaining alternative for the public agricultural extension system.

The final desired impact on food security and income of smallholder producers is expected to result from crop intensification and the resulting higher yields. Farmers are encouraged to try new crops and improved varieties, suggested and supplied by the VBAs. Furthermore, producers are exposed to training on improved crop husbandry, disease management and soil management practices.

In order to seek evidence to validate the elements in the impact pathway, change markers were identified as indicators of success. Annex 2 shows this set of indicators.

The remainder of this chapter will discuss three broad questions, following the impact pathway:

- Is there evidence to conclude that, at the smallholder level, productivity, income and food security have improved?
- Is there evidence of a new durable provision of input supply and advisory services based on the FIPS-Africa and VBA system?
- Is there evidence of a more effective process of agricultural innovation?

4.5 Results

Cropping Pattern

Crop choice, and especially the choice of improved varieties, differs among FIPS villages, the non-FIPS village and the old-FIPS village. The following table (Table 4.2) shows the details.

Table 4.2 Percentage of Farmers in Each Category of Villages Growing a Crop Variety

N=83	local maize	local millet	local sorghum	local sweet potato	local cassava	local beans	local soybeans	local cowpeas	local groundnuts	local vegetables	local fruits
Non-FIPS village	97	71	26	94	87	90	16	61	42	52	29
FIPS villages	70	60	29	62	65	65	22	49	51	16	30
Old-FIPS village	57	0	0	43	50	43	0	36	0	21	36

N=83	improved maize	improved millet	improved sorghum	improved sweet potato	improved cassava	improved beans	improved soybeans	improved cowpeas	improved groundnuts	improved vegetables	improved fruits
Non-FIPS village	19	6	0	13	0	19	3	10	6	0	0
FIPS villages	94	52	2	96	88	69	73	58	13	35	19
Old-FIPS village	86	14	0	100	79	79	43	43	0	21	7

The non-FIPS village has a much lower rate of adoption of improved varieties for all sampled crops, compared to the FIPS villages and the old-FIPS village. It is worth noting that the improved varieties have in many cases not replaced the local varieties, but are grown alongside local varieties, as additions to the cropping patterns of producers.

Some of the improved varieties introduced through FIPS were less prevalent in the old-FIPS village than in the FIPS villages. Farmers in the old-FIPS village explained that they had a problem with some of the improved varieties because they needed fertilizer to do well and, as the local varieties were doing reasonably well without fertilizer or had a particular taste or colour that was appreciated, they were not discarded altogether. In addition, there may be case- or

region-specific reasons; there may have been a dry spell when these improved varieties were planted, and replanting may have taken place with seeds left from the earlier harvest of local varieties. On the whole, however, the use of improved varieties is still high compared to the non-FIPS-Africa village.

Crop Production

To measure changes in yield, a choice was made to examine a number of crops, based on ranking for importance by farmers in the workshops. Maize, sweet potato, and cassava were considered most important.

PHOTO: FEMKE VAN DER LEE

Farmer inspecting her field

Maize

Figure 4.1 Average Household Maize Productivity, in kg per acre

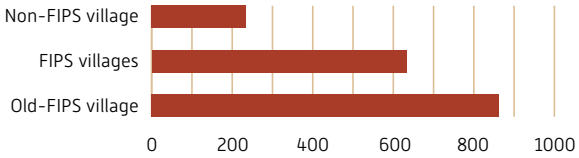


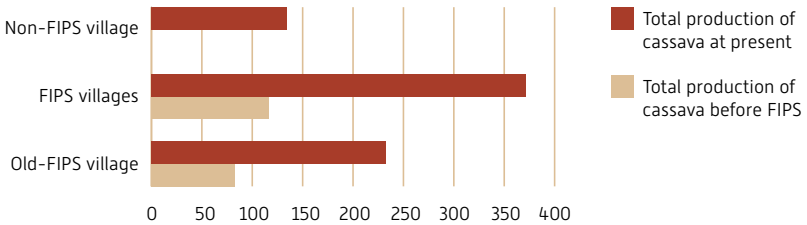
Figure 4.1 compares maize yields in the three types of villages. In the non-FIPS village, average maize productivity was estimated at 234 kg[2] of maize per acre (577 kg/ha). In FIPS villages, the estimated harvest per acre was almost three times higher, at 630 kg per acre (1556 kg/ha), while the farmers in the old-FIPS village reported the highest average yield of 860 kg per acre (2099 kg/ha).

Possibly the farmers that received FIPS assistance in the old-FIPS village have continued to improve their yields after FIPS has moved on to new villages. As the pre-FIPS estimates of most indicators in FIPS-Africa and old-FIPS villages are generally similar to those in the non-FIPS village, the starting position was likely to be similar.

Cassava

The following Figure (Figure 4.2) shows production per smallholder farm for the three types of villages.

Figure 4.2 Average Cassava Production per Household, in kg



For cassava, only total production per household was documented, rather than estimating yields and plot sizes, to reduce the length of the interviews. Figure 4.2 shows the total estimated cassava production per household before and after FIPS in the three types of villages. The difference between FIPS and non-FIPS villages is considerable, with the FIPS farmers producing about three times the amount produced by the non-FIPS farmers. The total production of FIPS farmers before they became involved with FIPS was about the same as non-FIPS farmers produce today. The improved cassava varieties promoted through FIPS grow faster and generally

[2] 1 bag = 100 kg

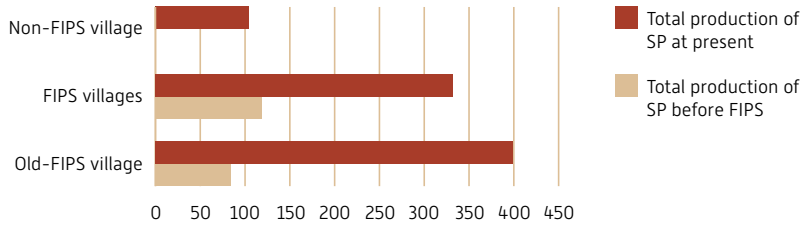
take half as long as the local ones to mature, with a similar yield per hectare. The number of tubers per plant is also much improved with the new varieties, and the size of the tubers has also increased. Taken together, the shorter season of growth and the increase in the number and size of tubers have increased cassava production considerably.

The old-FIPS village farmers seem to have reduced their production of cassava by reducing the area under the crop. The farmer interviews indicated they have given priority to maize production and, as we will see below, to sweet potato, most probably because surpluses of maize and sweet potato have a better market potential.

Sweet Potato

For sweet potato as well, only total household production was estimated before and after FIPS. Figure 4.3 shows considerable increases in sweet potato production per household in the FIPS and old-FIPS villages compared to before FIPS, and compared to the non-FIPS village.

Figure 4.3 Average Sweet Potato Production per Household, in kg



Again, a more than threefold increase in yield can be observed in the total production per household between non-FIPS and FIPS farmers. Pre-FIPS yield levels are similar to the yield levels in the non-FIPS village. Similar to the case of maize, farmers in the old-FIPS village have a higher production of sweet potato than the average in the FIPS village.

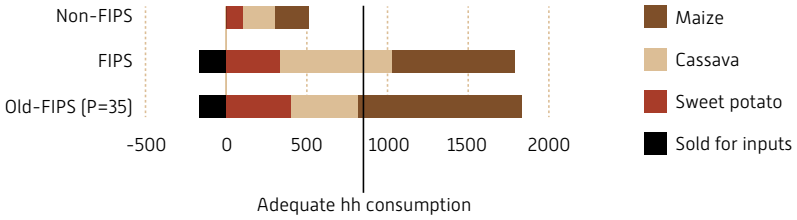
Total Food Production per Household Member

Based on the household data of yields of the three major staple crops, a picture of changes in household staple food production can be obtained. This is done by transforming the total production of these three staple crops into maize equivalents, based on calories, taking total food production, and recalculating the products to reflect their food energy content. Maize and sweet potato have each been given a factor of 1 (each contains 3200 Cal per kg), and cassava a factor of 1.86 (cassava has an energy content of 6000 Cal per kg). Figure 4.4 presents the food security situation for a family size of six members, which is the average in the study area. The calculations assume a need of 2500 Cal per day per person (based on the need for an adult male). For one season of 180 days, this implies a need of 843 kg of maize equivalent for a family of six (indicated in the Figure by the line 'adequate hh consumption').

There is a threefold increase in availability of food at the farm level with the introduction of the new technologies. This result is maintained over time, if the old-FIPS village is interpreted as indicative.

Crop production and cost estimates have been made for the three types of farmers, including the three crops of maize, cassava and sweet potato, as shown in the following Figure (Figure 4.4). This model is for a farm with one (1) acre, which is representative of the area for the farmers in the survey. The analysis assumes that a farmer needs to sell part of his or her harvest to buy inputs and satisfies household subsistence needs before selling. The part of the graph below the x-axis shows how much maize equivalent needs to be sold and deducted from total production and food availability (at maize price of Kshs 35/kg). It should be noted that only purchases of inputs are included. Non-FIPS farmers are assumed not to purchase inputs; it is also assumed that maize is sold for this purpose.

Figure 4.4 Total Food Balance in Maize Equivalents per Type of Household, in kg of Maize



The Figure shows that non-FIPS households are generally short of food by half of the amount needed. Maize production (214 kg) provides 25% of the total household needs. The Figure clearly shows that the food balance has improved for households in FIPS villages compared to non-FIPS villages and that FIPS households have produced twice their food needs. The relative

PHOTO: FEMKE VAN DER LEE

Farmer in his field with maize variety introduced by VBA

percentage contribution of each crop in terms of household food provision has remained roughly the same. For the FIPS village, maize production covers 71% of the required household consumption and for old-FIPS villages this is just over 100%. From FIPS to old-FIPS households, the contribution of each crop to total household production changes, but the total level of food production stabilises. Maize is more important in the case of the old-FIPS village.

The graph shows that after deducting the portion which needs to be sold for inputs, and the portion required for home consumption, a substantial surplus remains, which can be sold in the market, contributing to an improved household income. The assumed price for the surplus, of 35 Ksh. per kg, is conservative, and represents an average price for sweet potato, maize and cassava during the glut season.

The costs are based on the actual estimated investments by the farmers, which are much below the rates recommended by FIPS. The recommended fertilizer amount would cost 25,000 Kshs, which is equivalent to 714 kg of maize equivalent as shown in the Figure and this would consume almost all the surplus value realised by the FIPS and old-FIPS farmers. Farmers seem to weigh not only whether the harvest is attainable, but also the cost and the ultimate surplus achieved when they apply fertilizer. Apparently farmers make different economic decisions than had been assumed by the FIPS and agricultural extension economists. This raises the question of whether the advised rates of fertilizer are economically feasible, or need serious adjustments to the actual economic reality of smallholder producers in Western Kenya.

It is not clear that this is a time-dependent development from FIPS to old-FIPS situation; the number of cases is too small to tell for sure and this is not a panel data set, but the data suggest that continuous changes in the farming system may occur. It would be very useful to track changes over time in FIPS intervention areas by developing a panel data set. So far the data certainly suggest that FIPS has considerably improved household food security and that changes in crop choice may occur continuously.

Table 4.3 Numbers of Months of Food Self-sufficiency per Type of Village

	non-FIPS	FIPS	old-FIPS
At present	6	12	10
Before FIPS		7	5

Table 4.3 shows changes in food self-sufficiency as indicated by the interviewed farmers. In pre-FIPS conditions in the old-FIPS village and in the non-FIPS village, farmers could provide food for their families for periods of only 5-7 and 6 months of the year respectively. At present, as reported by farmers, in old-FIPS villages, food self-sufficiency has gone up to an average of 10 to 12 months. Because a small number of farmers still achieve only between 10 and 11 months of food self-sufficiency – though most farmers state that they have achieved full food self-sufficiency – there is a slight decrease in number of months of food self-sufficiency in the case of the old-FIPS villages.

Table 4.4 Sources of income used to purchase food, in three types of villages

Source of money for purchase of food	non-FIPS	FIPS	old-FIPS
Savings from selling crops	26%	41%	46%
Savings from other activities	6%	8%	31%
Selling capital assets	3%	3%	8%
Begging from family	35%	14%	8%
Working for richer farmers in the area	39%	32%	15%

Table 4.4 demonstrates that old-FIPS farmers ask less often for money from family members than non-FIPS farmers and use their own savings more often than non-FIPS farmers. Interestingly, the farmers in the older FIPS village are more dependent on selling crops to purchase food. They rely less on family than farmers in the FIPS villages, and seem to have diversified towards non-agricultural sources of income as well. They also work much less for others than the non-FIPs or FIPS farmers do.

It would be worth investigating further whether this does mean that, as a result of the generation of marketable surpluses for some seasons, the options for farmers participating in the FIPS innovations are increasing and that specialising in commercial farming has become feasible.

Income Improvement from Sales of Crops

Table 4.5 Average Income from Sales of Three Main Crops, in Three Types of Village (in Kshs, one season)

	non-FIPS	FIPS		old-FIPS	
	At present	At present	Before FIPS	At present	Before FIPS
Maize	142	1914	315	1335	614
Sweet potato	89	932	134	1786	150
Cassava	77	1058	185	1218	71
Total income	308	3904	634	4339	835

Table 4.5 shows that, according to farmer estimates, income from sales of the three major crops has increased between 5 and 6 times between the period before FIPS was working in the villages and the present. The difference between the non-FIPS village and the FIPS villages is even bigger: the incomes of farmers in new and old-FIPS villages are factors of 12 and 14 higher, respectively. The incomes in FIPS and old-FIPS villages before FIPS were higher than currently in the non-FIPS village (by factors of 2.1 and 2.7, respectively).

4.6 Sustainable Systemic Changes

The main innovation that FIPS has promoted is a different, more business-like delivery of services to assist producers in intensification of their farming. Here we discuss the evidence of systemic changes in the advisory and input supply service.

Changes at Farmer Level: Mindset of Experimentation

Besides having improved productivity, FIPS has also had an influence on the propensity of farmers to experiment with, adapt and adopt new farming practices. Although farmers in non-FIPS villages also indicated they had experimented with new technologies, this was much less pronounced compared to the FIPS villages, where FIPS Africa promoted experimentation by providing farmers with small test packages of farm inputs and services to assist them in their experimentation at a reasonable fee through local agro-input dealers.

It was observed that producers did test, adapt and partially adopt the practices promoted through FIPS. An indication of this is the observation that farmers started applying improved planting and tillage technologies on local varieties, especially the less endowed-farmers who lack the resources to invest in seeds of improved varieties.

Communication within FIPS-Africa

The farmers benefiting from FIPS Africa are connected to the programme through the VBAs, who in their turn are connected to FIPS headquarters through district coordinators and regional coordinators. FIPS headquarters connects the system to diverse sources of agricultural information, and the agricultural input industry. With the expansion of VBA activities, assistant VBAs (sub-VBAs) were introduced, who work closely with the VBAs to coordinate the FIPS-Africa activities in the villages. Certain VBAs have taken this as an opportunity to increase their reach, but also their income: they train sub-VBAs sufficiently to provide a single service to farmers (e.g. spraying livestock against ticks or vaccinating chickens) and keep a part of the fee earned by the sub-VBAs. They provide these sub-VBAs with the necessary inputs[3].

Although there is obviously a high dependence of the VBAs on FIPS-Africa, it was observed that the more enterprising VBAs were exploring alternative sources for seeds of improved varieties and fertilizers, other than FIPS-Africa collaborators. Some more entrepreneurial VBAs were also seen to diversify by engaging in non-agricultural advice and services.

Lasting Change in Access to Inputs and Advisory Services

Before the introduction of VBAs, an agricultural input dealer system existed in the study area. However, interviewed farmers indicated that the input dealers were found only in the larger towns, had only large packages of inputs available, and generally were not focused on the varieties the farmers preferred, nor did these input suppliers provide any training and advice on related farming practices. Not only has the provision of inputs been extended to the level of the farmer, the additional advice that comes with these improved varieties has also been improved.

[3] This will later be used in our calculations of the returns on investment of RIU-funded FIPS-Africa activities. Though we do not see examples of VBAs having between 500 to 1000 customers, we do see this method being used to extend the reach of each individual VBA. They may thus indirectly reach many more farmers than they would be able to reach directly.

The established public agricultural extension system does have the mandate to provide agricultural advisory services at the grassroots level. However, after systematic questioning about how this service is helping farmers, the general opinion appeared to be that the government extension service is insufficiently available, generally only appearing during chief barazas (group meetings at the chief's place), and its advice is of a very generic nature. As far as the farmers are aware, technologies such as new varieties, improved tillage, proper use of fertilizer and other crop husbandry practices have never been transmitted by the public extension service. It seems that the VBA system is reaching farmers better than the public extension service. Even though sometimes there was a slightly tense relationship between the public extension service and the VBA networks, on the whole the official extension officers were seen to appreciate the opportunity to learn new methods and approaches from the VBAs in the field, providing them with the chance to improve their services as well. This conclusion is based on anecdotal evidence but, as qualitative input in the discussion, it is worth exploring as a future approach to cooperation between private and public services.

Spill-over Effects

An effect of the FIPS intervention has been that the input industry is diversifying its product range to better respond to the demands of producers. In fact, some have joined in the development of these adapted technologies (e.g. specific composite fertilizer by ARM, small packages by Leldet) and have adapted them further. Another substantial development is the initiation of programmes similar to FIPS Kenya in Nigeria and Tanzania. In the latter country, the approach is being introduced at the government planning level in various districts through the United States Agency for International Development (USAID) which has funded FIPS-Africa in the past and at present.

4.7 Attribution to RIU

As discussed above, the findings from this study make it evident that the activities of FIPS-Africa have contributed to increased food security and income at household level. This impact cannot be attributed to RIU alone, as FIPS-Africa has had a number of other financial sources and supporters. In addition, there were certain conditions from the start, as well as some which developed during the course of the intervention, that have contributed to the effectiveness of the intervention and its impact at household level. However, as an external supporter, RIU has made certain activities and certain developments possible through its involvement.

Contribution of RIU to Impact

RIU invested a total of US$890,000, distributed over 2.5 years, from January 2010 to June 2012. Besides RIU funding, FIPS-Africa received considerable funds from other donors (for an overview, see Annex 1). FIPS-Africa's involvement in a variety of other projects and the financial support from different angles have contributed to the effectiveness and scale of FIPS-Africa's activities. RIU's involvement in terms of time, support and financial investment has been extensive, particularly in supporting the development of the VBA approach.

At the time that RIU's financial support commenced, in early 2010, FIPS-Africa was operative in 12 districts[4] [s/b 4] in Kenya and had recently started small activities in Tanzania (FIPS-Africa, 2012). The grants made available through the RIU Best Bet facility enabled FIPS-Africa to extend its activities in six districts in Kenya and two in Tanzania. RIU enabled activities in eight districts for at least 2.5 years, during which about 120 VBAs were trained and an estimated number of 540,000 beneficiaries have been reached (FIPS-Africa 2012).

Besides the financial support, RIU has supported FIPS-Africa as external advisor to the company and by providing it with publicity through its communication department. Every few months an RIU consultant or advisor would visit FIPS-Africa to discuss progress and potential ways to improve (director FIPS-Africa, personal communication). Through this advice, RIU contributed to the professionalisation of the company. This improvement in the professional operation of the company has not only led to increased effectiveness, but has also improved its profile and capacity to apply for additional funds.[5]

Since its initiation in 2003, FIPS-Africa has supported a significant number of farmers to improve their food security and raise their income levels. However, the improvement over the years in the levels of food security and income of farmers in "FIPS-villages" might not be attributable solely to the FIPS intervention; therefore, the possibility of other interventions in the area was explored.

Besides the intervention of FIPS-Africa in the studied FIPS villages, farmers mentioned two other development interventions. These were a dairy project implemented by a local NGO, and the provision of seeds and fertilizer by the government after the drought in 2011. These two interventions were only mentioned in one village in Siaya (Kakan). The farmers there felt that most of the support from these interventions had gone to farmers who had more capital – e.g. the fertilizer and seeds distributed by the government were given to farmers who had at least one acre.[6]

Other interventions were not found. Support from government extension to the farmers in the studied villages is negligible, according to the sampled farmers. Extension officers are generally seen only in village meetings and their advisory services are considered poor by farmers.

The individual interviews with farmers and the specific exercise during stakeholder workshops showed that the positive change in food security and productivity in the FIPS villages can largely be attributed to the FIPS intervention.

Conducive Environment

It was possible to set up and develop FIPS-Africa because of a number of factors that together created a conducive environment for the company to evolve.

[4] The 12 districts were: Bomet, Bungoma, Butere-Mumias, Embu, Kakamega, Kirinyaga, Kisii, Meru, Nakuru, Trans-Nzoia, Uasin Gishu and Vihiga districts.

[5] As mentioned earlier, the director of FIPS-Africa indicated that RIU has significantly contributed to the profile and capacity of the company to apply for additional funds (director FIPS-Africa, 2012, personal communication).

[6] This implies that a number of smallholder farmers in the studied villages were excluded; a significant proportion of the smallholder farmers in the region possess less than one acre.

The FIPS-Africa intervention has not been driven by a single actor. On the contrary, many actors became involved and contributed to the endeavour. Actors from the private sector, especially, have played a relevant role. At the time FIPS-Africa started, seed and fertilizer companies in Kenya were packaging their products in quantities that were too large and thus unaffordable for smallholder farmers. This, combined with often long distances to the shops, meant that the majority of smallholder farmers were not buying inputs from local agro-dealers. Agro-dealers furthermore had little incentive to give proper advisory services. They promoted seeds of new varieties or fertilizer poorly (if at all) and gave little or no explanation of the required techniques for effective intensification.

Over the years, the role of companies as input suppliers to the FIPS-Africa distribution network has changed. Feedback on performance of crops and brands of fertilizer in specific areas was given to the companies, and companies were linked with the district coordinators and local agro-dealers. As a consequence, stronger linkages are formed between the companies and localised distribution points (the agro-dealers and district coordinators). This has changed the relationship between FIPS-Africa and its commercial partners into a more commercial one: the input suppliers are happy to work with FIPS-Africa as long as they do not take a loss; delivery of goods will continue only if their costs are covered (director FIPS-Africa, Leldet Ltd. and ARM, personal communication).

Besides the private sector actors, some actors and elements within the public sector have actively contributed to the success of FIPS-Africa.

One of the important actors within the FIPS-Africa network is KARI (Kenyan Agricultural Research Institute).[7] In the years prior to 2008, KARI struggled to disseminate new varieties of cassava and sweet potato to farmers. After 2008, KARI and FIPS-Africa started to collaborate; KARI would deliver improved varieties, while FIPS-Africa was contracted to distribute the cuttings and vines within their network. Later, the collaboration evolved and FIPS-Africa started to relay information from the field back to KARI. KARI learned from the extension approach and its way of working with farmers, and FIPS-Africa also informed KARI on how certain varieties were being appreciated by farmers in specific agro-ecological zones. KARI provided expertise by giving training on, for example, feeding formula for chickens or on soil management technologies. KARI has also used the idea of commercialising improved production and surplus to develop the idea of "commercial villages", in which the farmers process and market their own produce to add value and keep it within the village economy.

Another important element of the enabling environment that contributed to the development and operationalizing of FIPS-Africa was the willingness of public institutes to fund the company's activities. The government of Kenya does not appear on the list of donors but FIPS-Africa's approach was positively endorsed by international donors. The approach and objective of FIPS-Africa fitted perfectly, at the right time, into such programmes as the KMDP (Kenya

[7] As a public institute, KARI is mandated to promote the use of research to strengthen the agricultural sector, see www.kari.org.

Maize Development Programme)[8], KASAL (Kenya Arid and Semi-Arid Land) programme[9] and the Feed the Future programme of USAID. FIPS-Africa has received a considerable amount of funding and grants and will have no problem funding the post-RIU phase.

4.8 Investments / Cost Benefit Analysis

Sustainability of the VBA Network: Lasting Change to the Extension Service

The sustainability of the VBA approach lies in the income earning capacity of the VBA as a privately funded extension officer. Fourteen VBAs were interviewed on their activities for the period from February 2011 to March 2012. It was evident that most of their income emanated from selling of chickens and cockerels, mating services, chicken vaccines, contracts for tick control spraying, seeds and fertilizer, and from facilitating demonstrations.

PHOTO: FEMKE VAN DER LEE

Village Based Advisor showing chicken vaccination

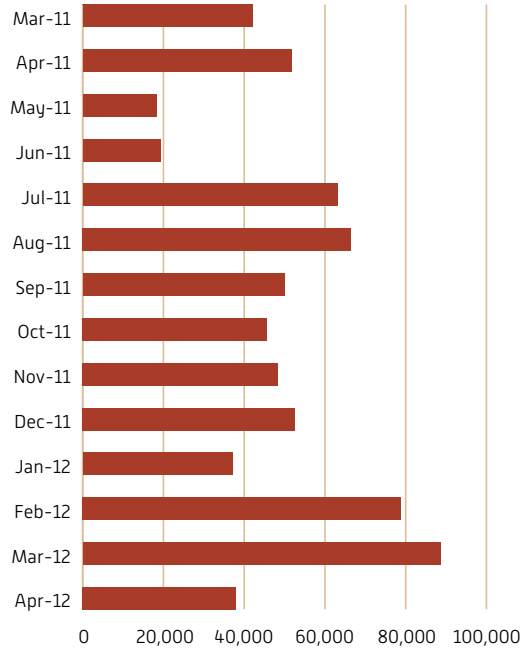
[8] KMDP is a USAID-funded project, implemented by ACDI/VOCA which started in 2003.

[9] In the period of 2007-2011, KARI was in charge of the implementation of KASAL (Kenya Arid and Semi-Arid Land) – a European Union (EU)-funded project intended to improve food security of Kenyan farmers through improvement in agriculture. In this period, KARI developed new varieties of cassava and sweet potato; however, KARI struggled with reaching and convincing farmers about the advantages of the new varieties.

The 14 VBAs collectively received a cumulative gross income of 659,001 Kshs over the 14 month period for which data was collected (i.e. since they started to collect this information systematically, using a standard form provided by FIPS-Africa). This implies an average gross annual income of approximately 40,000 Kshs. Roughly 95% of this income was received through farmers paying directly for services, as well as through margins on sold inputs, and 5% was derived directly from FIPS as an incentive to implement demonstration trials and through subsidised seeds. Discussions with the VBAs indicated that the FIPS-Africa programme had a good marketing effect on their businesses and hence they experienced additional benefits (i.e. sales).

The following Figures (Figures 4.5 and 4.6) show the results of the VBAs' activities.

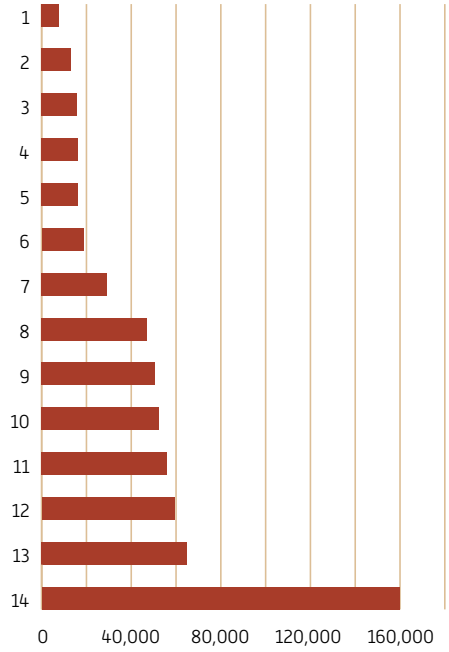
Figure 4.5 Total VBA Monthly Income, in Kshs



The Figure above shows the total monthly income for the 14 VBAs over a period of 14 months. It shows a highest income level of 88,600 Kshs in March 2012, while another peak in income is apparent in July-August, which coincides with the planting seasons in Western Kenya. The average income of the VBAs is slightly above 50,000 Kshs per month, which translates to 3,571 Kshs per VBA. The income the VBAs claimed to have obtained from their input marketing and advisory services is not that high, but it is additional to their normal income from farming.

Western Kenya has two growing seasons each year: the short rains season lasts from July or August until December or January, and the long rains season – which is the primary growing season – lasts from March or April until July or August. Hence, the spikes in incomes are very much related to the beginning of the planting seasons when the extension services would be in great demand.

Figure 4.6 Gross Annual Income per VBA, May 2011–April 2012, in Kshs



This income distribution is highly skewed, and the highest incomes are obtained by the VBAs with the longest track records. The lowest gross annual income received by a VBA was 7,600 Kshs, while the highest was 159,780 Kshs. Given that 50% of the VBAs earn less than 40,000 Kshs per annum (3,333 Kshs per month), this implies that additional support for entrepreneurship training and linkage to financial institutions may be important to support their business growth. Analysis of the VBA with the highest gross income (number 14 in the above Figure) is shown in the following Figure (Figure 4.7).

Cockerel mating, sales of chicken vaccines, sales of fertilizer, sales of seeds and sales of pigs contributed the most to revenues. The data show that there is less profit in the 'advisory service or 'demo' category of activities focused on by FIPS-Africa. The question arising, but not answered at this stage, is whether VBAs will continue to be motivated to engage in these activities when they contribute so little to their income. Of course, the provision and sales of fertilizer and seeds is linked to this 'demo' category, and that income might not be so high if there were no agricultural advice given with those sales. Also, this Figure is showing gross income but costs can be considerable. Figure 4.8 below shows the ratio of income/cost for each service or product. Sales of rabbits have the highest margins, followed by chicken vaccines, while the lowest margins are found in sales of seeds.

Figure 4.7 Revenue (Turnover) per Service Provided by VBA #14, May 2011–April 2012, in Kshs

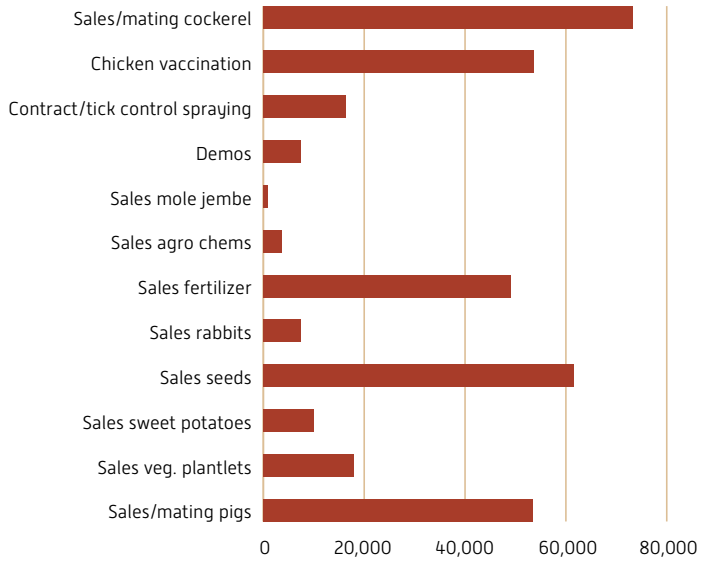
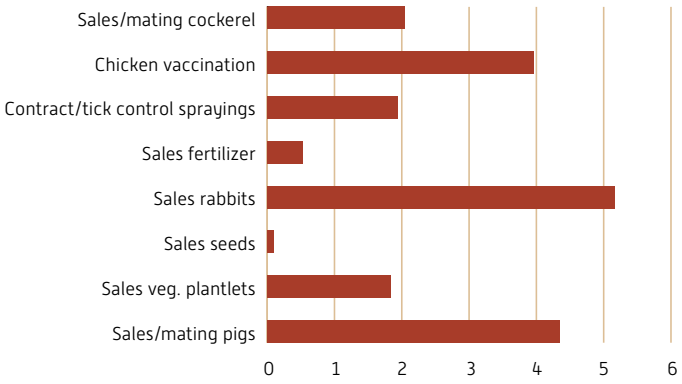


Figure 4.8 Ratio of Income and Cost per Product or Service



These data extend the discussion above. The profit from the sales of seeds and fertilizer is lower than for most other activities, which are all related to livestock production rather than crop production. VBAs may not be willing to continue to focus on activities such as the sales of seeds and fertilizer (and related agricultural advice) considering the relatively small profit. These advisory activities are not being paid for by farmers, but are linked to seed and fertilizer introduction and distribution.

Internal Rate of Return and Development Impact Scenarios

The rest of this section will aim to establish the expenditures by RIU and related values of crop outputs achieved through the VBA network. This requires a detailed picture of input (funds from all sources, with their precise timing) and output (precise overview of categories of expenditures); however, those details have not been provided and publicly available information

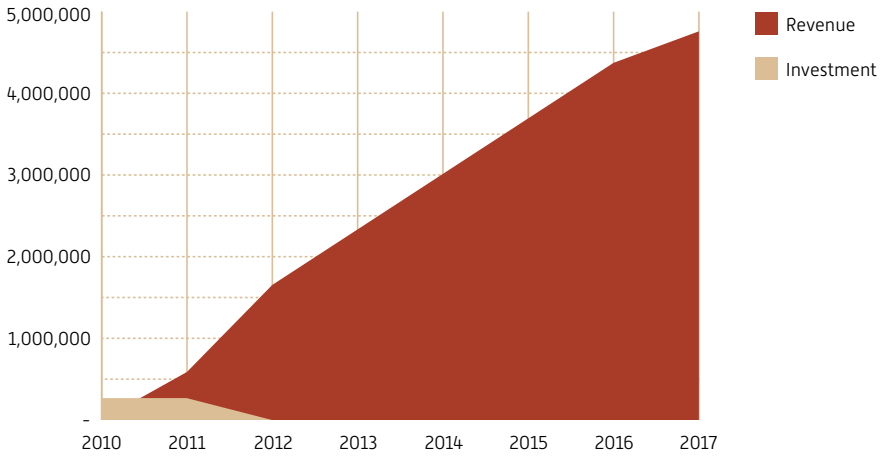
must be used. The returns on RIU investments have been calculated on the basis of a number of premises. The premises are presented first, followed by a calculation of returns and a graphical presentation of two scenarios: a high and a low farmer-to-VBA scenario.

The information on which the Internal Rate of Return (IRR) is based is presented in Annexes 5 and 6 for the high scenario, and in Annexes 7 and 8 for the low scenario. The difference lies in the number of farmers a VBA can add to the list of people he or she is assisting in improving farming methods. FIPS-Africa presentations state that 500 to 1000 farmers are being assisted per VBA but, from discussions and observations, it seems apparent that this is not the actual situation, but rather the ultimate goal. Also, the number of VBAs was not at full capacity from the beginning, the 120 VBAs were not all recruited at the start of the programme, and they have not all been as effective as they could be, as discussed above. With time and the adoption of the system of sub-VBAs however, this situation may improve.

For estimating the investments made by RIU, information on the expenditure of RIU on FIPS from FIPS-Africa, prepared for USAID in 2012, was used. For estimates of impact, the study authors used their own assessment of the numbers of VBAs that could have been funded, assuming that once RIU stops funding, the numbers of VBAs will not increase.

The first scenario (the high scenario) assumes that a VBA can add 100 farmers per year to his or her list of farmers, up to a total of 500 farmers, but that the list will not grow beyond that. Production data from the survey (gross production of maize equivalents per household) have been used to calculate total value of crop output related only to these linkages between VBAs and farmers alone (assuming 35 Kshs per kg). Any spillover effects will make these figures underestimates. Any lower price for cassava (after recalculation to maize equivalents) and/or sweet potato will make these figures overestimates.

Figure 4.9 Investment and Annual Development Impact: Actual Figures for 2010–2012, Predictions for 2012–2017 (High Scenario*)



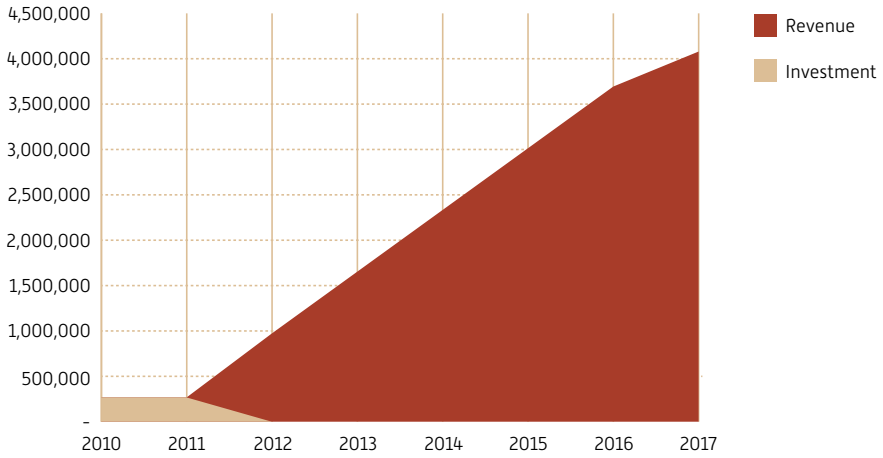
** Increase of client base per VBA = 100 per year, with a maximum of 500*

This assumes that the same VBAs will continue to do their jobs, and that no additional costs are incurred to keep them functioning at their present level of efficiency and with increasing numbers of clients. This also assumes that no additional funds are needed to increase their knowledge, or make their businesses run – in other words, it shows total cost recovery. This is not a realistic scenario for the latter reasons, not for lack of evidence of current results.

This is clearly an impressive result in graphic terms. In this scenario, the IRR is 276%, which is a high figure.

The low scenario assumes a maximum of 50 additional farmers that a VBA can link up with annually. This is shown in the following Figure.

Figure 4.10 Investment and Annual Development Impact: Actual Figures for 2010–2012, Predictions for 2012–2017 (Low Scenario*)



** Increase of client base per VBA = 50 per year, with a maximum of 350*

The results are quite positive in the sense that annual revenues are not much below those in the high scenario. The IRR is 182%, which is still quite high. As in the high scenario, additional funds would be needed for further growth of the impact, but otherwise a stabilisation of the present improved revenues can be expected.

4.9 Conclusions and Lessons Learned

At the general level, a positive picture can be painted. At the household level, a food-deficit situation seems to have changed to a situation of food surplus. Sales are mostly limited to a number of larger farmers, but this just means more is kept by the smaller farmers and consumed. The costs of maintaining levels of input are reasonable.

Impact in the near future also seems positive: not only can the farmers probably maintain their production level (provided soil quality does not deteriorate due to low use of fertilizer), there seems to be a continuous process of improvement at farm level in later years. At the same time, VBAs can accommodate new groups of farmers every year as the older farmers become more independent, self-financing and willing to experiment. The sub-VBA system will contribute to this. Under these circumstances, value for money is achieved and a satisfactory IRR is obtained.

There are also favourable conditions for future impact at the VBA level. Incomes grow with time, and additional non-farm activities and services make for self-sustained growth of income. At the same time, however, the crop-related activities that are the core of the VBA role within FIPS-Africa seem to be the least remunerative. The question is whether the motivation of VBAs will be strong enough to avoid focusing on these non-crop related activities, such as livestock services, or even on non-agricultural services.

At all these levels however, the conditions at present support actors in their capacity to innovate. Farmers, VBAs, district and regional coordinators, FIPS-Africa headquarters itself, and the private and public environment of FIPS all contribute to this capability. Farmers are much more enterprising and willing to experiment, although in that respect the VBAs are probably the most ambitious. FIPS-Africa, in cooperation with commercial partners and public funding, has developed a keen interest in innovation and the capability to innovate and learn from innovations elsewhere. Though most of this chain is privately funded, FIPS-Africa headquarters itself, ironically, needs public funds to play its role. This can be justified, however, provided the service is deemed of substantial public benefit. Governments are funding public extension services with the same objective.

When considering the function of FIPS as an agent of innovative technology, the question arises whether innovations are being introduced because there is an expressed need, or whether they are being introduced because they are available. In the case of FIPS-Africa, even though there was no actual needs assessment among farmers, there was a very clear awareness that an opportunity existed for improvements in agriculture, and that a very clear need existed among farmers for an alternative system of extension. The FIPS-Africa felt a responsibility to answer this need. The result is an innovation-seeking organisation that is keen to test its assumptions – or rather to have those assumptions tested by farmers. This attitude seems to have been adopted by FIPS-Africa's private business partners, some research institutions, and other donors and governments.

Technological options for intensification need to be tried and tested. FIPS-Africa has been very active in encouraging farmers to try new technologies and has made this possible by developing small packages of new seeds and fertilizer and making these available as cheaply as possible, so that there was minimal hindrance to experimentation. Most of these new technologies are provided for free, in cooperation with commercial providers. VBAs are also active in this process, establishing demo plots in the villages, with the crop yields being given to the owner of the field. These two levels of experimentation were augmented by the links between FIPS-Africa and the formal and scientific institutions in Kenya, both public and private. Experimenting is also taking place there, paid for by private companies themselves or supported by DFID, among others, and this source of innovative technologies was tapped into as well.

A specific challenge is the scaling up and out of technological options that have proven to be of use. FIPS-Africa seems to have developed a system that has no limit to scale: it can probably grow to quite a large scale, as farmers and VBAs grow in number and go through the process of becoming better farmers, thus becoming self-financing in a process of productivity growth. More recently, the sub-VBAs are also growing in number and reach, and becoming larger service providers. At all times, new farmers and VBAs can be added to the network. With the human dimension thus established, the organisation is focused on identifying promising technologies and bringing them to the attention of input and service providers. These providers have an interest in knowing and acting upon these new technologies, as they can improve their markets and be more profitable themselves. Perhaps the only limitation is in the size of FIPS-Africa headquarters itself; donors need to provide the money for FIPS-Africa to fuel the process of testing, adapting and assuring the continued use of successful technological options. Too large an organisation may hinder its obtaining public funding, unless governments take up this role in earnest, either by funding FIPS headquarters, or by integrating it as a public service, with the risk of a reduction in its efficiency.

A large number of actors are involved in these processes. Traditionally, research institutions are responsible for agricultural innovations. These institutions have been involved in FIPS-Africa, but in a more limited role than could be expected. Only certain individuals in these institutions seem to have recognised the potential of FIPS-Africa; they have supported it with the provision of new varieties and material and have been active in propagating interesting strains. However, mostly these organisations have been focused on technical research without forging linkages between themselves and the ultimate users, the farmers.

The role of the private sector in FIPS-Africa's success is much larger than the role of the research institutions. Though seed companies and fertilizer companies generally do not have separate research departments, they have been eager to acquire new varieties or knowledge that they could distribute. Most of all, they have been keen to adjust their strategies of distribution, based on the example and ideas of FIPS-Africa. In cooperation, small packages of new seeds were developed – and later further improved – by the seed companies. Fertilizers adapted to the soil type prevalent in an area, and to the needs of the crops, were also developed. Again, these were packaged in small bags for ease of purchase with a small budget. Even private retailers play a role, as additional demand for new seeds and fertilizer that cannot be answered quickly enough by the VBAs will be passed on to the agro-input providers. The VBAs themselves are even developing into private sector operators, a process that is actively encouraged by FIPS-Africa. They have been supported, but they also took a risk when they started with FIPS-Africa, as they do invest and also have lower yields from their own fields because they spend more time as VBAs and less time as farmers on their own fields.

Public actors have had a limited but very important role in the development of FIPS-Africa. The continuous funding arrangements have made it possible to develop the idea, to nurture it, to develop it further and then to roll it out. In that sense, RIU funding was only the last stage of a long process of funding and, had any one of those earlier donors withdrawn, the whole experiment probably would not have been so successful. Other donors have pledged their support now that RIU has ended its funding, and this has allowed the organisation to continue working

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Maize and beans

at the higher level of staffing that exists today. National government bodies have had a much more limited role; in this context, "public donor" means almost exclusively foreign donor, not local government.

Finally, the producers have had an important role in the process. They have to go through a process of change. Changing perspective and experimenting require taking risks, however small, and these changes must take place in a difficult environment, when producers are food-insecure themselves. This is brave in any circumstance. Producers have an important role in the process that will also benefit them; they provide the testing facilities and they set the priorities for the system as a whole. Working within the enabling environment of FIPS-Africa has allowed this process of innovation to develop both in depth and in scale.

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5

Maize

Nyagatare Maize Innovation Platform

Authors: Remco Mur and Geneviève Audet-Belanger

5.1 Introduction

The Rwandan economy is highly dependent on primary agricultural production. Rural livelihoods are based on agricultural production systems characterised by small family farms which practise mixed farming that combines rain-fed food crops, traditional livestock rearing and some vegetable and fruit production. Food crops account for 92% of the cultivated area (estimated to be 70% of the country's total land surface), and 75% of food crop production is consumed by the producing households, leaving 25% surplus production for marketing. A small number of farmers grow higher-value cash crops such as coffee and tea.

The RIU country programme in Rwanda aims to catalyse agricultural innovation and development in selected commodity chains in specific areas, through the establishment and facilitation of innovation platforms. Three functional platforms have been established:

- A cassava platform in Gatsibu district;
- A potato platform in Gicumbi district;
- A maize platform in Nyagatare district.

A fourth platform, the Karongi rural innovation platform, which focused on small irrigation, was phased out after the mid-term review in 2009. In addition, a National Innovation Coalition (NIC) was formed as a consortium of major stakeholders at national level in the agricultural system in Rwanda. The NIC was expected to become a driving engine of agricultural innovation in Rwanda; however, the activities of the NIC ended in 2010. *(www.researchintouse.com)*

This report concerns the Nyagatare district Maize Innovation Platform. Maize is a priority crop of the Government of Rwanda and maize production is expected to contribute to income generation and food security, which has been particularly targeted in Nyagatare district performance contracts and district development plans. The RIU Rwanda Country Programme aligned with this national priority setting by opting to intervene in maize in Nyagatare. The Maize Innovation Platform was established in June 2008 and aimed to address constraints related to maize production and markets.

Rwanda Policy on Agricultural and Rural Development

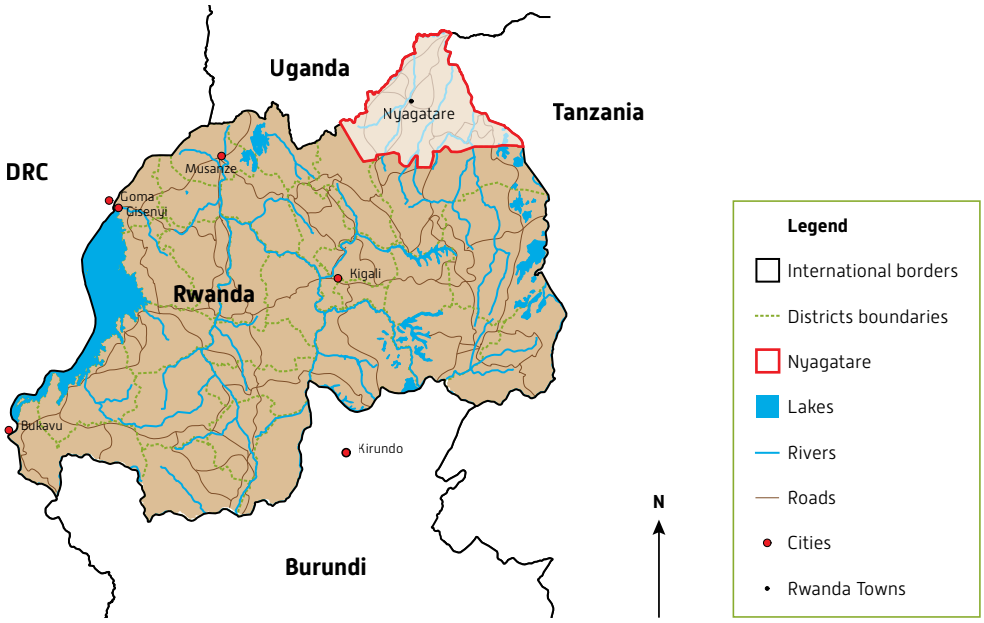
The RIU programme in Rwanda is operating in an ambitious and challenging policy environment. The framework for long-term development policy in Rwanda is provided through Vision 2020, which aims to make Rwanda an intermediate income country with per capita gross domestic product (GDP) of US$1,000 (app. GBP 620) by 2020. To realise the ambitions set for the agricultural sector, the Government of Rwanda adopted the National Agricultural Policy (October 2004), which focuses on the reduction of poverty and movement towards sustainable food security through the following means:

1. Modernised, innovative, professionalised and specialised family agriculture, which is income- and employment-generating and market-oriented (for domestic, sub-regional, regional and international markets);
2. Regionalised, integrated, diversified and specialised agriculture, enabling food security for the population and fair distribution of resources and incomes;
3. Agriculture concerned with preserving and safeguarding the environment and natural resources.

RIU has aligned its activities to the Government of Rwanda's (GoR) emphasis on the transformation of the agriculture sector into a modern, professionally-managed and market-oriented economic undertaking and its contribution to food security and overall national development. A Memorandum of Understanding was signed between RIU and the Ministry of Agriculture and Animal Resources. Partnerships between RIU and other initiatives/projects were established and involvement of various national agencies and local authorities in the innovation process was facilitated and strengthened.

Of particular importance and relevance is the GoR/ Ministry of Agriculture (MINAGRI) Crop Intensification Programme (CIP), which was launched in 2007 with unprecedented government financial support as well as contributions from additional development partners. It aims to increase agricultural productivity in six priority crops, namely maize, wheat, rice, Irish potato, beans and cassava. CIP's main pillars include land use consolidation and the purchase and distribution of fertilizer and seeds of improved varieties. Due to the limited local production, the

Figure 5.1 Map of Rwanda and Nyagatare District



Source: ESRI data CloudMade DIVA-GISS

Rwandan government imports maize seeds from neighbouring countries. Land use consolidation refers to combining small plots of land, belonging to different owners, to produce the same crop, in order to manage and use the land in an efficient, uniform manner so that it may give increased yields in specific areas, resulting in a bulk of marketable surplus.

Maize Production in Nyagatare District

One of the seven districts of Eastern Province, Nyagatare district is the largest district of Rwanda. It is divided into 14 sectors made up of 106 cells and 630 villages, covering an area of 1,741 square km. Nyagatare district borders Uganda to the north, Tanzania to the east, Gatsibo district to the south, and Gicumbi district to the west. The district is generally characterised by slightly inclined hills separated by drained valleys, which are dry for a long period of the year (June-October). The total population in Nyagatare is 291,452 inhabitants (167 inhabitants per square km, in contrast to 321 inhabitants per square km at the national level).

Box 1. Land use in Nyagatare (2008)

Total land under cultivation (2008)	**34.1%**
Food crops	31.6%
Cash crops	0.4%
Forage	0.4%
Fallow	1.7%

Traditionally, Nyagatare district has been a pastoral area, with vast pastures for extensive livestock raising (cattle and goats). Nowadays, the economy of the district is mainly based on mixed arable farming and livestock. Most farmers cultivate a variety of crops over the year, across seasons. During the short rains (season B, March-June), beans, cassava, sorghum, bananas and groundnuts are the most cultivated crops, while some maize is also cultivated. The long rains (season A, September-January), is the main maize season, however, while the same crops as in season B are also widely cultivated.

Table 5.1 shows that, since 2008, the area under maize, as well as its productivity, have increased substantially. Maize is mainly grown for food security. In 2011, only 16.9% of the total production in Nyagatare was marketed, compared to 12.3% nationally. Since 2006, market prices have increased annually, but with a serious drop in 2010.

Table 5.1 Maize Area and Production in Nyagatare District (2008-2011)

Year	Area (ha)		Yield (kg/ha)		Production (MT)		Market Price	Annual Increase
	Season A	Season B	Season A	Season B	Season A	Season B		
2006							154	
2007							160	3.9%
2008	4,830	1,094	1,800	650	8,693	711	199	24.4%
2009	10,269	1,498	3,000	1,434	30,809	2,148	232	16.6%
2010	10,644	-	2,515	-	26,775	-	183	-21.2%
2011	15,250	4,281	2,515	2,197	38,359	9,404	-	-

Sources: MINAGRI crop assessment 2011A season: crop area, yield and production
MINAGRI crop assessment 2011B season: crop area, yield and production
http://amis.minagri.gov.rw/

The most important crops for food security used to be beans, maize, cassava, sweet potatoes and bananas. In 2008, maize, beans, sorghum, bananas and groundnuts were mentioned as the most important cash crops.

5.2 Intervention Description: the Nyagatare Maize Innovation Platform

The RIU-funded Nyagatare maize platform was the first attempt to organise maize value chain actors in a multi-stakeholder interaction forum. The Maize Innovation Platform was designed to establish a more systemic and multi-actor approach to maize development in Nyagatare. The platform brought multiple actors together in a coordinated way to reflect, identify and address constraints and opportunities in the maize sector. This represents a new way of intervention thinking for many development actors in Rwanda, where development interventions and policies are generally developed and implemented in a top-down manner. Through the platform, RIU aimed to introduce value chain and market-oriented thinking and to promote farmer entrepreneurship.

The Nyagatare Maize Innovation Platform was established in September 2008. Annex 1 provides the timeline of the evolution of the platform, including major events and important decisions. The platform was officially registered in July 2010. A major objective of the platform is to enhance the interaction amongst stakeholders in the maize sector in Nyagatare. Important actors in the maize sector include:

- value chain actors (farmers, traders, processors, etc.)
- service providers (input suppliers, research and extension personnel, credit NGOs, etc.)
- enablers (local authorities, MINAGRI, etc.)

Table 5.2 Land Use Practices in Nyagatare District

	Non-members		IP members	
	2008B	2009A	2008B	2009A
% of households growing maize	33%	40%	26%	52%
Average area owned (hectare)	0.56		0.96	
Average area rented (hectare)	0.07	0.06	0.12	0.13
Average area cultivated (all households, in hectare)	0.60	0.60	0.97	0.98

The platform initially focused on increasing productivity, in line with the objectives of the CIP. Individual producers and members of maize-producing cooperatives were assisted through the platform in accessing high quality maize seed and fertilizer. In addition, they received technical training in good crop husbandry and post-harvest practices.

According to the platform members, these activities resulted in yield increases and the attention then shifted towards storage and marketing of maize. A series of platform meetings was organised and facilitated. The main focus of these meetings was to:

1. critically assess remaining bottlenecks across the maize value chain;
2. understand and agree on the roles of platform members in removing these bottlenecks;
3. identify new opportunities for innovations;
4. redefine membership, including identifying and recruiting new members.

Access to credit, marketing and profitability of maize production were raised as important challenges during the meetings. The objective of the Maize Innovation Platform was redefined as follows:

> *"Building a network of actors in the maize value chain with an aim of improving the livelihoods of maize producers and other stakeholders through using new knowledge to increase production, enhance access to credit and to improve maize trade in Nyagatare District".*

These meetings resulted in the establishment of a maize investment group (NYAMIG) and a pilot Inventory Credit System that assists individual producers and producer cooperatives in storing their produce for a longer period, while still having access to much-needed cash income at the time of harvest.

In its strategic plan for 2011-2015 (October 2010), the platform describes itself as a network that represents and advocates for the interest of maize value chain actors. The plan further defines the main objectives of the Maize Innovation Platform as follows:

- To promote professionalisation of the maize value chain;
- To collaborate, on behalf of its members, with organisations or people interested in the maize value chain;
- To ensure the autonomy of its members in order to improve the management of marketing and trade issues;
- To reinforce the partnerships between its members and other partners;
- To collaborate, cooperate, affiliate and work with other organisations pursuing similar goals and objectives.

PHOTO: REMCO MUR

Members of the maize innovation platform

In order to achieve those objectives, the platform initiated a set of activities, through capacity building, facilitation, networking, exchanges of information and advocacy, in order to:

- Increase production and yield;
- Enhance post-harvest management and handling;
- Ensure the quality of the product and access to market.

(source: Nyagatare Maize Innovation Platform Strategic Plan 2011-2015, October 2010).

Table 5.3 Number of Platform Members

Platform members	2009	2010	2012
Individual farmers		29	36
Cooperatives		16	19
Traders		6	6
Financial institutions		1	1
Processors		0	0
Service providers		10	12
Seed multipliers		9	9
Total	**55**	**71**	**83**

Platform Members

Membership in the platform is voluntary and open to individuals, cooperative societies, institutions, NGOs and companies involved in the maize sector, including production, processing, trade, services, export and post-harvest *(NYAMIP Status, 2010)*. Officially, there are founding members, adhering members, associate members and honorary members. In 2008, at the establishment of the platform, there were 55 members. The assessment shows a bias in the selection of platform members, in that there appears to be a difference in land ownership between the control and the platform members. Platform members own an average of 0.96 ha in contrast to 0.56 ha for non-members (baseline situation). In 2009, at the time of registration, the platform had 74 members and the number increased to 86 in 2012. The assessment showed that the cooperatives represent approximately 1,016 households. The total rural population in Nyagatare is estimated at between 45,000 and 50,000 households.

5.3 Evaluation Methodology

The study was conducted between 14 March and 5 April 2012. No suitable baseline study had been done at the start of the platform, so the evaluators referred to existing statistics for the years 2008 and 2009, as well as endeavouring to collect certain data retrospectively.

Because of the broad range of objectives of the Maize Innovation Platform, the methodology has sub-divided the effort over three questions:

1. How has the RIU effort changed the capacity of the maize sector to innovate?
2. Has the maize platform contributed to increasing income and food security as a result of higher productivity, improved storage and better post-harvest handling?
3. Have the creation of the maize trading company NYAMIG and the introduction of an Inventory Credit System (ICS)[1] contributed to increased income and food security?

For the assessment, a team of four experts, supported by local facilitators and enumerators, conducted the following activities in order to answer the above questions:

- A start-up workshop at district level with representatives from maize sector stakeholder groups;
- A household survey, targeting beneficiaries and non-beneficiaries of the platform;
- An assessment of stakeholder perceptions on the capacity of the platform to innovate;
- Mini-workshops/focus group discussions in villages, involving local stakeholders (both beneficiaries and non-beneficiaries);
- Key-informant interviews (semi-structured) and focus group discussions at district and sector levels;
- A final validation workshop with representatives from local stakeholder groups.

For the household survey, six maize cooperatives (platform members) were sampled in three sectors, or sub-districts. The household survey randomly sampled 18 members of each cooperative. (Cooperatives differ in size from 25 to approximately 100 active members.) For each of the same three sectors, one non-member cooperative was sampled as a control group. For each of the non-member cooperatives, a sample of 10 members was taken. Focus group discussions were held with members and non-members in each of the sectors. An additional focus group discussion was held in Rwimiyaga sector with members of a cooperative affiliated with the platform.

5.4 Impact Pathways: The Capacity to Innovate

The impact pathway related to enhancing the capacity to innovate is represented in the Figure below. Through capacity building, facilitation meetings, assessments, and financial support, RIU has contributed to establishing the Nyagatare Maize Innovation Platform. The aim was to develop and sustain the enhanced capacity to innovate, which is ultimately expected to contribute to improved incomes and food security through specific activities initiated by platform members. The impact pathway describes the actual results; it was developed in retrospect and is based on document review, validated by RIU and platform stakeholders.

[1] An Inventory Credit System provides producers with credit, using their stored production as collateral.

Table 5.4 Impact Pathway Related to the Objective to Improve the Capacity of the Maize Sector in Nyagatare to Innovate

Input	Results and Impact			Spin-Off
Establishing local capacity to facilitate the platform Facilitation of innovation platform Platform self-assessment Training of stakeholders Financial support for functioning of the platform	Systems in place (administration, governance, accountability, link to shareholders) Enhanced stakeholder interaction	Enhanced capacity to innovate Innovation processes based on needs and opportunity assessment (3 interventions)	Improved income, food security and risk reduction: see impact- specific interventions	New interventions initiated New policies enhancing specific innovations

The RIU Rwanda country team played the facilitating role in the establishment and development of the platform. The team facilitated platform meetings, organised learning events, including exchange visits, and financed the functioning of the platform and activities. RIU also played a major role in guiding the platform in analysis and action planning.

The innovation platform was initiated with the active involvement of the Rwanda Development Organisation (RDO), a national NGO. RDO was already involved in promoting maize production in Eastern Province even before the initiation of RIU, through the CIP and in collaboration with the Catalyst programme. RDO is the formal implementing NGO of the CIP of the Ministry of Agriculture and Animal Resources. RDO officers were especially involved in the implementation of the actions of the platform related to improving cultivation practices. The actual platform facilitation was in the hands of the Rwanda RIU team and, to a lesser extent, RDO.

RIU and RDO assisted the platform in self-assessment and provided training and other capacity building activities to improve the performance of the platform and its members. In addition, RIU provided financial support for the functioning of the platform (e.g. meetings, transport, experts' input). The platform was established in September 2008 and formally registered a year later. It has a board which is elected every two years.

Improved interaction between major actor groups in the maize sector is seen as the key mechanism to improve the capacity to innovate, and the maize platform is the main instrument to achieve this improved interaction. The interaction was achieved during the platform meetings as well as in more practical actions, which resulted from the meetings.

Farmers were central to the platform intervention. The main focus of the platform was on improving the position of farmers rather than taking a more systemic view aiming to improve the sector as a whole, providing advantages and benefits to multiple actors. Table 5.5 shows the changes in interaction of farmers (both IP and non-IP) during the last three years, as expressed by producers during focus group discussions.

Table 5.5 Changes in Relationship between Actors

	Producers non IP		Producers IP	
	Negative	**Positive**	**Negative**	**Positive**
Coops		• Support to cooperatives • Capacity building	• Some cooperatives inactive • Few services to producers • Limited trickledown of information • Members leaving for abroad or other regions	• Producers can market their product through cooperatives • Storage facilities
External Coops		• Exchange visits to other coops • Peer learning		• Interactions with new cooperatives • Peer learning, visits
Traders		• Increased prices • Some traders own a mill which can be used for processing	• Prices still low • Use of unbalanced scales	• Providing larger quantities to traders • Improved market knowledge • Traders are more visible • Increased competition
Transport Providers				• Better organization of producers to make use of transport providers • New relationships with transporters
External Services Providers	• ADRA's work is regarded as lacking structure, farmers not supported sufficiently – not continuous support	• RDO well appreciated for support through CIP • Radio diffusion of information • New knowledge training	• Difficulty accessing agronomist • ad hoc support when time is available • Relying on a few individuals for dissemination	• Increased support to producers under CIP's framework • RDO's support is appreciated • Receiving training, support
Credit Institutions	• Difficult for producers to access credit, few links with credit institutions		• Credit not released to access fertilizers • Generally limited access to credit • Farmers lack collateral to obtain loans • Bad timing	• Producers can access credit
Processors	• Access remains difficult	• Some producers manage to get their maize processed		• New relationships with processors • Increased access to maize flour
Government	• Not enough access to infrastructure and post-harvest tools to maintain quality of the maize	• Sensitisation to maize production • Fertilizer, seeds provided • Training • Sheeting for post-harvest handling	• Agronomists sometimes hard to reach	• CIP allowing producers to increase yields, land consolidation • Capacity building • Support for cooperative organisation • Access to farm inputs through voucher system

In particular, the interaction with service providers (RDO and sector agronomists), as well as with Duterimbere, a micro-finance service provider, can be regarded as major achievements of the platform, although the number of producers directly accessing credit is still limited (see following discussion of the ICS). The involvement of the private sector is limited, however. Rather than enhancing interaction between farmers and traders, NYAMIG was formed to provide an alternative trading channel for farmers. Small traders benefited from the establishment of NYAMIG, but for medium and larger traders, NYAMIG meant increased competition (see also section 5.6).

Institutes are generally not represented as entities in the platform; membership is on an individual basis, except for farmer organisations and cooperatives. Although the Rwanda Agricultural Research Institute (ISAR) was a member of the platform, links to it were limited, as they were made through one individual. When that individual left the platform, the representation of ISAR ended. RDO, as an organisation, and the district authorities are also not represented as entities, but on an individual basis.

Table 5.6 Actors Involved in the Various Interventions

Activity	Value Chain Actors	Service Providers	Enablers
Improving cultivation practices	Farmers Maize cooperatives	Sector agronomists RDO agronomists RADA/RAB (input supply) ISAR (Agric. Research) Rural radio	Ministry of Agriculture / CIP District government
Post-harvest handling	Farmers Maize cooperatives	Sector agronomists RDO agronomists	District government
Marketing and Inventory Credit System	Farmers Maize cooperatives Small traders	Duterimbere Rural radio RDO agronomists	District government

The platform, through NYAMIG and the ICS specifically, attracted the interest of policy-makers at all levels in the platform approach and in ICSs. District government provided additional support to NYAMIG in the form of cocoons for maize storage. A national law on ICSs is in preparation.

The innovation platform was able to identify the constraints and opportunities in the maize sector, with a special bias towards the interests of smallholder farmers. Initially, the need for increased production and productivity was identified as the major objective. When production started to increase, the platform shifted focus towards access to credit, storage, post-harvest handling and marketing. Potentially, these interventions could contribute to poverty reduction and food security.

The platform members initiated a package of actions, based on the identified constraints and opportunities. The CIP served as a major opportunity, providing the platform with legitimacy and an entry point for quick action in the Rwandan context. The need for additional support (i.e. training and information) was appropriately chosen as the platform's contribution (see also section 5.5). The programme was well aligned with CIP, which is regarded as a prerequisite for

the success of interventions in Rwanda's agricultural sector. In the field of post-harvest handling and marketing, the platform developed and implemented action plans and experimented with several solutions, which were not all equally successful.

The capability of the platform to formulate and implement adequate solutions in post-harvest handling and marketing remains limited. This is partly related to insufficient ability to analyse the value chain and market systems. Later in this chapter it will become clear that there are some inadequate assumptions and flaws in the design of both NYAMIG and the ICS. The platform was not able to mobilise knowledge and information that could have supported better interventions.

Platform members allocate their time to the platform, but RIU has provided financial support for meetings and activities. So far, platform members have not allocated financial resources, and risks were insured through RIU; no additional financial resources were secured to ensure sustainability of the platform after the end of RIU's support.

The platform is still dominated by farmers (or at least has a bias towards farmers' interests), their cooperatives and other actors that have the development of smallholder agriculture as their primary objective. Time is needed to achieve a more integrated and systemic approach to sector development that also considers other actors' issues and perspectives. The question was raised whether the interests of smallholder farmers are even represented in the platform by its leaders, who generally belong to the higher wealth classes. Feedback and communication mechanisms within cooperatives proved to be inadequate; important information on decisions taken in the platform did not trickle down to "ordinary" members of the farmer cooperatives represented in the platform. The innovation platform can only function well if cooperatives are internally well organised, accountable to members and performing well. This requires attention.

Planning of activities and decision-making were driven by RIU but the assessment generally showed a high degree of consensus about the directions of the platform and its activities. However, due to the dominant role of RIU in platform management and governance, the internal accountability mechanisms have not had the opportunity to develop and mature; reporting and monitoring of activities and experiments has been a weakness of the platform. The platform is still externally driven and funded. The platform has showed a clear evolution from production-oriented activities towards post-harvest handling, access to credit and marketing. Facilitated by RIU, the platform conducted a self-assessment. Regular meetings were organised for self-reflection, under the supervision of the RIU team. The meetings were well attended by platform members, but implementation of resulting recommendations was hardly monitored. All in all, there is still little evidence that the platform would be able to function without external facilitation and to sustain a durable role in facilitating innovation in the maize sector in Nyagatare and beyond.

With regard to spin-off in terms of policy change or new innovation platforms, it is still too early to make an assessment. The platform is an indirect approach to rural development, aiming to build local capacity to innovate. There is a need for evidence that such an approach can provide development impact before it will be adopted and replicated on a larger scale. Nevertheless,

some spin-offs related to the particular activities initiated by the platform have been observed, including the design of a draft law for ICSs. Initiatives related to ICSs for other crops and in other areas have been launched, as well.

5.5 Increasing Productivity and Improved Storage and Post-harvest Handling Impact Pathway

Many maize farmers in Nyagatare district have been benefitting from the CIP, which started its effort to enhance agricultural production in 2007. At the initiation of the Maize Innovation Platform in 2008, many farmers still used high quantities of local seeds and inadequate spacing, while fertilizer use was limited. The capacity of government agricultural extension services was insufficient to reach vast numbers of farmers. Therefore, the Government of Rwanda and RIU decided to join efforts to boost maize production in Nyagatare through extensive support to the CIP. A major feature of CIP is the distribution of subsidised fertilizers and improved seeds to smallholder farmers.

The activities under this second impact pathway contributed directly to the objectives of CIP. In November 2009, the Maize Innovation Platform, in collaboration with RDO and the agriculture department in Nyagatare district, launched a campaign to promote good crop husbandry, particularly targeting proper use of seeds and fertilizers in Nyagatare district, Eastern Province.

PHOTO: REMCO MUR

Maize bags

Table 5.7 Impact Pathway Related to the Objective to Increase Productivity and Improve Storage and Post-harvest Handling

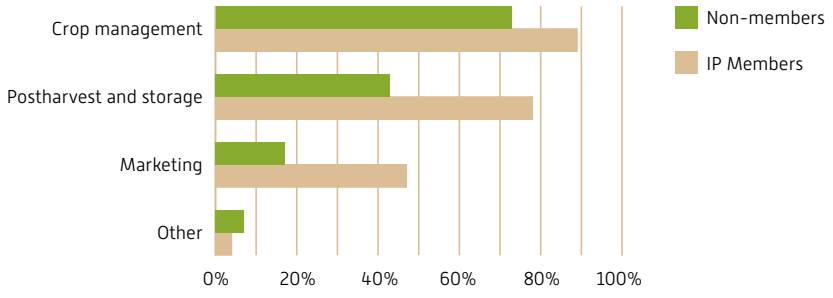
Input	Results and Impact			Spin-Off
Resources invested in:				
Introduction of new maize variety Demonstration plots and farmer learning events Training for farmer leaders / farmer facilitators Communication and radio dissemination Maize innovation day	Farmers trained Improved access to seeds and inputs Capable farmer facilitators Improved drying facilities	Application of new techniques, seeds and inputs Improved quality of stored maize Increased production and productivity	Improved food security Increased income from maize sales	Other farmers using new technologies

Demonstration Plots and Training

RIU-Rwanda supported the maize platform to set up demonstration plots at sector and cell levels, and to train farmer facilitators. Farmer facilitators were identified and trained to follow up these demonstration plots and share their knowledge on best agricultural practices with other farmers. In most cases, farmer facilitators were leaders of maize production cooperatives. RDO and government sector agronomists facilitated the training sessions. RIU contracted rural radio in Nyagatare to broadcast related messages.

Based on the assumption that information is passed on to cooperative members, the programme's focus was mainly on training cooperative leaders, who would than provide training and information to their constituencies. The programme has trained at least 124 leaders of cooperatives affiliated with the platform. Over 90% of surveyed platform member households received training. For non-platform members this was approximately 75%. More than 60% of platform members mentioned that they received training through the cooperative, compared with 42% of the control group. The sector agronomists are also major providers of training, both to the platform members and to the control group. The platform members indicated that

Figure 5.2 Training Received in the Last 4 Years



they received training from RIU, although RIU itself did not provide training. In the workshops and focus group discussions it became clear that farmers had difficulty distinguishing between the activities of RIU, the innovation platform, CIP and RDO agronomists. A major reason is that these activities are often interlinked: RIU is connected to the platform, RDO is the major service provider for CIP as well as for RIU, and RIU and the platform adhered to the objectives of CIP. Non-platform members also received training, possibly from RDO, but also from other NGOs and government agronomists, under the larger umbrella of the CIP. For over two-thirds of the households, the trainings were provided to the heads of the households, predominantly men. Training outside the platform did show a stronger representation of women heads of households, than the training provided within the platform.

The training most offered to producers has been on crop management. Training in post-harvest handling has been reported by 43% of the control group while 77% of innovation platform members have received post-harvest training. This training followed the activities covering crop management; it was a need which emerged after yields increased but with a continuing lack of adequate handling and marketing. Again, marketing training is more prominent for the platform members, through specific activities such as NYAMIG and the ICS.

To support these training activities, special learning events were organised. According to the RIU end-of-project report (2011) "Farmer Learning Events" are special field gatherings where participants share information on what they have done, key achievements and challenges. They were organised by RIU to foster more interaction between farmers, researchers and extension services with the goal of enhancing demand for research outputs and inducing change in the ways researchers and extension services work with farmers. Learning events related to maize production were organised by the Maize Innovation Platform on the following topics:

- *M081*: the new early-maturing maize variety suitable to the Nyagatare dry area (April 2009);
- Achievements and challenges related to the CIP and the role of the platform in improving access to knowledge (December 2009).

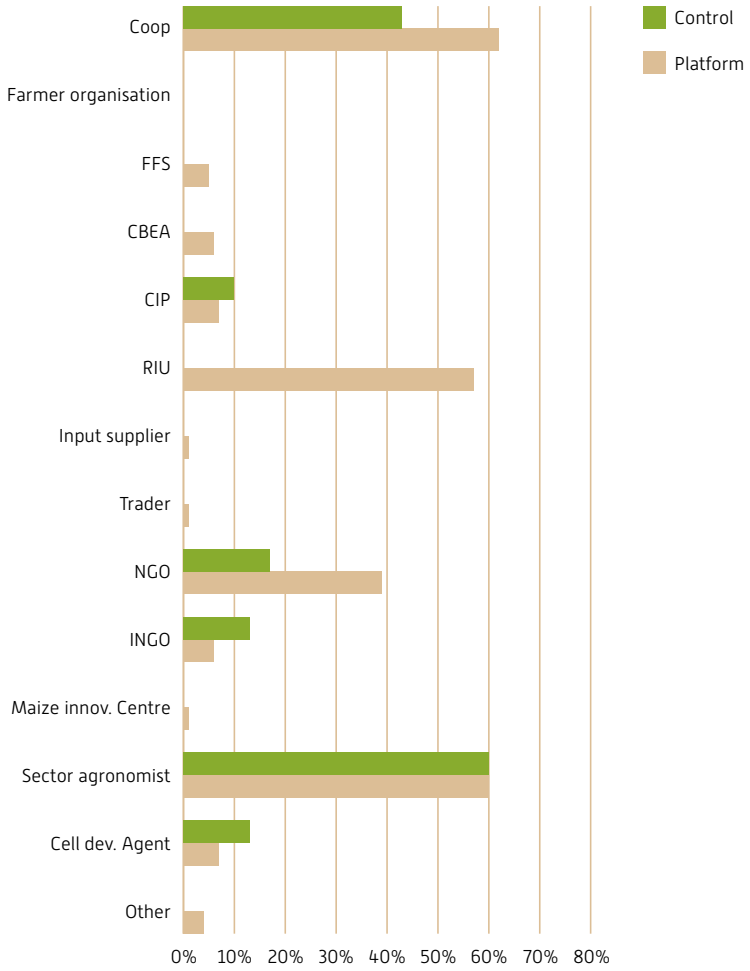
Radio Broadcasting

In March 2010, RIU signed a contract with the National Broadcasting Agency (ORINFOR) to prepare a weekly radio broadcast on RIU activities for local radio stations. The following information was disseminated through Nyagatare Community Radio:

- Coverage of the Maize Innovation Platform workshop on 28 October 2009: an interview with the RIU country coordinator was broadcast on national radio, with the support of community radio;
- A special 45-minute radio programme was produced and broadcast with the participation of the chairman and members of the Maize Innovation Platform, as well as the district representative who participated in the maize platform workshop;
- Farmer learning events were conducted.

Every Thursday, community radio broadcasts messages related to the maize platform, often related to improved cultivation practices.

Figure 5.3 Training Providers to Smallholder Farmers



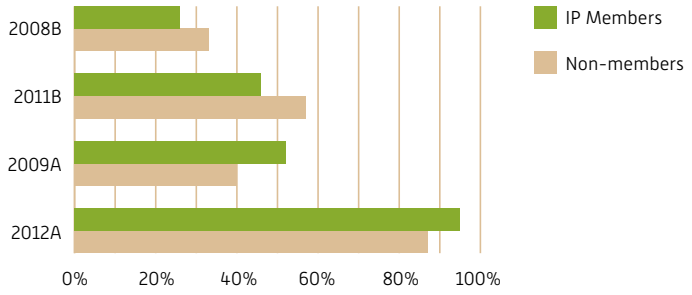
Introduction of New Maize Variety

In collaboration with ISAR, RIU supported the introduction and the first multiplication (7 ha) of the *M081* early-maturing maize variety, specifically developed by ISAR for the relatively dry conditions in Nyagatare district. This was inspired by RNRRS outputs related to the introduction of new varieties and methods to boost maize production. The chairman of the platform performed the first multiplication. However, adoption rates were poor. The impact evaluation showed that in 2011 there were no farmers using the variety. The productivity of the variety was reported to be lower than other varieties used.

Changes in Farming Practices

There have been major changes related to maize production in Nyagatare district between 2008 and 2012. The percentage of farmers growing maize, among both platform members and non-platform members, has increased dramatically for both the long and short seasons.

Figure 5.4 Percentage of Households Growing Maize Before (2008–2009) and After (2011–2012) the RIU Intervention in the Long (A) and Short (B) Rainy Seasons



The rate of producers cultivating maize in the long season increased to 94.5% for the platform members and 87.3% for the control group. Beans remained the second most important crop, generally regarded as complementary to maize production.

Table 5.8 Land Ownership and Use among Platform Members and Non-members

	Control Group 2009A	Control Group 2012A	IP members 2009A	Members 2012A
Average area owned (are)	0.56	0.56	0.96	1.06
Average area rented (are)	0.06	0.18	0.12	0.20
Average area cultivated (are)	0.60	0.72	0.98	1.17
Average area maize cultivated (are)	0.08	0.20	0.20	0.47
% of cultivated area allocated to maize cultivation	13%	28%	20%	40%

The questionnaires showed that maize has become the most important crop for food security among platform members. For non-platform members, beans are still largely considered the priority crop for food security, with maize indicated as the second most important crop. Maize has also become the most important cash crop in the last 12 months, followed by sorghum and bananas for innovation platform members. For the control group, a similar pattern is observed, with bananas ranked second.

Initially, CIP and RIU focused on improving cultivation practices, including adjusted planting distance, land preparation practices, fertilizer use and the use of improved varieties. Almost all respondents reported changes in planting distance and land preparation techniques, with limited difference between innovation platform members and non-members. The use of improved varieties increased, especially among platform members. In season 2009A, most farmers were still using local varieties for production, whereas the majority now use the hybrid *ZM607*. For season 2009B, the change is less drastic, with more farmers continuing the use of their own local variety. The adoption of the *M081* variety, developed by ISAR and introduced through the platform, has been very limited. As changes are similar for both the control group and the platform members, it can be assumed that changes in seeds used are linked to the CIP program.

An increase in the use of urea, Di-Ammonium Phosphate (DAP) and manure is observed for both platform members and non-members, especially for the long rains season. Currently, approximately 40% of farmers use urea, DAP or organic fertilizers. Change in fertilizer use may imply a change from no use to use, but it also might mean a change in quantities, timing, etc. The use of animal traction for land preparation has not changed over the last four years.

Possibly as a result of larger areas under cultivation and different land preparation techniques, there has been an increase in employment of casual labourers for agricultural tasks, especially among platform members in season A, with an increase of about 40% and just over 20% for the control group.

Impact on Production and Productivity

The increase in land allocated to maize among platform members was much higher than among non-platform members. It should be noted that platform members have more land on average than non-platform members and that this makes it less risky to allocate larger proportions to a certain crop.

An increase in production volumes is observed among platform members as well as among non-platform members (Figure 5.6). Part of the increase can be attributed to increased areas allocated to maize production, especially among platform members (Figure 5.5). The other part can be attributed to increased productivity (Figure 5.7). This applies more for non-platform members than for platform members; productivity among platform members increased from 1.5 to 2.2 tonnes/ha for the short season and for the long season the average yield increased from 1.8 to 2.2 tonnes/ha.

Among non-platform members, however, yields increased from 1.1 to 2.4 tonnes/ha, which means that non-platform members are now achieving yields during the long season similar to yields of platform members. In the short season, platform members have higher yields: 2.2 tonnes/ha compared with 1.3 tonnes/ha for non-members.

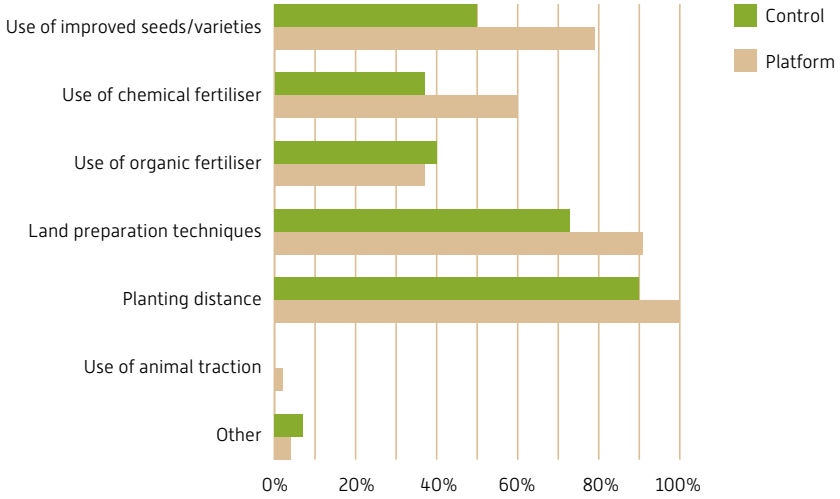
Table 5.9 Relative Changes in Maize Production and Productivity

	IP members		Control group	
	Season B	Season A	Season B	Season A
Increase in maize production area	84%	31%	12%	12%
Increase in production (total volume)	139%	36%	87%	63%
Increase in productivity (production per ha)	50%	21%	83%	123%

Changes in Post-harvest Handling and Storage Practices

Storage of maize in order to sell it later for a better price has increased among both platform and non-platform members. But even though this practice is growing in popularity, over half of the surveyed population still only sells maize directly at harvest. During the 2012A season, 28% and 23% more maize was stored than in the 2009A season, for the platform and non-platform

Figure 5.8 Major Changes in Production Practices Indicated by Producers



members, respectively. This increase is smaller than the increase in maize production, indicating that a large proportion of the produced surplus is still marketed upon harvest. Most farmers who do store maize sell their maize one or two months after harvest, only rarely three or four months after harvest.

Most households store their maize at the household level rather than at the cooperative level. Quantities stored at the cooperatives are larger and may be sold later to institutional buyers such as World Food Programme (WFP) or large traders. Due to larger yields at the platform

Figure 5.9 Changes in Post-harvest Handling and Storage

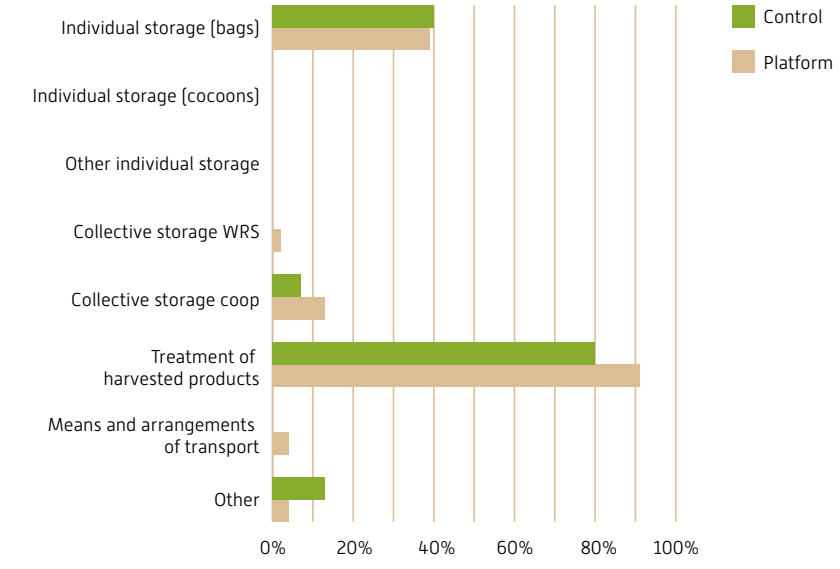


PHOTO: GENEVIÈVE AUDET-BELANGER

Maize drying

level and relatively small storage capacity at the household level, the cooperatives offer a viable option to farmers to store their harvest. While no producers of the control group stored at the cooperative level in 2008-2009, they had started to do so by the time of the workshop, although in small quantities, which is consistent with the observation that their production volumes are lower than for platform members. All surveyed producers reported having a percentage of post-harvest losses below 5%.

About 55% of platform members and 43% of non-platform members reported processing their maize in 2008. A major shift in practices occurred over the last four years, with 95% of farmers currently processing at least part of their harvest of maize. A larger share of platform members reported using private large-scale mills (84%) than small individual mills (60%), whereas 76% of the control group reported using a small individual mill and 55% used a private large-scale mill. This could be due to the larger quantities harvested by platform members as well as proximity to the industrial mills. Collective processing is very rare and individual beer brewing seems to be decreasing, as maize is becoming increasingly important for food security.

Over time, the quantity of maize consumed at the household level has increased, with between 10% and 50% of the harvested maize kept for consumption and a larger number of farmers not producing maize for season B. Farmers in the control group, across seasons and the year, tend to consume a larger share of their maize, with producers consuming over 50% of their harvests.

Conclusions

Between 2009 and 2012, maize production has increased in Nyagatare district. This applies both for households affiliated with cooperatives that are members of the platform as well as for those affiliated with non-member cooperatives. The increase in production by platform members is a result of increases in the production area as well as increases in productivity. The increase in production by non-platform members is mainly due to increases in productivity. Increases in productivity result from improved cultivation practices and the adoption of new varieties and use of fertilizers. These practices have been promoted under the powerful, government-initiated CIP, which has probably had the most influence on production levels. Stakeholders identified RDO as having contributed most to the changes. In addition to being the preferred implementing organization of CIP, RDO has also been the implementing partner of RIU in Nyagatare. Although it is very likely that, through its support to CIP, RIU has contributed to increased production and productivity in the district, it remains hard to attribute a certain percentage of the change directly to the programme. This is even more the case because the RIU programme, following good development practice, has aligned its intervention closely with the CIP. The role of the platform and RIU was limited to training and demonstrations. The distribution of subsidised fertilizers and improved seeds, a major element of CIP, was not part of the RIU-supported and funded activities. In all, since 2008, the maize production and productivity of maize have increased for cooperative members, which can be attributed to the CIP and its affiliated projects and programmes.

5.6 NYAMIG and the Inventory Credit System (ICS) Impact Pathway

RIU-facilitated research identified inadequate trading and marketing systems as key bottlenecks for maize development in Nyagatare district. A Participatory Market Chain approach was used to stimulate networking and promote access to markets for maize producers in Nyagatare district. (www.researchintouse.com). The limited power of farmers and the relatively low prices they obtained for their harvested maize were identified as major constraints. RIU-Rwanda supported the process of establishing a Maize Innovation Platform Investment Group (NYAMIG Ltd.), which was regarded as the business arm of the platform. This was an attempt to empower

farmers in the maize value chain and to provide them with a better bargaining position. The aim of NYAMIG was to take a leading role in collecting, purchasing and marketing local maize, in order to ensure competitive prices for maize producers and to improve maize supply to processing units and institutional buyers. It was expected that 25,000 farmers would benefit from higher prices and a better organisation of maize commercialisation in the maize value chain. With RIU support, NYAMIG was formed and registered as a commercial company in April 2009.

Table 5.10 Impact Pathway Related to the Nyagatare Maize Investment Group (NYAMIG) and the Inventory Credit System (ICS)

Input	Output	Outcome	Impact	Spin-Off
Resources invested in:				
Facilitation of the creation of NYAMIG Awareness raising of farmers on ICS Facilitation of the establishment of the warrantage system Subsidised collective storage facilities Subsidised drying yard and sheds	Enhanced awareness and understanding of NYAMIG and the ICS Functioning ICS in place Enhanced post-harvest capacity (producers)	Profitable business (NYAMIG) Increased volumes of stored and sold products through ICS Improved access to credit Access for farmers to new markets and services	Higher prices for products Increased income	MFI is replicating ICS in other areas MFI is replicating ICS for other products Other MFIs are replicating ICS Improved/new government policies on ICS New clients working with cooperatives

In September 2011, NYAMIG counted 35 shareholders, including 14 maize production cooperatives, 19 individual maize farmers and processors, Rwanda Development Investment (RDI) (an investment wing of the NGO RDO) and Duterimbere, a micro-finance institute (MFI), holding a total of 90 shares. Although NYAMIG is regarded as the business arm of the platform, only a small number of platform members actually hold shares in NYAMIG. Duterimbere and RDI are major shareholders in NYAMIG (with 22% and 30% of shares, respectively). NYAMIG started operations in 2010 (season 2010A). The cost of a share at the creation of NYAMIG was FRw 120,000 (GBP 119). The total shares provided NYAMIG with a total capital of FRw 10,800,000 (GBP 10,735). RIU supported NYAMIG with additional capital of FRw 31,250,000 (or GBP 31,063). This allowed NYAMIG to purchase and handle 250 tonnes of maize during its first season of operation. Mainly due to this capital injection, the value of a share increased to FRw 550,000 (GBP 546).

The Inventory Credit System: How It Works

Together with Duterimbere, NYAMIG established an inventory credit or warrantage system. ICSs are developed in response to farmers' income instability due to price fluctuations resulting from liberalisation. Since prices tend to be low during harvest periods and to rise subsequently, ICSs can provide a solution. Through a credit to satisfy urgent cash needs, and using the stored product as collateral, farmers can postpone the moment they sell their produce to a time when prices are higher.

The maize marketing through NYAMIG is very much interwoven with the ICS, which started in 2011. Almost all transactions at NYAMIG are now related to the ICS. The warrantage system involves the following platform members and actors:

Table 5.11 Actors in the Inventory Credit System and their Roles

Actor	Role
NYAMIG	Collection, treatment, quality control, storage, sales, repackaging
DUTERIMBERE	Pre-financing to farmers of 60% of maize stored at NYAMIG as a credit
Maize cooperatives	Production of maize through members, post-harvest handling, collection, packaging, delivering to NYAMIG
Traders	Sourcing, collection of maize, selling to NYAMIG
Individual farmers	Production of maize, post-harvest handling, packaging, delivering to NYAMIG
Buyers (processors, institutional buyers)	Buying from NYAMIG
WFP P4P	Buying from NYAMIG
Shareholders	Investment in NYAMIG (FRw 120,000 or GBP 119 per share)
RIU	Technical support, financial support to NYAMIG

The ICS basically works as follows:

1 ***Harvest and post-harvest:*** After harvest, farmers dry maize and remove the seeds from the cobs.

2 ***Collection and storage:*** Farmers/Cooperatives/Traders store at NYAMIG central storage (in Nyagatare town) after quality control and treatment. Transport is the responsibility of the supplier.

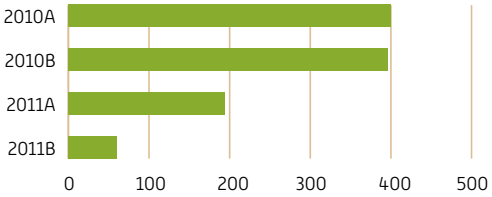
3 ***Quality control:*** NYAMIG ensures quality control, i.e. humidity control and visual inspection. If the maize is accepted, suppliers receive a certificate which entitles them to obtain a loan at Duterimbere.

4 ***Credit:*** A client has to open an account at Duterimbere. Duterimbere pays a maximum of 60% of the current market price of stored maize to suppliers, through their accounts at the MFI. This provides suppliers with cash directly after harvest. The first payment is considered to be a loan, at 1.5% interest per month. In case of cooperatives, the loan is provided to the cooperative and the cooperative is responsible for paying the members (often in cash because, in general, individual members don't have accounts).

5 ***Price setting at storage:*** Market price is established through information from different sources, including direct information from local traders, e-soko (the Rwandan agricultural commodity price database) and other sources.

6 ***Selling:*** NYAMIG identifies potential buyers and sells maize. By selling in large quantities, at a later stage, and with guaranteed quality (per the Rwanda Bureau of Standards), the price of the product is expected to be higher than the market price at harvest. The sale price is negotiated between NYAMIG and the buyer. The joint marketing committee of NYAMIG and Duterimbere decides to whom to sell, at what moment and at what price. Producers have no direct influence on these negotiations and decisions, even though they are technically still the owners of the product.

Figure 5.10 Quantities Sourced by NYAMIG (in tonnes)



7 ***Final payment:*** After sale, farmers are paid the remaining 40% of the value of their produce at harvest, plus the difference with the actual sales price. FRw 2/kg (NYAMIG fees) and the storage costs are deducted. The farmers also pay 1.5% interest per month on the loan to Duterimbere. Storage costs at NYAMIG include fumigation, labour, sacs and other storing materials, other treatments required, and losses; they have been FRw 22/kg (GBP 0.022) and 18 FRw/kg (GBP 0.017) respectively for the 2011A and 2011B seasons.

Inventory Credit System: Results

Collective marketing through NYAMIG began for season 2010A (harvest January 2010). During the first two seasons of collective marketing, NYAMIG managed to negotiate contracts with the WFP through the Purchase for Progress (P4P) project. For the 2010A season, a contract for 400 mt was agreed upon and NYAMIG was able to source sufficient maize. Maize was bought at FRw 129/kg and sold for FRw 134/kg to WFP. In the 2010B season a contract for 800 mt was agreed upon, but NYAMIG was only able to source 396 mt of maize. This was a reason for WFP not to establish new contracts with NYAMIG. During the 2010B season, NYAMIG bought maize at FRw 134/kg and sold to WFP for FRw 139/kg. In season 2011A, NYAMIG bought maize at FRw 170/kg and sold for an average price of FRw 207/kg. In season 2011B, NYAMIG bought maize for FRw 200/kg and sold for FRw 206/kg.

The volume of maize sourced decreased significantly for seasons 2011A and 2011B. One major reason for this could be the relatively high market prices for maize compared to 2010. It appears that maize prices at harvest in 2010 and early 2011 (season 2011A) were low compared to the foregoing years (see Figure 5.11.) These low prices might have been an extra motivation for farmers and traders to sell through NYAMIG, which they expected to offer an acceptable price. When prices at harvest in 2011B appeared to be higher again, farmers were more eager to sell directly to traders; hence, NYAMIG had difficulty sourcing sufficient supply. This continued during season 2012A. Selling through NYAMIG and the ICS is based on the assumption that maize prices will increase significantly after harvest. However, the increase is not known in advance and

Box 2. Purchase for Progress (P4P)

Through P4P, WFP's demand provides smallholder farmers in 21 pilot countries with a greater incentive to invest in their production, as they have the possibility to sell to a reliable buyer and receive a fair price for their crops. It is envisioned that in the wake of WFP purchasing in a more smallholder-friendly way, other buyers of staple commodities, including governments and the private sector, will also increasingly be able to buy from smallholders.

At the same time, P4P invests in capacity building at country level in areas such as post-harvest handling or storage, which will yield sustainable results in boosting national food security over the long term. The five-year P4P pilot (2009-2013) rests on three pillars:

1. ***Demand:*** *Through P4P, WFP tests innovative ways to buy staple food and promote marketing opportunities for smallholder farmers.*
2. ***Supply:*** *P4P links WFP's demand with the expertise and resources of partners who support farmers to achieve better yields, reduce their losses after the harvest and improve the quality of their staple crops.*
3. ***Learning and Sharing:*** *P4P will gather and share lessons on effective approaches to connect smallholder farmers to markets in a sustainable way and share them widely with stakeholders.*

Source: http://www.wfp.org/purchase-progress/overview

PHOTO: GENEVIÈVE AUDET-BELANGER

Maize bags ready for transport

depends on many factors, such as levels of production, and national and regional food prices. Selling through the ICS implies a degree of uncertainty, and a delay in access to (a part of) cash for the crop. Thus, an important question to answer is at what market price at harvest farmers will consider selling through the ICS to be a useful option. A related question is how much profit farmers expect to make through the ICS, i.e. how they assess price fluctuations after harvest.

Table 5.12 Maize Inventory Credit System: Some Data

Year	2010A	2010B	2011A	2011B
Volume traded (tonnes)	400	396.5	194	66.7
Buying price per kg (FRw)	129	134	170	200
Selling price per kg (FRw)	134	139	207	206
Storage and handling costs per kg (FRw)	-	-	22	18
Profit for NYAMIG per kg	2	2	2	-12
Monthly interest (1.5%* 60% of sales at market price)	-	-	1.5	1.8
Added value per kg (FRw) (supplier)	3	3	19.5	-7.2[2]
Number of cooperative suppliers	3	5	8	1
Individual suppliers	9	12	21	8
Total number of direct beneficiaries (individuals)[3]	186	263	430	57
Average volume per supplier	33 mt	21.7 mt	6.7 m	7.4 mt
Average volume per individual	2.1 mt	1.4 mt	0.45 mt	1.1 mt
Average profit per individual (FRw)	6,300	4,200	8,775	-133
Share of supply sourced at cooperatives	7.5%	31%	20%	5.4%

NYAMIG sourced maize from individuals as well as cooperatives. For the seasons it has been operational, the largest volumes came from individual farmers and local traders. The share of total supplies to NYAMIG from cooperatives varied from 5.4% (2011B) to 31% (2010B). Considering that most smallholders do not deliver directly to NYAMIG, but mainly through their cooperatives, the added value of their involvement in the ICS is limited.

The average volume of production for platform members is 1041 kg of maize (season 2012A). Famers store part of the harvested maize themselves, both for consumption and for selling at a later stage. A portion of the harvested produce is sold at harvest. The latter share could potentially be sold through the ICS in order to provide the household with a better price. The average amount sold at harvest for season 2012A was 311 kg. If the difference between the market price at harvest and after three months of storage is FRw 37 (an increase of approximately 20%, the highest rate obtained so far, during season 2011A), farmers gain FRw 19.5 per kg. For 311 kg they can make a profit of FRw 6,064 or approximately GBP 6.50 through the ICS. The question is whether farmers are prepared to wait three months to gain an extra GBP 6.50 on their marketable product. Their immediate need for cash and the uncertainty of how much they will gain through the system do influence their willingness and ability to sell through the ICS. The decision to sell through ICS highly depends on the farmers' confidence in the capability of NYAMIG to identify markets and make beneficial price agreements. These questions need to be addressed by NYAMIG management.

[2] Maize sold four months after harvest.

[3] Based on information using actual numbers and estimates of members of cooperatives.

The above Figure shows the wholesale prices for maize on the Kigali market. These can be used as a proxy for the development of farmgate prices in Nyagatare between 2009 and 2012. The Figure explains clearly why season 2011A was a good year for the ICS: wholesale prices at harvest (February 2011) were approximately GBP 155 per tonne. Four months later, prices had increased to GBP 260 per tonne, an increase of 68%. During this period, NYAMIG realised a price difference of 20%. As shown in Figure 5.11, the price fluctuation in the first half of 2011 was much higher than in other years. Therefore, NYAMIG could make more profit during such a year in order to compensate for years in which it can make less profit due to smaller fluctuations. Two questions arise: how high this difference (and thus the profit) needs to be in order to compensate for the years with smaller margins, and whether producers are ready to sell their maize through the system for a longer period (i.e. multiple years).

Profitability of the Business

The profit margin taken by NYAMIG is relatively low. This margin should provide NYAMIG with capital to expand its business and to cover the possible losses it may incur during seasons in which prices do not increase as expected. Because NYAMIG is taking the risk of price speculation, it is uncertain whether this margin will be sufficient over a longer period of time. In addition, up to now, some of the costs have been covered by RIU (e.g. 50% of the salary of the manager is paid by RIU). These costs are currently not included in the handling costs transferred to the producers. If NYAMIG wants to develop a sustainable, profitable business by engaging in the ICS, the business model needs to be reviewed, addressing the above-mentioned concerns.

Running an ICS requires sound business capacities and access to market information, as it entails a form of speculation. At the time of the evaluation, NYAMIG did not have sufficient capacities to properly manage the business and the ICS in a sustainable way. In order to make NYAMIG a viable and sustainable enterprise, serving business as well as development objectives, the business model needs revision and the capacity of management needs to be enhanced.

NYAMIG and the ICS offer farmers an alternative marketing channel. They can also increase awareness among smallholders about their position in the value chain and about market prices and dynamics. This can occur both through the participation of farmers in the credit scheme and also through information provided through radio broadcasting and other information channels.

However, the volume of maize marketed through NYAMIG and the ICS is still low: in season 2010A it was 1.5% of total production in the district and in 2011A it was 0.5%. The impact is probably limited to those directly participating in the system and, even for these farmers, the benefits proved limited.

New Experiments with Credit Systems

The ICS is intended to address the need for cash at harvest, but is not able to sufficiently address the need for cash *before* harvest and thus it does not inhibit farmers selling their immature produce before harvest (locally referred to as *Kwotsa Imyaka*). Therefore, the platform piloted two additional systems to enhance access to finance for agricultural producers before harvesting.

The first system involved an interest-free advance loan on expected harvest by NYAMIG to the producers or cooperative, with the harvest – estimated by NYAMIG and sector or RDO agronomists – serving as collateral. After harvest, the borrower was to pay back in kind (maize) to NYAMIG. During the pilot, NYAMIG provided a total of FRw 1,300,000 (GBP 1292) of loans to 16 cooperatives and individuals. However, pay-back rates were disappointing. Because of the low pay-back rates, the system was discontinued after a single season.

At the end of 2011, NYAMIG and Duterimbere introduced a second financial service to producers, called *Humura-Muhinzi* ("Farmer, do not worry"). *Humura-Muhinzi* is a financial service linked to the warrantage system, which allows farmers to take out credit a month before harvest, paying it back, with interest, after harvest when they deposit their product at NYAMIG through the warrantage system. The product will be warranted by the estimated harvest of the maize in the field. The credit product is provided specifically in December/January for season A and May/June for season B. This specific time is suggested for two reasons: first, the maize crop will have grown big enough to estimate the production fairly accurately, and second, it is during these times that farmers face important cash challenges, as these periods correspond to the need to pay school fees, and to the end of the year feasts. *Humura-Muhinzi* was piloted in the 2012A season, targeting three cooperatives (CODAR, COPAMA, CoImaga) and three individual farmers.

PHOTO: GENEVIÈVE AUDET-BELANGER

Market

5.7 Impact on Marketing

Although the overall impact of NYAMIC has been limited, some major changes related to maize marketing have been observed. Farmgate prices of maize at harvest have increased significantly over the last four years, an increase benefiting both members and non-members. Farmers are now obtaining prices higher than FRw 100 at harvest and FRw 150 after harvest. Twenty percent of the control group and 34% of the innovation platform members obtain prices higher than FRw 150/kg. In 2008, this was 0% for both groups. More farmers get higher prices, and the range of prices offered is wider, with prices sometimes peaking around FRw 200 (these figures have not been corrected for the estimated 17% inflation rate in 2009-2011, www.indexmundi.com). In addition, the percentage of farmers selling maize has increased, both among platform and non-platform members.

It is hard to draw any conclusions about the attribution of these changes to RIU or the platform. Regional demand and trade arrangements have probably most influenced the price increase. The demand for maize in neighbouring countries is high and productivity is insufficient, which pushes international traders to source maize in Rwanda for South Sudan, Democratic Republic of the Congo, Kenya, Somalia, etc.

Table 5.13 Maize Sales in Nyagatare

		2008B	2011B	2009	2012A
IP Members	Percentage of producers selling maize at harvest	6%	16%	18%	30%
	Average product sold at harvest (kg)	250	578	966	972
	Average price obtained (FRw/kg)	98	135	89	148
	Percentage of harvested product sold at harvest	57%	61%	71%	65%
	Percentage of producers selling maize after storage	12%	24%	18%	50%
	Average product sold after storage (kg)	477	1,227	671	1,006
	Average price obtained (FRw/kg)	89	179	89	157
	Percentage of harvested product sold after storage	69%	78%	65%	73%
Non –members	Percentage of producers selling maize at harvest	7%	20%	7%	30%
	Average product sold at harvest (kg)	125	118	225	232
	Average price obtained (FRw/kg)	75	117	75	135
	Percentage of harvested product sold at harvest	63%	53%	67%	55%
	Percentage of producers selling maize after storage	7%	23%	7%	47%
	Average product sold after storage (kg)	185	234	600	274
	Average price obtained (FRw/kg)	75	177	95	159
	Percentage of harvested product sold after storage	73%	68%	85%	50%

5.8 Spin-off

NYAMIG and the ICS are perceived as very successful and promising interventions by many stakeholders. First attempts at scaling out and replication have been initiated. In Nyagatare, NYAMIG and Duterimbere opened up the ICS for beans for the season 2011B. Nine individuals and one cooperative stored 107 mt of beans at a market price of FRw 250/kg. At the time of the assessment, the beans were still in storage. Duterimbere is also expanding the ICS to other districts, working with cooperatives that have sufficient storage capacity.

On the national level, interest in the ICS was raised at several different ministries. A draft law on ICSs has been developed and is expected to pass the parliament. District agronomists from the entire country visited Nyagatare to be exposed to the system. At the provincial level, the governor has shown interest in the system and has facilitated an exchange visit for all mayors to Nyagatare. Finally, a national initiative has been launched with support of RIU and H2O Venture partners, with the aim to establish a national ICS. At the same time, the Rwanda Grain and Cereals Corporation (RGCC) has been established as an attempt to improve market access for smallholders in the whole country.

5.9 Attribution to RIU

Given that very few farmers benefit directly from NYAMIG and the ICS, its impact has been limited. The major impact on income is due to increased production. Platform members managed to increase their production mainly as a result of expanding the area allocated to maize. However, the production of non-platform members has increased as well.

Table 5.14 Maize Production among Platform and Non-platform Members

	Short Season				Long Season			
	Production 2008B (kg)	**Production 2011B** (kg)	**Absolute Increase** (kg)	**Relative Increase** (%)	**Production 2009A** (kg)	**Production 2012A** (kg)	**Absolute Increase** (kg)	**Relative Increase** (%)
IP Member	393 kg	941 kg	548	139%	766	1040	274	36%
Non Member	141 kg	263 kg	122	87%	245	400	155	63%
Difference	252 kg	678 kg	436 kg	-	521 kg	640 kg	122 kg	-

Data show that the absolute increase in production among members has been 548 kg and among non-members only 122 kg for the short season, a difference of 436 kg. The difference in relative increase is 52% for the short season B (i.e. the difference in relative production increase between the platform members and non-members). For the long season, the absolute increase in production is higher among platform members (274 kg compared with 155 kg, a difference of 122 kg). However, the relative increase is higher among non-platform members: 63% in contrast to 36%.

The impact evaluation is made more difficult by the presence of the powerful CIP, which is responsible for the dissemination of subsidised fertilizers and seeds. The RIU contribution to increased production was mainly focused on training, extension and provision of information.

Although these services are important, without improved access to fertilizers and seeds the RIU impact would have been very limited.

Another problem in the assessment is that the baseline situation of platform members appeared different than the situation of non-members. Platform members had access to more land, and the production at the baseline (seasons 2008B and 2009A) differed significantly between the two groups. Hence, it is very difficult to draw conclusions on the attribution of change to RIU.

5.10 Investments

The annual investments made by RIU in the Nyagatare Maize Innovation Platform are provided in Table 3.15. Total investments from 2008 to 2012 are GBP 313,391. Investments included the facilitation of the platform and its activities, the services provided by different consultants and local organisations, mainly RDO, as well as investments in hardware and the purchase of maize during the first season of operation of NYAMIG.

Table 5.15 RIU investments in the Nyagatare Maize Innovation Platform, 2008-2012

Year	2008	2009	2010	2011	2012
FRw	104,252,990	51,609,966	98,642,237	37,562,154	5,653,986
GBP	109,740	54,326	103,834	39,539	5,952
Cumulative (GBP)	109,740	164,066	267,900	307,439	313,391

5.11 Conclusions and Lessons Learned

The major premise for investing in innovation platforms is that agricultural innovation results from stakeholder interaction, and that it comprises technical, organisational and institutional components. The major question of this impact assessment was whether innovation platforms are useful mechanisms for promoting agricultural sector development. The innovation platform in Nyagatare focused on the maize sector and included technical intervention in maize production, as well as innovation in the maize value chain. This combination of promoting technical and market innovation through multi-stakeholder interaction may not be unique, but it does provide an interesting example for market-driven interventions that potentially provide financial triggers to change.

The Nyagatare Maize Innovation Platform was the first attempt to catalyse agricultural development through a more systemic and multi-actor approach in the district. RIU managed to bring different stakeholders in the maize sector together within the platform to enhance interaction, facilitate joint identification and analysis of constraints and opportunities, and develop joint action plans. It is still too early to assess the sustainability of the programme's efforts to establish the capacity to innovate among the stakeholders in the maize sector in Nyagatare. Some positive changes have been observed, related to the different impact pathways; there are also clearly certain flaws in the design of the particular interventions. Some of these flaws are probably inherent to the experimental nature of the approach. Others are serious problems and

weaknesses in the analysis, design or implementation phase. This chapter will present the major conclusions and lessons derived from four years of experimentation by RIU in Nyagatare district and three years of experience with the Maize Innovation Platform.

The Capacity to Innovate: Enhancing Multi-stakeholder Interaction

Since its creation, the Maize Innovation Platform has increased its membership, but the actual actions identified and implemented through the platform involve a limited number of stakeholders. The platform's focus has been very much on enhancing the position of producers, which had been less favourable than the positions of other actors. At the same time, focusing on the constraints of one group of actors entails the risk of excluding others and of taking a narrow view on certain problems or opportunities. The Maize Innovation Platform has had a clear focus on two issues: improving cultivation practices for improved production and promoting the ICS for better prices and access to markets for smallholder producers.

Maize cooperative

PHOTO: REMCO MUR

The engagement of smallholder producers in the platforms has been indirect, through the leaders of farmer cooperatives. This indirect engagement can only be successful if representation, accountability and feedback to constituencies are all well-regulated. For producer organisations and cooperatives, this implies well-functioning organisations. In the case of Nyagatare, cooperatives are often young and immature and have inadequate management and leadership capacities.

RIU facilitated the continuous process of needs identification and analysis, action planning, and self-assessment. The local NGO, RDO, played an important role in the implementation of platform activities. Neither facilitation tasks nor capacities have been transferred to platform participants, and as such the platform still largely depends on outside facilitation services by RDO. The challenge is to continue platform meetings and activities and build the capacity to facilitate the multi-stakeholder interaction. It is estimated that the facilitation of an innovation platform requires half of a full time equivalent employment position for a period of two years, after which the capacity and responsibilities are to be transferred gradually to the platform itself.

Improving cultivation practices provided an obvious opportunity for action, as there was a need to reinforce the efforts of the CIP. Generally, the platform was able to establish a strong collaboration with CIP – and its main service provider, RDO – which is the main implementing agent of RIU. The platform activities aiming at improving agricultural production are well aligned with CIP. During the last four years, production has increased significantly as a result of improved cultivation practices and expansion of the maize area. Through the CIP, it is likely that RIU has contributed to this change. However, as explained earlier, it is not possible to quantify the contribution.

Over time, the platform's focus shifted from improving productivity to marketing and access to financial services. NYAMIG was created and the ICS was launched. NYAMIG was created as a new enterprise to address market imperfections in the maize value chain, rather than looking for alternatives involving existing traders. As a result NYAMIG and the ICS became the principal focus of the platform, with limited energy being dedicated to the piloting of other new practices in the maize sector.

The ICS is based on the idea that prices increase after harvest and that farmers do not have sufficient storage capacity themselves. NYAMIG takes on the risks for the stored product. The price margin realised by speculating on market price increase should cover the all costs made by NYAMIG, including a profit margin for NYAMIG. There are doubts whether NYAMIG and the ICS are, under the current set-up, viable and sustainable mechanisms to help farmers obtain better prices and improve access to markets. Currently, the number of smallholder producers directly benefiting from the system is still limited and benefits are relatively small. Especially for smallholders, the ICS does not seem to be a major opportunity to improve their livelihoods, and for larger producers there is also little evidence of impact.

Irrespective of the ICS, smallholder prices for maize have increased. Whether this is a result of their inclusion in the platform remains questionable. The difference in prices received by platform members compared with non-platform members is limited and there was a regional trend of increasing prices.

The examples of NYAMIG and the ICS also demonstrate the need for consultation with experts on specific issues: the business model underlying NYAMIG and the ICS is based on a number of assumptions that do not seem to hold true. By calling upon expert knowledge this could have been avoided. The input of expert knowledge, however, should be based on specific issues and be precisely needs-based. There is also a need for adequate management capacity. The current management of NYAMIG is unable to oversee all activities: source maize, manage stocks, monitor and analyse prices, identify potential buyers, achieve agreements and organise sales.

One major question that needs to be answered is under what conditions farmers would be prepared to sell their produce through the ICS. This decision depends on the actual market price at harvest as well as the expected beneficial margin that the ICS can obtain on behalf of the farmers, which proved very uncertain and difficult to predict. Smallholder farmers, especially, are not eager to take the risk and to postpone the sale of their harvest several months. The business model of NYAMIG itself also needs revision: the current profit margin is too small to sustain the business. NYAMIG and the ICS are interesting experiments, but the business model is not yet mature, and needs further adaptation and experimentation in order to develop into a viable enterprise serving both business and developmental objectives.

The Nyagatare maize platform was able to identify the right issues, and has initiated, coordinated and implemented experimentation with technological and market options. A continuation of this process is desirable, but the future of the platform as a largely self-organising forum of maize sector stakeholders has not entirely been assured. The internal capacity within the platform to continue to mobilise the human and financial resources to continue to operate, continue to identify needs and opportunities in the maize sector, and experiment with new production, post-harvest and marketing practices is not in place. Therefore, further outside support would be required to improve the self-governing capacity of the platform.

PHOTO: ROGER BYMOLT

6

Pig producer, Malawi

The **Malawi Pig Sector** Innovation Platform

Authors: Roger Bymolt and Bertus Wennink

6.1 Introduction

Over the last decade, pork production in Malawi has been on the increase, as seen by the significant increase in pig population (Table 6.1). The majority of Malawian pig farmers are smallholders, rather than large commercial farmers. Pigs are perceived to be 'easy livestock' by NGOs which have integrated pig-rearing activities into their livelihood programmes, because pigs proliferate rapidly and are not too demanding in terms of feeding.

Since 2000, the Government of Malawi has progressively initiated reforms in the livestock sector, mainly through state withdrawal from productive activities in the sector. These reforms included the privatisation of slaughter and cold storage facilities which are mostly situated in and around the cities of Blantyre and Lilongwe. Malawi, like many other sub-Sahara African countries, has experienced sustained population growth, and a growing middle class has begun to demand more and better quality food, including meat. Although, for cultural and religious reasons, pork is not part of the daily menu of many Malawians, there is a growing demand for processed pork products in urban areas. This demand is currently being met by importing pork from South Africa.

The RIU programme in Malawi began in 2008, aiming to make better use of agricultural research outputs for improved productivity and profitability of smallholder farming. The RIU Malawi programme has sought to work closely with the Ministry of Agriculture & Food Security (MOA&FS) to add value to the implementation of the Malawi Agriculture Sector Wide Approach (ASWAP). It has done this by advancing an 'innovation systems' perspective that attempts to go beyond the conventional research and extension systems.

The Malawi RIU programme has four strategic priorities[1]:

- Enable the establishment of the National Innovation Coalition (NIC) based upon existing institutes and individuals that will collaborate to improve innovative capacity of the Malawian agricultural sector;
- Facilitate farmers' empowerment to assure their participation in agricultural innovation initiatives;
- Support the development of innovation platforms at national, district and area levels;
- Facilitate a knowledge, information and communication support and learning group which would, among other tasks, provide input to innovation platforms.

Unlike some of the RIU programmes in other countries, which focused on putting specific research into use, the RIU programme in Malawi focused primarily on initiating 'innovation platforms'. 'Innovation platforms' involve sector stakeholders sharing a common interest who regularly meet, exchange ideas and agree upon joint actions, with the objective of triggering agricultural innovation. The RIU programme created innovation platforms and related multi-stakeholder structures for specific commodity sectors (cotton, legumes, horticulture, livestock and fish farming) and thematic issues (agricultural input and output supply) or crosscutting themes (multi-stakeholder facilitation, farmer empowerment and organisation). The sector innovation platforms were intended to create an environment conducive to sustainable partnerships and coalitions, as well as to making decisions on how to improve the functioning of the value chain.

At the outset, the NIC proposed that the Livestock Innovation Platform focus on the pork and dairy sectors, in line with the priorities set in the national Agriculture Development Programme. Because of time and resource constraints, the Livestock Innovation Platform chose to narrow the focus to the pig sector. Recent increases in the number of smallholders raising pigs in Malawi (resulting in an increase in pig production), as well as an increasing demand for pork were considered to be opportunities to trigger change for the benefit of smallholder pig farmers and the pig sector generally. The key constraint identified was the weak link between supply side and demand side actors. Within the innovation platform, the decision was made to tackle the poor match between supply and demand by investing in local physical slaughtering and marketing infrastructure. The Livestock Innovation Platform then invited pig farmer association/cooperative leaders into the platform, as they would be responsible for managing the new marketplaces in each of the four locations. Under the supervision of the innovation platform, local pig slaughtering and marketing facilities were built.

[1] http://www.researchintouse.com/programmes/riu-malawi/riu-mw03strategy.html

Aim and Methodology of the Impact Study

The objective of the study was two-fold: a) to draw insights from the innovation platform approach used by RIU Malawi to bring about sustainable change in agricultural commodity sectors in order to inform future interventions; b) to assess the sustainability and value for money of the RIU Malawi livestock platform.

For the impact study in Malawi, the districts of Mzuzu (northern Malawi) and Mulanje (southern Malawi) were selected because the intervention there had been completed earlier than in the other districts. An 'impact pathway' (see section 6.3) was constructed retrospectively to structure the data collection. The team gathered data and information for impact assessment through a household survey comprising 170 households (79 households in Mzuzu and 91 households in Mulanje), including a control group of 20 households which did not participate in the RIU project in each district. Households surveyed were selected randomly from Mzuzu and Mulanje cooperative member lists. The control groups comprised smallholder pig farmers in neighbouring areas who were not cooperative members. The KIT team also facilitated 12 focus group discussions (6 in each district), interviewed a number of key informants and undertook additional desk research of RIU documents.

Information from focus groups with farmers and farmer organisation leaders added nuance and helped greatly to describe processes of change. Interviews with key informants, combined with desk research, further assisted in the triangulation of data. In both Mzuzu and Mulanje, validation workshops were also held at the end of the fieldwork phase, where emerging findings were presented to farmer organisation members and leaders, to which they could respond.

This report offers first a brief overview of the pig sector in Malawi, as well as the challenges that were identified by the RIU programme (section 6.2). Next, the aim, rationale and activities for the Malawi RIU programme in the pig sector are presented (section 6.3).

The impact pathway, which was constructed based on desk research and validated by the country director, presents the outcomes and impacts of the interventions (section 6.4). The results of the impact study (household survey, focus group discussions and interviews with resource persons) are presented with respect to these identified outcomes and impacts (sections 6.4 through 6.8). These results also identified other changes (section 6.9).

Finally, the report discusses the ways in which impacts and changes can be attributed to the RIU programme, and the lessons that can be drawn from the experiences of the programme (sections 6.10, 6.11).

6.2 The Malawi Pig Sector

Trends

The livestock sub-sector of Malawi is relatively small (Goyder and Mang'anya, 2009). It is a typical low-input, low-output system. However, livestock constitute a source of protein and an important source of income for rural households. The livestock sector is considered to have export

potential, and to hold promise for reducing unemployment. The Malawi pig sector has shown steady growth over the last few years. In 1997/98 the pig population of Malawi was estimated at some 430,000 pigs (Chintsanya et al.,2004); that number has risen to more than 2,000,000 pigs in 2011 (Table 6.1).

Table 6.1 Pig Population of Malawi (2008/09 – 2010/11)

Agricultural Development District		2008/2009	2009/2010	2010/2011
Northern	Karonga	119,147	141,218	117,174
	Mzuzu	85,514	108,633	120,472
Central	Kasungu	287,281	397,018	435,978
	Lilongwe	375,929	401,579	447,712
	Salima	26,945	37,781	46,680
Eastern	Machinga	173,863	181,653	214,897
Southern	Blantyre	340,494	504,652	669,396
	Shire Valley	61,616	79,530	95,017
National		1,470,789	1,852,064	2,147,326

Source: Census by Agricultural Development Districts

The observed increase in the pig population is the result of policy changes as well as of the changing livelihood strategies of smallholder farmers. In fact, the decline of the tobacco sub-sector, due to various reasons, urged the government to adopt an agricultural diversification policy, and invest in agricultural commodities other than tobacco and encourage farmers to explore other income-generating activities. Pig farming provides an alternative income-generating activity for smallholders, particularly for those who are less resource-endowed, as pigs reproduce relatively quickly.

From 1999 onwards, sector reforms resulted in the withdrawal of the state from direct involvement in pork chain activities such as the management of cold storage and slaughtering facilities, which took place from 1999 on. These facilities served, and continue to serve, buyers and consumers in urban centres such as Lilongwe and Blantyre. The main buyers are hotels, restaurants and supermarkets which sell processed meat.

A major constraint for pig farming is the frequent occurence of African Swine Fever (ASF), for which there are no drug-based treatments. Outbreaks of ASF, which is endemic throughout the country, kill close to 100,000 pigs every year. In order to confine outbreaks, quarantine areas are declared in which pigs are culled, and any processing, transport or trading of pigs is prohibited in the area for a defined period.

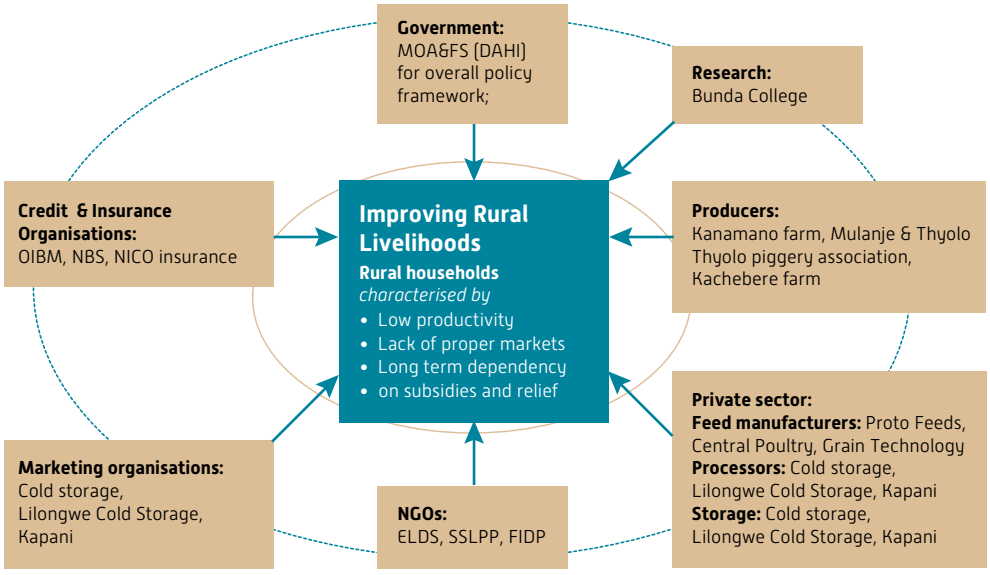
Key Actors

Pig farming has become widespread across Malawi and has been the focus of several interventions by NGOs as part of their household income and livelihood enhancement programmes and by the MOA&FS, which promoted particular management practices or breeds. Livestock is more important in districts of the southern region (Table 6.1), where landholdings are small and households cannot satisfy their cash demand by selling crop surpluses. NGOs have promoted pig farming by assisting farmers in sourcing hybrid pigs for cross-breeding with local breeds. For extension and training services, farmers have been largely reliant on government veterinary staff in the districts and these are widely reported as being too few in number (Goyder and Mang'anya, 2009; interviews with cooperatives and Agricultural Development Districts (ADD)).

The livestock research centre of the MOA&FS Department of Agricultural Research and Services (DARS) at Lunyangwa in Mzuzu, working with the Chitedze Research Centre and Bunda College of Agriculture, has developed some livestock technologies. In the pig sector, these include promoting the use of improved breeds such as Landrace, Large White and Tristar, as well as cross-breeding with local breeds.

There are numerous so-called 'pig clubs' across the country formed under various development programmes that are intended to promote pig farming. Farmers join these clubs for various reasons, such as to access piglets through NGOs or pass-on schemes, to benefit from training and extension services, to exchange information or to undertake any other collective action. However, most of these clubs have limited capacity. At a higher level of farmer organisation, the existing pig farmer associations in Mzuzu and Mulanje – the sites of this research – were registered as cooperatives during the course of the RIU programme (although this process was not part of the RIU programme itself).

Figure 6.1 Actors in the Malawi Pig Sector



Challenges in the Pig Sector

According to the RIU Malawi annual report (2009) and the report of the first livestock platform meeting (2009), pig farmers had seen improvements in productivity prior to the RIU programme. However, they expressed their frustration at a lack of domestic markets for their pigs. Farmers ended up selling pigs only in local community markets where both demand and prices were low. At the same time, Malawian processing companies have found it difficult to access a supply of quality pigs, due to a lack of proper marketing infrastructure. This supply gap in the domestic market has led to pig processors resorting to importation of pork from South Africa.

The Government of Malawi established livestock marketing structures in the 1960s which were privatised in the mid-1990s. Still, the slaughtering and marketing infrastructure and coordination is poor. A current critical constraint in the pig sector is poor communication among chain actors, resulting in a missing connection between the farmers and existing profitable domestic markets. The livestock platform baseline study asserts that developing the current pig marketing channels is "paramount to raising farmers' income and reducing poverty and should be considered as a best strategy for enhancing the adoption of improved pig production technologies and disease control interventions" (Goyder and Mang'anya, 2009). Furthermore, this study describes how the pig industry has also been greatly hampered by the unavailability of formal slaughter and cold chain facilities which are largely owned by individuals who do not handle pigs because of their religious beliefs. For example, S&A Cold Storage, which is the largest livestock processor in the whole southern region, does not handle pig products for this reason.[2]

6.3 Interventions by the Malawi RIU Programme

Aims Pursued

The RIU programme aimed to facilitate the establishment of a Livestock Innovation Platform. This platform was responsible for identifying and developing interventions that would help the pork sector in general and help pig farmers specifically to improve their income from the pork sector. Addressing the poor connection between supply and demand was prioritised as the key constraint to address. The platform decided that this should be done through the creation of formalised pig marketing structures (Malawi RIU Annual Report 2009-10; validated by interviews with the RIU Malawi Country Director, May 2012). The ultimate goal was to make the existing local pig farming systems more competitive, thus delivering better quality products and higher incomes. The 'innovation' component of the RIU programme was the construction of local slaughter and market facilities and commercialisation of pig enterprises (RIU Malawi Annual Report 2009-10).

Rationale

The new local slaughter and market facilities were expected to improve the linkage between value chain actors and to align production with market requirements. Furthermore, they were expected to enhance value chain efficiency, which would ensure better prices for farmers and benefit other value chain players. It was believed that meeting market requirements would

[2] http://malawimuslims.com/2012/03/24/superior-halaal-meats-in-expansion-drive-campaign/ [last accessed 26 June 2012]

improve incomes, further encouraging farmers to adopt improved pig husbandry practices. The required technologies were already developed, and the knowledge was thought to be available through government and NGO development programmes.

Approach and Activities

The RIU Malawi activities revolved around two intervention axes: a) providing grants for the construction of the slaughter and market facilities and training of pig farmers from the associations and cooperatives involved; and b) facilitating the creation and functioning of a platform where the key stakeholders of the pig sector could meet, exchange ideas and otherwise interact to enhance marketing of pigs.

The construction of four decentralised market structures was planned, and accomplished, in the districts of Mulanje, Mzuzu, Balaka and Dowa. These structures were intended to provide formal slaughtering facilities along with permanent, easily accessible locations for selling live pigs and dressed carcasses, as well as processed meat. The slaughtering facilities were also expected to contribute to the containment of ASF and to provide a market linkage with large processing companies. Original estimations were that a target group of 19,600 pig farmers would use the four markets by 2011. Agreements between private sector buyers and piggery associations and cooperatives would be facilitated by RIU, as would trainings of associations in group dynamics and negotiation skills.[3]

The role of RIU was primarily to broker linkages between the pig farmer associations and the pig processors, bringing together all stakeholders in the pork sector into platform meetings to discuss modalities for improving the marketing of pigs. These would include determining the private processors' demands (number of pigs, quality requirements, etc.) and negotiating the signing of contracts between pig farmer associations (suppliers) and private pig processors. A number of RNRRS[4] research outputs had been reviewed to inform the Livestock Innovation Platform's focus on the pig sector.[5] Most relevant among these was 'better organisation helps farmers to access markets', because benefiting from a high demand for pigs from processors was expected to be an opportunity in the RIU programme.

Furthermore, the RIU programme would provide grant funds and technical coordination to the Livestock Innovation Platform for construction of the markets and then advertise the pig markets to the public. It would also facilitate training of the pig farmer associations in pig husbandry techniques to meet the expectations of the private processors, as well as training in group dynamics, business management and marketing (RIU Malawi Annual Report 2009-10).

Role and Composition of the Livestock Innovation Platform

The Livestock Innovation Platform comprised a range of stakeholders active in the livestock sector (see Figure 6.1). These included NGOs, livestock processors, feed producers, research organisations (i.e. Bunda College), MOA&FS, and a senior representative from the Department

[3] http://www.researchintouse.com/programmes/riu-malawi/riu-mw10impact.html

[4] http://www.researchintouse.com/rnrrslegacy/index.html

[5] http://www.researchintouse.com/programmes/riu-malawi/riu-mw44innovplat-livestock.html

PHOTO: ROGER BYMOLT

Meet inspection: registration

of Animal Health and Livestock Development. The platform met several times to determine priorities for actions in the sector and in 2009 submitted a funding request to the NIC to authorise the investments based on an action plan.[6]

After these decisions had been made, further stakeholders were brought in. Most notably, representatives from the pig farmer associations (later to become cooperatives) of the four districts were invited by RIU Malawi programme management to participate in platform meetings from 2009 onwards. In practice, this meant three or four farmer association executive committee members would engage in platform meetings and activities. For each of the four districts involved in the intervention, a 'facilitator' was chosen by the platform to facilitate the relationship between the platform and the farmer associations and offer additional support. For Mzuzu and Mulanje, the focus of this research, the facilitator in both districts was from ADD. A platform 'champion' was also elected by the platform to provide leadership and drive in the platform. The champion, a well-respected researcher from Bunda College, was selected based on his professional competence, individual interest, and passion for and familiarity with the sector.[7]

The Livestock Innovation Platform action plan principally involved the construction of four slaughter and market facilities in four districts throughout Malawi. These were to be operated by the farmer associations (later cooperatives) in each of the four locations, hence the importance of farmer association leaders in the Livestock Innovation Platform. However, several events changed the approach and planned activities, influencing the expected outcomes and impacts of the interventions. The initiators of the action plans (i.e. the platform members) were rapidly confronted with funding constraints. In fact, the funds available were insufficient to sup-

[6] http://www.researchintouse.com/programmes/riu-malawi/riu-mw40innovationplatforms.html
[7] http://www.researchintouse.com/programmes/riu-malawi/riu-mw32platchampions.html

port the implementation of all activities foreseen in the plans. As a result, several activities were ultimately not accepted; e.g. the planned investments in transport facilities in Mulanje were cancelled in favour of the acquisition of freezers for storing pork.

Platform members, at the request of RIU Malawi programme management, adopted a 'self-help' approach for the construction of the markets, whereby the pig farmer associations took the lead. They were responsible for obtaining the necessary market construction permits and other official documents, searching for and gathering construction materials, and contracting labour. The designs for the slaughter and market facilities were similar for all four sites; i.e. pens for holding pigs before slaughter, a slaughtering slab with a capacity of one or two pigs, a kitchen for cutting meat, a storage room with freezers and an outlet for selling meat to customers. Experts from ADD designed the plans with input from the farmer associations.

During this process of market construction, the platform had a planning and monitoring role, with farmer organisations reporting to the platform. Pig farmer associations reported on progress and accounted for the expenditures made; therefore, leaders of the associations were trained in bookkeeping and accounting. Platform meetings were also opportunities for representatives of associations to share and exchange experiences.

The Constructed Impact Pathway

The impact pathway presented below (Figure 6.2) has been reconstructed by the KIT team in order to understand the intervention logic at the outset, and to structure the measuring of the effects of the intervention. It presents the original inputs, expected outputs, outcomes, impacts and spin-offs. This pathway informed the gathering of data for the different elements. As for inputs and resources invested, additional desk research in Malawi and interviews with resource persons revealed that not all of the planned inputs were realised.

Capacity building for marketing was mainly done through the elaboration of the platform action plan. The Malawi RIU programme funded limited training of members and leaders on group dynamics, agribusiness management and meat processing (see Table 6.3). Training for pig husbandry (breeding, feeding, housing etc.) was not funded, as technologies were supposedly already available and disseminated (as mentioned earlier in this section).

In its early stages, the platform began brokering linkages between supply actors (organised pig farmers and meat processors) but later it became almost solely focused on the construction of slaughter and market facilities. However, links between farmer organisations and ADD extension services were reinforced, even without specific RIU funding, as a result of the general interest of government services in transforming farmer organisations into professional cooperatives as part of national policies. ADD extension services provided the above-mentioned trainings (group dynamics, etc.) to farmer organisations. In the cases of Mzuzu and Mulanje, links between farmer organisations and ADD extension services were further strengthened because the platform facilitators for these areas were ADD employees.

Resources were allocated by RIU Malawi for the construction of the four slaughter and market facilities, including technical support and coordination through the platform. The RIU pro-

gramme, at a cost of US$11,300, also funded the official launch ceremonies of the newly constructed markets, which were opportunities for RIU-sponsored articles in national newspapers. Through these events policy-makers were also informed about the RIU initiative. Policy-makers had also participated in NIC meetings and in the Livestock Innovation Platform meetings prior to the platform's focus on the pig sector.

Figure 6.2 Impact Pathway for RIU Malawi Interventions in the Pig Sector

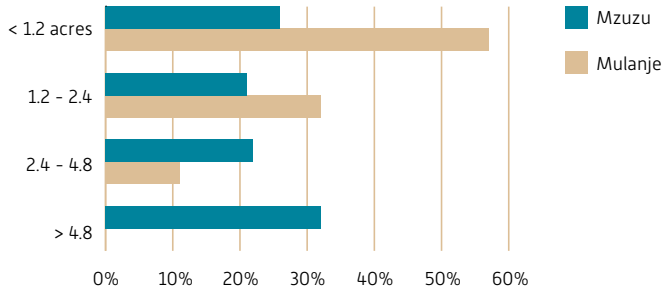
Input	Results and Impact			Spin-Off
Capacity Building: • Marketing strategies • Negotiation • Group dynamics • Pig husbandry **Brokering Linkages:** • Market linkages: pig farmer associations & private commercial buyers/ processors • Support of actor linkages: extension, vet services, inputs, other NGOs, etc. **Construction:** • RIU grants and technical support for building pig markets in each of the RIU locations including slaughter facilities **Communications:** • Publicising initiative • Drumming up policy support	Strengthened capacity of organisations involved with farmer empowerment Increased ability of extension services and NGOs to become more effective development facilitators Market strategy developed and implemented Pig farmer association leaders trained in management Farmers trained in improved production techniques Stronger market linkages (buyer/seller) Stronger linkages between (organised) pig farmers and service providers Markets built to expected quality standards PR material created (newspapers, radio, website) Engagement with policy makers (local, region and national)	Improved management functioning and cohesiveness Increased quality/ quantity of production Reduced losses to ASF Increased levels of trade between pig farmers, associations and buyers/processors through the markets built More/closer supporting services to association and individual farmers Market infrastructure functioning as designed Policy-makers taking into account views of stakeholders in creation of policy	Increased trust/ coordination in the chain (sustainability) Greater profitability Improved incomes at household level	New interventions initiated New markets established elsewhere New policies enhancing innovation

6.4 Changes in Pig Production Practices

Seventy-nine and 91 households, with on average 7 and 6.7 members, were interviewed in Mzuzu and Mulanje districts, respectively. In Mzuzu, 75% of the households are able to provide their household members with three meals per day during all 12 months, while in Mulanje this is true of 46% of the surveyed households.

In Mzuzu, 47% and in Mulanje, 89% of the households have landholdings of less than 1 ha. Households that own more than 2 ha make up 25% of the sample in Mzuzu, while in Mulanje, none of the surveyed households own more than 2 ha of land (Figure 2.3).

Figure 2.3 Landholding in Mzuzu and Mulanje (% of households)



In Mzuzu, 48% of the households have an annual income less than 50,000 MK; in Mulanje 76% of the households generate less than 50,000 MK annually. For households with incomes of more than 100,000 MK, the respective percentages are 35% in Mzuzu and 7% in Mulanje (Figure 6.4).[8]

Figure 6.4 Annual Household Income Categories in Mzuzu and Mulanje (% of households)

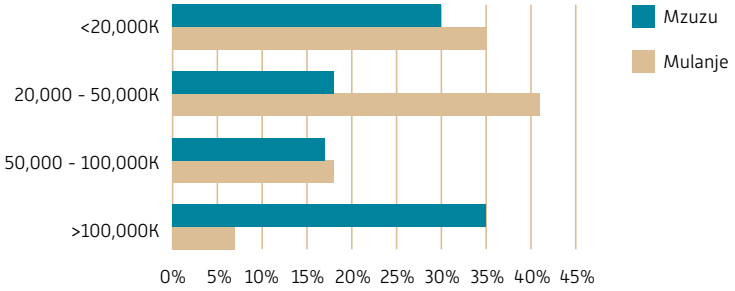
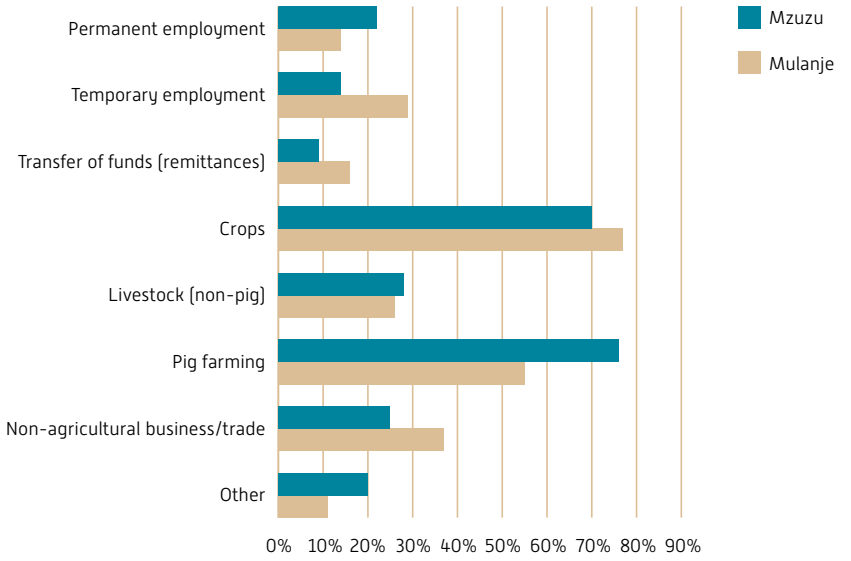


Figure 6.5 shows the sources of income for households in Mzuzu and Mulanje during the past 12 months. Given that the survey sample comprised pig farmers, it is not surprising that pig farming ranks high as source of income. However, it should be noted that pig farming was not mentioned as a source of income by all respondents because some were new to pig farming, or had temporarily ceased pig farming after culling their pigs in response to an outbreak of ASF on their farms. Marketing of crop surpluses is clearly another important source of income for the majority of households (70-80%) in both Mzuzu and Mulanje.

[8] Note: the date of the survey after the devaluation of the Kwacha on the week of 8 May 2012. The currency rates used were 100,000 MK = US$370.

Figure 6.5 Sources of Household Income in Mzuzu and Mulanje during the Past 12 Months (% of households)



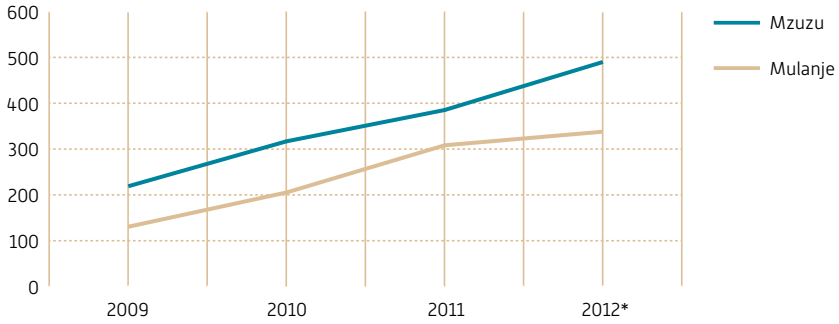
Production of Pigs

According to pig census data collected by the ADD, increases in pig production have been experienced across Malawi for at least the past decade (Table 6.1). Similar trends were also found among respondents to the household survey in Mulanje. Many respondents in Mzuzu were affected by an outbreak of ASF at the end of 2011, which reportedly contributed to a reduction in the number of pigs on some farms; however, many more farmers have started raising pigs since 2009 (Table 6.2). These data are supported by reported increases in the number of pigs sold by respondent households between 2009 and 2012 (Figure 6.6). This confirms the identified need by the platform to improve the pork marketing system in Mzuzu and Mulanje.

Table 6.2 Maximum Number of Pigs Owned 2009 & 2012 (% of households)

Year	District	0	1-5	5-10	>10
2009	Mzuzu	44%	13%	15%	28%
	Mulanje	61%	10%	13%	16%
2012	Mzuzu	6%	50%	31%	13%
	Mulanje	15%	49%	18%	18%

Figure 6.6 Number of Pigs Sold by Respondent Households 2009–2012



* 2012 figures were only available for the first six months of the year, and so have been doubled to give a projected estimate.

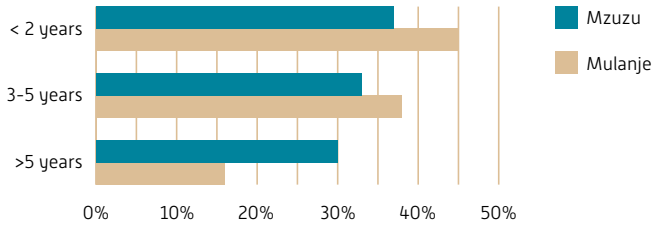
An underlying assumption of the Livestock Innovation Platform was that prior work by NGOs and district agricultural offices meant that production capacity on the supply side was not a major constraint and that marketing was the weakest link in the chain. While it was certainly found that marketing is a weak link in the pig sector, it was also found that the majority of cooperative members (as well as non-members) also suffer from poor production skills. Low production capacity is partly reflected in the quantitative household survey data, which showed relatively small numbers of pigs being held by farmers (Table 6.2) and low pig sales (Figure 6.6). Another indicator suggesting low production capacity is that in Mzuzu only 39% of respondents said pig farming was their number one source of income, and in Mulanje the figure was just 27% (Figure 6.5). Furthermore, in Mzuzu, 70% of respondents have been raising pigs for less than five years, while in Mulanje that figure is 83% (Figure 6.7).

Low production capacity is most clearly reflected in the responses given by farmers themselves during focus group sessions. Most farmers said they are "not doing pig farming as a business" but as an additional livelihood activity, and that they lack basic knowledge and resources to profitably raise pigs. They expressed, in particular, a lack of basic knowledge on how to boost production (through improved feeding and improved breeds) and quality (through improving pig health). Visits to numerous pig production facilities by the KIT team, following focus group discussions, confirmed the poor production capacities.

Services for Support to Production

Some pig farmers were found to be 'early adopters' who had received support from NGOs such as Oxfam to build pig houses and receive training. However, the majority had not received any NGO or public extension support, either directly or indirectly through those who have had that support (Table 6.3). Moreover, many pig farmers are fairly inexperienced. Less than a quarter of the respondents in the survey have been farming pigs for five years or more; the majority are new to the business (Figure 6.7). They lack basic knowledge of pig rearing and expressed desperate need for support in both production knowledge and market linkages.

Figure 6.7 Number of Years Respondents Have Been Raising Pigs (% of households)



Generally speaking, there was no support from the RIU Malawi programme for hands-on training for farmers on pig husbandry. It appears that the RIU programme missed an opportunity by not focusing on the production side, parallel to the marketing, to ensure that pig farmers could access the knowledge and resources required to produce the volume and quality of pigs that the market demands – particularly large processors in Lilongwe who have specific size and fat percentage requirements.

The Mzuzu cooperative claimed that 90,000 MWK (US$330) was made available for sensitisation in the rural areas in 2008/09. Since then, they said they have not received funds from any source. However, with support from ADD Mzuzu, the cooperative organised two trainings in 2008 on pig husbandry and cooperative management. There was financial support through the Malawi RIU programme for training on group dynamics (cooperative management). The Mulanje cooperative received financial support from RIU to organise trainings in 2009 for a group of selected members, covering group dynamics, cooperative management, meat processing techniques and business management.

PHOTO: ROGER BYMOLT

Pig shed

Table 6.3 Households (%) where a Member has Received Pig-related Training

	2009	2010	2011	2012	%households receiving any training 2009-2012*
Mzuzu	6%	10%	19%	6%	29%
Mulanje	9%	27%	25%	9%	48%

* Some households received trainings in multiple years

** This includes all pig related trainings and is not disaggregated according to training provider (RIU, ADD, other NGOs etc.) because this often could not be accurately recalled by respondents

6.5 Functioning of the Slaughter and Market Facilities

The slaughter and market facilities were constructed according to the Livestock Innovation Platform action plan. These facilities were to be operated by the farmer associations (later cooperatives) in each of the four locations. In constructing the marketplaces, the platform decided to take a 'participatory' approach which went much further than in-depth consultation with key stakeholders and members. The farmer association leaders and members were closely involved in the procurement of raw materials, financial reporting, and actual construction of the marketplaces.

The markets in Mzuzu and Mulanje, which were visited for this study, are regarded by a range of stakeholders as the best of the four markets (Hirvonen, 2011; interviews with Mzuzu and Mulanje cooperative leaders, May 2012). The Mzuzu and Mulanje marketplaces were also completed before the marketplaces in Balaka and Dowa (Mzuzu in June 2011 and Mulanje in January 2011).

The slaughter and market facilities appear to be constructed to a good standard, meaning that the structures were strong and reasonably finished. However, a major issue is the capacity of slaughter facilities at both markets. These markets are only able to slaughter a maximum of two or three pigs per day. While this is sufficient for local retail, it is well short of the 20 to 30 slaughtered pigs that large processing companies such as Kapani indicated during platform meetings that they would need to have available for pick-up within a given 24-hour period (interview with Kapani supply manager, May 2012). The linking of the cooperative-run slaughter and market facilities with large scale processors was the primary objective identified by the Livestock Innovation Platform. This is not reflected at all, however, in the layout of the facilities that were finally built.

Locations

The facility locations were largely determined by the willingness and assistance of the local authorities to provide sites for them. While this is not a very consultative approach, it was apparently pragmatic – the cooperatives did not have to pay for the land on which to build. In Mzuzu, this led to the conversion of an old chicken slaughterhouse, about 6 km from the town centre. It is near a cattle slaughterhouse, so it is convenient for veterinary services to certify meat. For those members who live in Mzuzu town, and have the means to hire transport, this distance is no problem. However, for those members who live greater than 10 km away from the facility, it is a great challenge to visit the facility, let alone get their pigs there. Transport opportunities from the villages to the town are already infrequent and costly, and the connection from the town centre to the facility is even more challenging. This means that many of the

cooperative members have never returned to the marketplace since the opening ceremony in 2011. In Mulanje, the facility is located only about 2 km from the centre of the town, which makes it much more accessible.

Power Supply

The Mzuzu facility has been connected to an electricity supply, and the cost of electricity is paid for by the cooperative. Electricity is used to power two deep freezers, which can keep slaughtered meat for several months. The Mulanje facility reportedly paid for an electricity permit a year and a half ago but it is still waiting for connection by the state electricity company (ESCOM). This means that the display refrigerators (with glass tops), which were purchased with part of the RIU budget, are not in use. The cooperative is currently renting limited freezer space from a domestic household living behind the facility.

Slaughter Facilities

The slaughterhouses at both sites are equipped with wood-fired boilers, not electric boilers. Boiled water is used to remove hair and prepare the carcasses in a hygienic manner. Cooperative leaders cited the supply of wood for the boilers as one of the many constraints of the market slaughter facilities, making them impractical for slaughtering a large number of pigs at one time. Of course, a cooperative's ability to slaughter a large number of pigs in a 24-hour period also requires other capacities (e.g. credit, organisation, transport facilities for pig collection, timely veterinary services) that are all under-developed within the cooperative at this time.

PHOTO: ROGER BYMOLT

Meet inspection at a slaughter house

6.6 Trade in Slaughtered and Live Pigs

Slaughtered Pigs

The functioning of the slaughter and market facilities in Mzuzu and Mulanje over the past 12 months has enabled more pigs to be certified as fit for human consumption by veterinarians onsite. This is significant because previously a majority of members who slaughtered pigs would do so at home – 46% of the households in Mzuzu and 20% of the households in Mulanje– which meant the meat was not certified as fit for human consumption. This facility makes pork safer for consumers, and potentially can boost sales through greater availability of certified meat.

Figure 6.8 Ways Households Sold Pigs 2009 and 2012 – Mzuzu (% of households)

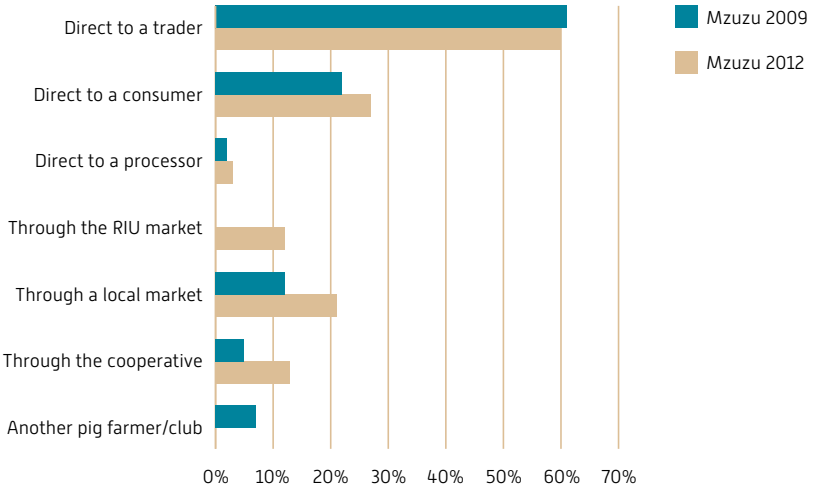
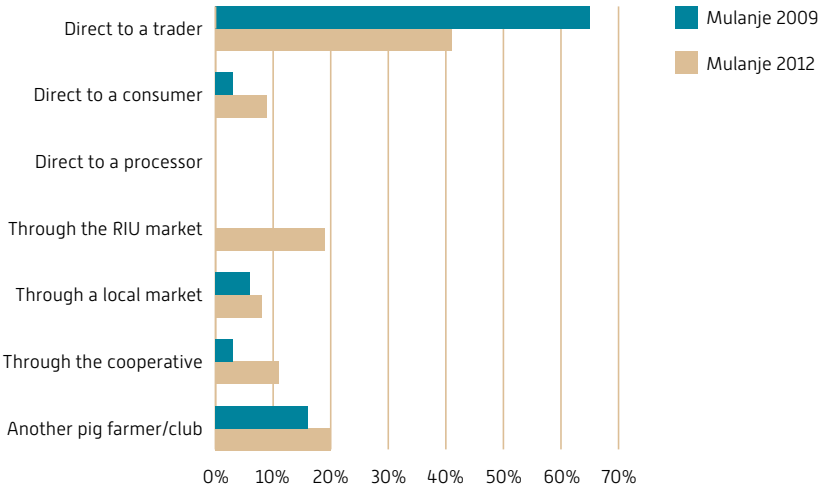


Figure 6.9 Ways Households Sold Pigs 2009 and 2012 – Mulanje (% of households)



The RIU Malawi target was for 19,600 pig farmers to use the four local slaughter and market facilities by 2011[9]. At present, this appears to have been a considerable over-estimate, even considering the most indirect impacts (Figures 6.8 and 6.9). Only 12% of the interviewed households in Mzuzu and 19% in Mulanje cited the new market as the primary market outlet for their pigs.

In Mzuzu, the cooperative has 125 members. According to records kept by the marketing committee of the cooperative, only 17 different people (10 cooperative members and 7 non-members) had slaughtered and sold pigs using the new facility, for an average price of 425 MK/kg of meat, from May to December 2011. Just ten cooperative members had sold 60 weaners (weaned piglets) during the same period, for an average price of 6,685 MK per pig (Table 6.4). This represented some 10% of the membership, mainly members who live close to the market. Starting in December 2011, the Mzuzu facility had to be closed for a period of four months, due to an outbreak of ASF.

The cooperative in Mulanje has about 100 members. From December 2010 to the time of evaluation (a period of a year and five months), the cooperative slaughtered 70 pigs and sold 190 weaners (Table 6.4). The records did not specify the number of farmers involved or prices obtained (Table 6.4). The prices for meat are fixed by the cooperative, which also takes a levy. The cooperative prices aren't always higher than those obtained by sales by individual farmers. In fact, many households sell pigs when they need cash and negotiate prices directly with traders.

Table 6.4 Sales of Slaughtered and Live Pigs through the RIU Markets

Location	Slaughtered pigs (meat & value)	# of farmers	Live pigs (# & value)	# of farmers
Mzuzu	1,577 kg 671,500 MK	17	60 weaners 401,000 MK	10
Mulanje	70 pigs	Not available	190 weaners	Not available

Source: Data provided by MLICO Mzuzu and MPPMC Mulanje

Table 6.5 Pig Sales in 2011 (% of households that have pigs)

Districts	0	1–2 pigs	3–4 pigs	5–10 pigs	> 10 pigs
Mzuzu	40%	18%	17%	18%	6%
Mulanje	52%	19%	14%	15%	0%

Table 6.6 Pig Sales in 2012 up to June (% of households that have pigs)

Districts	0	1–2 pigs	3–4 pigs	5–10 pigs	> 10 pigs
Mzuzu	62%	16%	9%	8%	5%
Mulanje	69%	19%	11%	2%	0%

[9] http://www.researchintouse.com/programmes/riu-malawi/riu-mw10impact.html

PHOTO: ROGER BYMOLT

Slaughter house

In general, sales through the new RIU markets remain relatively low when compared to overall sales (Tables 5 and 6). However, potential for greater sales through the facilities does exist, given that data from the survey showed the number of households raising and selling pigs to be increasing since 2009.

Live Pigs

Both the Mzuzu and Mulanje slaughter and market facilities have NGOs and other institutions as their largest customers for live pigs. At present, NGOs are the only large institutional buyers of piglets, often buying them for pass-on programmes in order to spread pig farming to other areas of the district. In the case of Mzuzu, the ADD directed the NGO to the cooperative. The fact that the cooperative and the ADD began working more closely in a mutually supportive arrangement is an excellent development. This is also an opportunity for the cooperative to realise a higher turn-over, through supplying volumes of live pigs (weaners) rather than slaughtered pigs, given that the capacity of the slaughter and market facilities is limited.

African Swine Fever

ASF is a serious viral disease of pigs, endemic in Africa. The ASF virus is highly contagious and can spread very rapidly in pig populations by direct or indirect contact. (Humans are not susceptible to ASF virus.) This virus can persist for long periods in pig products and in the environment and can vary in virulence from highly pathogenic strains that cause near 100% mortality to low-virulence isolates that can be difficult to diagnose. There is no vaccine or treatment.[10]

[10] http://www.cfsph.iastate.edu/Factsheets/pdfs/african_swine_fever.pdf

It was not possible to determine whether or not the pig slaughter and market facilities had a significant impact on the spread of ASF, given the short time that the markets had been open, and the fact that the disease, by its nature, occurs in epidemic outbreaks. An outbreak occurred once in Mzuzu, at which time the Mzuzu cooperative market was closed down for a period of four months. This action may have contributed to the containment of the disease, but given the low number of pigs passing through the market, its actual impact on containing the disease was most likely negligible. Nevertheless, it is encouraging that a coordinated response was initiated through the responsibility of the cooperative.

Clients and Customers

Many cooperative members, including leaders, had an expectation that marketing would be easier with the construction of the slaughter and market facility (focus group discussions, 2012). However, little strategic thought was given to promoting the market as a retail outlet and as an organisation that could enter into contractual arrangements with formal buyers. At present, the cooperatives simply telephone some of their regular customers who pass word on to others that meat is for sale. This marketing is only targeted to individuals and families buying meat. For consumers who want to buy certified meat, the marketplace in Mzuzu is a prohibitive distance (and uphill) from other retail businesses. For example, it is not in close proximity to local marketplaces, making it less likely that consumers will drop by the cooperative for their weekly purchases of pork.

In Mulanje, the cooperative market is located less than 2 km from the centre of town, on a flat road easily accessible on foot, by bicycle, or by local minibus. The location of the Mulanje market is convenient for producers in close proximity to the town, and to consumers and hotels. Of course, for the many members of the cooperative in the villages, feeder roads with few transport options are problematic for transporting pigs that are too large to be carried by bicycle.

Up to now, the markets at Mzuzu and Mulanje have lacked visibility. Large buyers such as NGOs have found the Mzuzu cooperative through the ADDs which have facilitated the sales. On-going support from the ADDs will continue to be vital for these nascent cooperatives to sell to buyers. The introductions that ADDs make to buyers enhance the reputations of the cooperatives, which get a chance to prove they can do business.

In short, the markets are not being actively promoted to new customers. They are not based in shopping areas, there are no advertisements to invite customers, no hours of operation published outside, no price lists, etc. The cooperatives have received little advice on how to operate a retail outlet and, considering that this is a primary source of business, it is an area where they require support. As an example of the lack of retail experience, a cooperative member asked "People are buying meat on credit and not always paying. What do we do?" indicating that even simple policy about whether or not to sell on credit is lacking.

6.7 Functioning of the Cooperatives

Membership

The RIU programme was not responsible for the formalisation of the pig associations in Mzuzu and Mulanje into cooperatives. This registration was done in 2010 with the help of ADD; however, it can be argued that the RIU programme contributed by injecting some impetus into these farmer groups, which by their own admission were able to do little for their members prior to the RIU programme.

The Mzuzu Livestock Cooperative (MLICO) for raising and marketing pigs currently has 125 members, who are organised into 9 clubs, each of them covering a so-called club zone. These club zones don't always correspond with the formal administrative zones. In the Mzuzu cooperative, two categories of members can generally be identified:

- Those for whom farming is an activity that follows another professional career; they have knowledge of pig farming and may have been doing it for some years. These second-career farmers have maintained their old networks, and also have capital to invest in housing, feed and vaccinations. They live relatively close to town and the new marketplace.
- Those for whom farming is their core business and main source of income but pig farming is a new activity. They live relatively far from Mzuzu town and lack knowledge and capital to make pig farming profitable.

PHOTO: ROGER BYMOLT

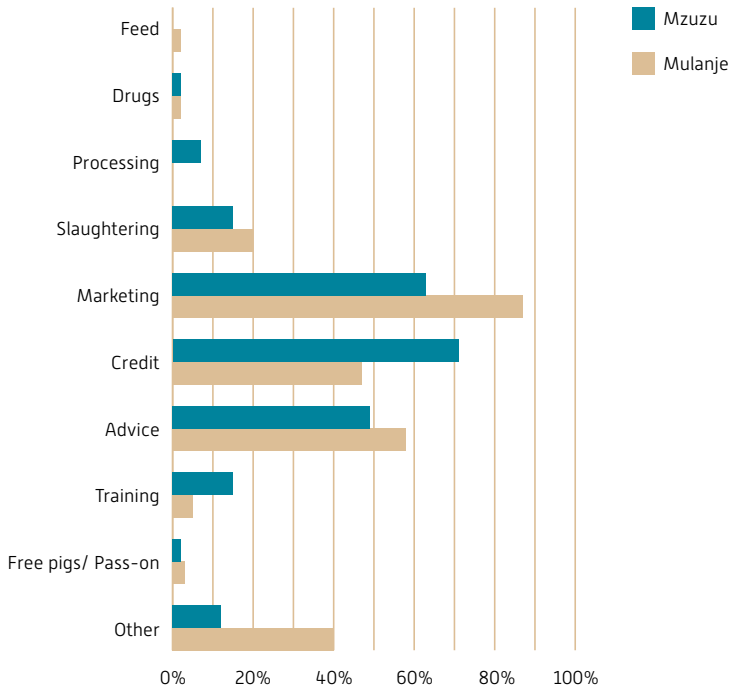
PIG production and marketing cooperative, Malawi

The Mulanje Pig Production and Marketing Cooperative (MPPMC) has some 100 members, organised into 18 clubs at village level. In Mulanje, generally speaking, there are three categories of members:

- Those for whom farming is the main economic activity. They live in or close to Mulanje town, are close to the leadership of the cooperative and have the required social and professional networks to access capital and up-to-date knowledge for pig husbandry. They sell their pigs through the new market.
- Those who are pig farmers in the villages surrounding Mulanje and who have been engaged in pig farming for more than five years. They got their starting capital and knowledge through NGO pass-on pigs and training programmes (e.g. Oxfam). They are beginning to sell through the newly-constructed market and will only continue if it is profitable for them.
- Those for whom pig farming is a new activity, and not yet their core business. They lack knowledge and capital to start up and have never been formally trained. Having seen the benefits of pig farming for others, they have just started to do it with help from other club members. These farmers are selling very low volumes of pigs and their main benefit is through the access to pig manure to improve their arable farming.

A key challenge for both cooperatives is how to bridge the capacities and expectations of these different membership groups. Marketing of pigs, access to credits and obtaining advice are the main reasons for households to join cooperatives; i.e. to make pig farming a business (Figure 6.10).

Figure 6.10 Reasons for Joining a Cooperative (% of households)



The building of the facilities brought an unrealistic expectation for some members of easy sales and guaranteed prices. For others, there was an expectation of free services, particularly trainings, access to credit, and an organised pig collection system.

Impetus Following Market Construction

The building of the facilities has brought fresh impetus to the cooperative leadership. As one Mzuzu executive leader remarked, "before the slaughter and market facility we didn't actually do much". During the course of the RIU programme, the cooperative and its members were actively involved in constructing the facilities and this brought members together out of necessity. Now the cooperative and its members have rallied around the new building, and it has become the foundation for providing other services to their members. For example, the cooperative in Mulanje has hosted trainings at the site. Both facilities had well-attended opening days; these were opportunities to bring all members together from near and far. The remaining challenge is to translate this initial excitement into actions that enable the cooperative to mature and function more effectively for its members. Members of several pig clubs stated that, since the openings over a year ago, they have had no contact with the cooperative or the slaughter and market facility.

In Mzuzu, the cooperative attempts to meet every two weeks, but some members reported that the executive doesn't always attend. As one member put it, this results in "just discussing the same things over and over again - nothing gets done, and people get despondent travelling long distances for this". This frustration could potentially weaken cohesion among cooperative members at a time when the cooperative needs patience and buy-in from its members to support it through its nascent phase.

Financial Capacity

Both the Mzuzu and Mulanje cooperatives lack financial capacity, including both working capital and access to credit. In the words of the cooperative leadership, "this makes it difficult for us to move". This "difficulty to move" applies in two senses: inability to invest and grow the cooperative, and inability to physically move around to meet with members up to 20 km away from the marketplace. The Mzuzu executive says, "we know that we need to better pass on information to the grassroots". However, neither cooperative has access to a vehicle or a motorbike, unless they hire one for a specific purpose.

Cooperatives are able to operate financially due to three main revenue streams: membership sign-up and annual fees, sales of shares and a 5% levy on pigs sold and slaughtered (10% for non-members). However, after operating costs are paid (for guard, electricity, etc.) and annual dividends have been paid out, there is little left for cooperative investments and diversification of income-generating activities.

This is compounded by the fact that many 'members' listed on paper have not actually paid membership fees. A number of clubs in both Mzuzu and Mulanje were organised by NGOs and farmers were encouraged to sign up, but for all intents and purposes it is difficult to classify them as active members. Such passive members are estimated to be half of the membership of both cooperatives. Cooperatives are in a 'Catch 22' here: they need operating capital to offer

services to the rural members, but rural members want to see that services can be delivered before they pay their membership fees. The fact that the cooperatives lack means of transport to the rural areas reinforces the scepticism of these members. However, cooperatives need to be careful not to alienate rural members who have not paid their fees, lest they weaken their membership base.

In short, the cooperatives require working capital to function, to lobby for services and to deliver these services to their rural members, which comprise a significant number. Without such services, farmers are not able to improve their production for marketing through the new (RIU) market.

Organisation of Logistics

As nascent organisations, both the Mzuzu and Mulanje cooperatives have yet to develop organisational capacity for logistics. This includes logistical support for the many club members that comprise their cooperatives. If farmers can't afford to hire vehicles (or if it is not cost-effective) to move their pigs to the cooperative market, then they will continue to look to local traders and to each other to sell.

One large company, Kapani, located in the capital, Lilongwe, was part of the early Livestock Innovation Platform meetings and specified that it would like to purchase 25-30 pigs a week, and could even pick up carcasses for free, if there were good coordination with the company's other business in the area. However, it is evident that the cooperatives do not yet have sufficient linkages with pig clubs and members to coordinate the timing of these sales. Attention should have been focused on building up these supply chain linkages in the programme. As this did not occur, the cooperatives should focus on building these linkages locally (e.g. with hotels and wholesalers) and learning from this experience at a lower level first.

Clubs

Clubs are lower level units that have a loose membership within the cooperative structure. Clubs were not given specific attention in the RIU Malawi programme; however, it is evident that strengthening the clubs is fundamental to supporting the cooperative structure for marketing. Due to geographical distance and lack/expense of transport, clubs are important both for sharing knowledge on trainings/best practice and for coordinating club members so pigs can be picked up at set times (e.g. monthly). Unfortunately, many clubs are barely operational. Some members have come to feel the clubs don't have a purpose once the cooperative has been formed; they expect the cooperative to do all the work, which is not realistic. Other clubs are extremely loose-knit and have no real leadership, making coordination difficult. Some members have been disillusioned since the cooperative was formed because it hasn't brought any change to their clubs or themselves. It is clear that coordinating marketing from small-scale pig producers to cooperative markets requires at least a minimum of functioning at a club level.

Representation in the Cooperatives

Leadership in the cooperatives is selected through elections. New elections are due for both and, in one case, well overdue. At the same time, neither of the cooperatives has yet held an annual general meeting (AGM). The present leadership positions are held by those who live

geographically close to the slaughter and market facilities, and were closely engaged in the association before it became a cooperative. There is recognition by the present leadership that the members from further away should be better represented in the leadership. This would be one way of binding the clubs more closely with the cooperatives and spreading information. The reason cited for why no AGMs have been held until now was that the cooperative didn't do anything – "How do you have an AGM without having done something?" With the new marketplace now functioning, the end of the year (in June) would be an ideal time for this to happen.

6.8 Impacts

Coordination in the Pig Value Chains

With regard to formal market linkages, the cooperative in Mzuzu has been fortunate to have a very supportive ADD officer assisting with marketing to institutional buyers, particularly selling piglets to NGOs. In Mulanje, too, the cooperative has had some support from the MOA&FS to find buyers. Given the relatively small number of pigs being supplied by cooperative members at this time, the cooperatives do not appear to be experiencing a lack of demand for their pigs and meat.

During focus group sessions, farmers who had supplied piglets for sales to NGOs said that the prices received were significantly better than they would normally expect in the local market (although this is very difficult to quantify, due to variations in the sizes and breeds of the piglets being sold, and a lack of available records on prices). NGOs are also happy with this arrangement, as they want quality piglets of improved breeds which have been inspected to be disease-free. The experience of cooperative selling to NGOs has been a positive one for all concerned. Farmer members are happy with better prices, and in many cases transport was arranged for pick-up of these pigs. The ADD acted as a broker (without taking a financial cut), and at least one member of the ADD staff was a facilitator in the Livestock Innovation Platform (in Mzuzu). It is very doubtful if such trades would have been possible without the investments made by RIU in the Livestock Innovation Platform and in the cooperative marketplace because: a) such brokering between the cooperative and a buyer would not have occurred; b) the cooperative utilised the holding pens of the slaughter and market facility; and c) the cooperative became functional as a result of the joint action required to build the facilities.

While this is a positive result in terms of improved coordination in the pig value chain, it should be remembered that such sales have been infrequent events and that cooperative markets have found it difficult to find more regular local buyers. The value chain remains local (farmers > cooperative market > consumer) and undeveloped, and the main market opportunity of larger scale processors remains untapped. It is clear that the capacity of most cooperative members is insufficient to sell regularly through the cooperative, with the exception of the more experienced farmers living near the marketplace in Mzuzu. In most cases, farmers have little choice but to act as individuals when procuring inputs (feed and drugs) and they rarely have access to finance, training and information, nor affordable transport to bring their pigs to the marketplace.

Capacity of the farmer cooperatives is also low, although this has improved through the period of the RIU intervention. Serious constraints include organisational capacity (still gaining experi-

ence and skills), financial capacity (management not paid, low access to funds, no credit), and capacity to access members and buyers (no means of transport other than private). This means, for instance, that the original plan of the Livestock Innovation Platform to link these cooperatives in Mzuzu and Mulanje with larger processors in Lilongwe is not possible at this time. The RIU market slaughter facilities that were built are well below the capacity required to hold and slaughter the number of pigs that private processors demand. Also, at present there is a gap between what the cooperatives can supply and what the processors demand – i.e. 20-30 quality, slaughtered carcasses that can be picked up at once on select dates.

The cooperatives need to take action to find new, formal buyers in order to improve their market linkages and gain organisational experience, e.g. by regularly supplying to hotels or large retailers, or through kiosks at local markets. If this can be done, there can be reasonable hope that the cooperatives can progress to larger and more sustainable trading relationships, with larger volumes of pigs being sold and slaughtered through the marketplace. A rough estimation of what should be possible is the sale and/or slaughter of seven pigs a week (one/day), rather than the current one to three pigs a week.

Although this may produce a small amount of revenue to support the market's operation (due to the levy taken on each sale), it will hardly result in the kind of long-term impact that RIU and the innovation platform envisaged when they developed the action plan. It is unfortunate that, while improving the coordination in pig value chains was an objective, the Livestock Innovation Platform focused solely on building slaughter and market facilities rather than building a marketing system. Now it is up to newly-formed cooperatives to make the most of the investment in the marketplace, despite their lack of experience in marketing, lack of capacity across the board, and lack of support from the Livestock Innovation Platform, which is now dormant.

Income from Pig Farming for Households

It is difficult to assess at this time whether pig farming has become more profitable, reflected in higher incomes, because both markets have only functioned for 12 months. At present, the volume of pigs being sold through the newly constructed RIU markets is very low (Table 6.4). Statistical comparison with a control group is not required to show that these low volumes, contributed by only a small number of cooperative members, have little direct impact on pig farmers' incomes up to now. Those who have benefited are those who are close to the cooperative leadership (such as executive or committee members) and live close to the newly-built facilities or have good access to private transport. Members who live some distance from the facilities rarely sell through the market, primarily due to high transport costs.[11]

The cooperatives in Mzuzu and Mulanje both believe that they offer very competitive prices to farmers. Many farmers who had sold through the markets concurred, during focus group sessions, that the prices offered by the cooperative are 'good', compared with those paid by traders. Furthermore, the cooperative is perceived to be transparent about properly weighing a carcass

[11] The number of pigs sold could not be correlated with farmer distance from the RIU marketplace because data collected in the household surveys on 'distance to the RIU marketplace' was found to be unreliable. Some respondents and enumerators interpreted 'the marketplace' as the nearest marketplace, including any local market. This information was alternatively obtained through farmer focus groups in areas around the RIU marketplace.

with accurate scales, whereas traders often have no scales when they estimate the weight and offer a price to the farmer. It is difficult to quantify the advantage that the cooperative offers because pigs vary in weight, age and breed, farmers do not usually keep records, and even the records of one cooperative do not include data on weights and prices/kg at the time of sale.

PHOTO: ROGER BYMOLT

Pig raising in Malawi

It might reasonably be expected that if prices at the new RIU market are so favourable, many farmers would choose to sell there. However, the great majority of farmers continue to choose to sell to traders, as well as directly to consumers and to other farmers (Figures 6.8 and 6.9). Several reasons for this were offered in the focus group sessions. Part of the reason is that a levy must be paid to the cooperative when a pig is sold or slaughtered (5% of the sale price for members, 10% for non-members). In addition, there are transport costs, which can be considerable for an individual farmer moving large pigs to the market. Weaners are easier to take to the market because they can be transported by bicycle. Furthermore, because cooperatives are not well-capitalised, they struggle to pay farmers on delivery, so receiving payment often means a wait of a week or two and another trip to the market. This was described in the focus groups as a significant disincentive, because many small-scale farmers are cash poor and sell when they need the money urgently. At the time of research, the Mzuzu cooperative was paying farmers after it received money from the sale, whereas the Mulanje cooperative, after experiencing a backlash from farmers, had begun paying farmers the same day. According to farmers in the focus groups, some Mulanje cooperative members are misinformed and continue to think the cooperative pays a week later. Finally, a fear was expressed by some farmers in more rural areas that, if their pig is found to carry a disease by the veterinary services at the cooperative market, the meat will be disposed of and they will not receive any money. These are all disincentives and barriers to farmers selling at the new RIU market rather than to traders or privately.

To increase income for pig farmers in the areas studied clearly requires support in marketing and also in basic production methods to fully benefit from the new marketplaces. Farmers particularly need access to up-to-date information on production factors such as feeding, drugs and housing, which remain major constraints for many farmers to even having any livestock to sell. This is particularly the case in Mulanje, where many households are poverty-stricken and more reliant on off-farm activities for their income. Cooperatives can play a leading role by using the linkages they already have with ADD and other service providers, as well as using the knowledge and skills of the more resource-endowed and advanced members of the cooperatives.

6.9 Other Spin-off Effects

With regard to policy-making and implementation in the pig sector, representatives from MOA&FS who participated in the platform feel that effective participation of pig farmers and their organisations in the design and construction of slaughter and market facilities has enhanced the ownership and management of such structures. The platform's approach "helps to tailor interventions to local conditions" (interview, MOA&FS representative, May 2012). This effect of the RIU programme is confirmed by the RIU Malawi management team, whose knowledge and experience has been solicited for setting up and facilitating innovation platforms in the roots and tuber sector in Malawi (interview, RIU programme manager, May 2012).

Other spin-offs of the interventions by the RIU Malawi programme involve skill development for members of the Livestock Innovation Platform (three meetings in 2010 and 2011). For farmer leaders and other representatives of the cooperatives, these meetings were opportunities to learn about designing and building a marketplace, working as a team (cooperative leaders and members) to achieve a tangible result and being aware of the importance of sharing knowledge and

experiences with other farmers. Farmer leaders also learned basic skills in financial management (how to handle and account for donor funds) which are useful in other areas.

The platform facilitators received training on facilitation and training skills. Specific trainings helped them to identify key stakeholders in the pig sector, analyse value chains, write concept notes and develop action plans. These skills are also useful for other projects and in their daily work outside the RIU programme. Local facilitators brokered with cooperatives, local government, public sector services and private entrepreneurs at the district level. The intensity and results of such facilitation were dependent on the individual facilitator's motivation, commitment and pre-existing knowledge, as well as the facilitator's position relative to the cooperative and farmers. This refers to having a close working relationship with the cooperative, which was partly determined by geographical proximity.

6.10 Value for Money and Sustainability

To assess the 'value for money' of the intervention requires an analysis of many items. Among these are: pre-assessment study; RIU headquarter costs; National Innovation Coalition; platform facilitator trainings; farmer empowerment learning groups; Livestock Innovation Platform; pig cooperative trainings; market construction costs; and RIU Programme communications. Many of these items are spread across various other Malawi RIU programmes and some have been paid out of different budget lines by the RIU UK office, making it difficult to isolate all spending related to the Livestock Platform Innovation Platform and market construction.

However, considering just the Livestock Innovation Platform, pig cooperative trainings and market construction costs, some observations can be made. Most of the costs are predictably related to the Livestock Innovation Platform and the construction of the markets. The marketplace in Mzuzu was more expensive than the other markets because, after work had begun to convert an existing poultry facility, it was found that foundations needed to be relaid. The costs of the market construction were hardly extravagant and, if anything, they reflect the tight budgets that were available for the intervention. With the limited amount of money available per slaughter and market facility, it is perhaps not surprising that their capacity does not meet the requirements of large processors involved in the platform meetings. The platform attempted to distribute funds for the markets equitably and, while not a bad thing per se, this meant there was little flexibility. With such a modest level of funding, it might have been wiser to construct only one or two of these markets in combination with addressing the marketing system (e.g. accounting for challenges in production, transport, finance and gaps in knowledge) to develop a 'proof of concept' that could be implemented later in other areas. Relatively little money was disbursed for pig cooperative trainings, for example. Nevertheless, the slaughter and market facilities appear well-constructed and prospects for sustainability appear good, with each market likely to serve the area for a long time, provided that the cooperatives are able to remain fully engaged in management, as they are at present.

Finally, the costs of the Livestock Innovation Platform, while not insignificant relative to the money invested in the marketplaces, are reasonable. The platform succeeded in bringing together stakeholders from across the sector – an important contribution that can be built on by

future interventions. It also demonstrated the feasibility of innovation platforms in Malawi as a way of taking a multi-stakeholder approach to decision-making. Unfortunately, the platform was not able to be sustained when RIU funding for the cooperatives ended, although in interviews some platform members have said that they remain in limited contact with some other members, and the facilitators from ADD in Mzuzu and Mulanje remain engaged with the activities of the cooperatives.

Table 6.7 Selected Costs of the Malawi RIU Programme for Livestock

Item	Description	GB£	US$
Livestock Innovation Platform	Meeting costs (DSA, transport, accommodation, food, venues, etc.)	30,963	48,395
Pig cooperative training	Training costs - **Mzuzu**	509	796
	Training costs - **Mulanje**	2,823	4,412
	Training costs - Balaka	1,377	2,152
	Training costs - Dowa	1,050	1,641
	Totals	**5,759**	**9,001**
Market construction costs	Marketplace - **Mzuzu**	23,966	37,459
	Marketplace - **Mulanje**	13,049	20,396
	Marketplace - Balaka	12,698	19,847
	Marketplace - Dowa	12,845	20,077
	Totals	**62,558**	**97,778**

Source: figures provided by the Malawi RIU country office

6.11 Conclusions

Attribution to the RIU Programme

The perceived innovation contributed by the RIU Malawi programme and the Livestock Innovation Platform members was the construction of four slaughter and market facilities. It is questionable whether this can really be regarded as innovation as there was no experimentation or iteration and construction was approached as a project led by the platform. Two of the four slaughter and market facilities (Mzuzu and Mulanje Districts) were targeted in this impact study because they were regarded as more advanced than the other markets, which were completed only shortly before this impact study was undertaken.

Although construction of the markets was accomplished, their outreach to pig farmers and impact on farmer households has been rather limited (particularly when compared to the initial RIU country target of 19,600 farmers using the markets across four districts by 2011). As discussed in section 6.8, the RIU programme has created the potential for changes in the coordination in pig value chains, but at present this potential is far from realised.

The underlying reasons for this were explained in the preceding sections, but can be summarised as follows: a singular focus on building slaughter and market facilities rather than developing the marketing system; low capacity and lack of resources for cooperatives to offer services to members (although this is improving); very low capacity of pig clubs to link farmers with the markets; lack of credit, both for farmers to improve pig production and for cooperatives to improve their services; lack of capacity at the new markets to slaughter many pigs at one time for pick-up by large private companies; low production capacity of pig farmers to produce quality pigs (lack of knowledge, experience, finance, coordination); high cost/lack of availability of transport; and lack of coordination to get pigs to the RIU market.

The application of an 'innovation platform' was itself something of an innovation, although its capacity to stimulate innovation proved to be weak – it took a classical project approach that didn't achieve its objectives in terms of the number of farmers reached, nor in building the capacity to link the RIU markets to large processors. Furthermore, the Livestock Innovation Platform ceased to function as soon as the RIU funding ended. However, a platform approach, with a well-defined mandate but without too many structures and procedures, is a way to provide leadership for policy implementation in a highly complex setting such as the agricultural sector, where public, non-profit and for-profit organisations need to work together to address multifaceted issues.

The building of the slaughter and market facilities has motivated the associations to formalise as cooperatives, and for some pig farmers to become more serious and professional about marketing pigs. Farmer leaders admitted that, before the programme, the cooperatives actually did very little (for a number of reasons, including lack of resources to act). This has meant that the cooperatives are now working on developing longer-term vision and action plans. However this process is still in the early stages and not yet developed. It would have been ideal for the RIU (or another body that understands the institutional history of the cooperatives) to support this process.

Lessons Learned

Once the pig sector had been chosen and the action plan accepted, the platform focused almost solely on building slaughter and market facilities, and donor funds were allocated primarily for construction. The platform missed the opportunity to innovate through, for example, a market systems approach, despite investments made by the RIU programme in skill development of the facilitators.

The private sector actors needed to be involved throughout the process to make sure that slaughter and market facilities would be built in line with their requirements and that the cooperatives would be prepared for trading with such private enterprises, i.e. being able to supply volumes of quality carcasses. The private sector, which was intended to be a key trading partner of the cooperatives, seems to have been absent following initial consultations.

The platform facilitators working with the cooperatives and RIU markets assessed were both from ADD. According to their formal mandate, they are particularly knowledgeable about pig farming and aim to take into account farmers' interests. Any strategic discussion on marketing

of pigs was limited to the cooperatives. Facilitators that could also support this strategic discussion and take into account the perspectives and interests of multiple actors would have been an added advantage. The geographical proximity of the facilitator to the cooperative and the motivation of the facilitator to engage with the cooperative were found to be important factors in providing necessary support to cooperatives.

The initial decision to focus on pig marketing was based on the assumption that adequate knowledge and technologies for pig husbandry were already available at the farmer level. However, the majority of farmers still require basic advisory and extension services, which are scarce. Such initial assumptions need to be verified; in reality, the lack of knowledge and technology was found to be a major constraint to farmers being able to market their pigs. Furthermore, disseminating available pig husbandry technologies (e.g. technical leaflets, information days) would help to facilitate the supply of quantity/quality of pigs, even when no direct RIU support is provided to ADD.

The development of value chains always requires interventions at several levels and support to multiple actors. A focus on marketing, rather than on building slaughter and market facilities at all four sites, would have cost more than the funds available through the RIU Malawi programme (2009 2011). Therefore, it might have been an option to limit the RIU interventions to one or two sites, where a proof of concept could be demonstrated before rolling out to other areas.

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PHOTO: GENEVIÈVE AUDET-BELANGER

Mini workshop with platform coopertaive members in Rwanda

7 Synthesis

Authors: Peter Gildemacher and Remco Mur

A major question at the basis of the impact assessment was whether the Africa component of the RIU programme made a measurable contribution to agricultural development that could be considered value for money. The RIU programme aimed for two parallel goals: first, realizing impact at scale through agricultural development; and second, learning how to improve the contribution of research to agricultural development. In line with these goals, the value of the programme is assessed here for two types of results:

1. Direct and expected future results realised in agriculture as a result of the RIU investments;
2. Generic insights on how to realise durable change in agricultural systems, gained with regard to effective contributions of research to agricultural development.

This synthesis will first focus on the currently realised and expected future results. Next, generic lessons about agricultural development in practice will be drawn from the five cases.

7.1 Current and Future Household Level Impact

When considering the balance of total investments in the five cases that were studied, compared with the results achieved, a mixed picture emerges. In the case of cowpea in Nigeria and VBAs in Kenya, there is a clear positive return on the investments made by RIU. The value created far outweighs the investment made by RIU, and continued value creation is expected. In the other cases, however, such a direct relationship between RIU investment and value created could not be demonstrated.

Table 7.1 Summary of Results of the Five Cases

Case	RIU Investment (GB£)	Major Results	Current household impact	Future household impact	Capacity to innovate
VBA Best Bet	554,349	• Measurable income improvement • Food security improvement • Improved research extension famer linkages • Alternative agricultural service provision system at scale • Better access of producers to improved technology	+	+	+
Armyworm Best Bet	289,360 (Spex-NPV) 227,913 (CBAF)	• Community-based forecasting adopted within ministries • Public extension/local government linkages improved • Change in perception of role of producers in agricultural services • Private biotech laboratory initiated	-	+/-	-
Pig Platform Malawi	86,497	• Farmer-run pig slaughtering and marketing facilities built	-	-	-
Maize Platform Rwanda	313,391	• Multi-stakeholder platform functional • Farmer-run maize trading company built • Inventory credit system piloted • Improved maize production popularised	-	+/-	+
Cowpea Platform Nigeria	310,000	• National Agricultural Research Council adopted platform approach • Triple bagging technology popularised and commercialised • Multi-purpose, Striga-resistant varieties popularised • Improved fodder bailing technology developed and promoted	+	+	+/-

In Table 7.1, results of the five cases are presented in summary form for the sake of comparison, based on the details presented in the five case study chapters. Both the VBA Best Bet and the Cowpea Innovation Platform have resulted in current household level impact and are likely to continue to deliver household level impact in the future. For the Maize Innovation Platform in Rwanda, any impact as a result of intensified production was obscured by the strong general trend towards intensified maize production as a result of Rwanda's Crop Intensification Programme. The Inventory Credit System shows promise, having had positive household level impact in one of the two years considered. Future household level impact depends largely on improvement in the capacity of the maize trading company, NYAMIC, to realise price premiums as a result of storage and speculation on price trends. For the Armyworm Best Bet, no household level impact could be demonstrated. In the first place, there had not been major outbreaks of armyworm since the initiation of the Best Bet and, more importantly, no change could be detected in decision-making by producers with regard to armyworm control. Still, there are indications that the capacity to be aware of and respond to armyworm infestations has improved, especially in Kenya, which holds the promise of future household level impact. The Pig Innovation Platform in Malawi rightly identified pig farming as an important opportunity for local economic development, but it has failed to effectively take advantage of this opportunity; it has not delivered household impact to date, and appears unlikely to deliver this impact in the future.

Looking at the results obtained in the five cases, one can be cautiously optimistic about the overall results obtained thus far, and the prospects of accumulating future impact. Table 7.1 shows that the interventions together have cost £1.78 million, invested over a period of roughly two years, in six countries. The investment has resulted in two cases with current and future household level impact (VBA Best Bet and Cowpea Platform, Nigeria), one case in with good prospects for future results (Maize Platform, Rwanda), one case with possible future impact (Armyworm Best Bet), and a single case for which minimal results were obtained (Pig Platform, Malawi).

It has to be kept in mind however, that the selection of cases was not random, but focused on drawing lessons regarding impact as a result of promoting agricultural innovation. The five cases only form a subset of the RIU programme in sub-Saharan Africa, and these results cannot be considered representative of the entire programme. Prior to its mid-term review in 2009, much of the RIU intervention was less results-oriented and has not been considered in the study presented here.

7.2 Capacity to Innovate

RIU was not a conventional programme that simply aimed to maximise the development return on public investment made by the programme. Besides contributing directly to household level impact, the contribution to innovation capacity of these RIU cases has been assessed, to determine whether they contributed to improving the speed and efficiency of emergence of improved practices in agriculture.

The case of the VBA Best Bet shows evidence of an improved capacity to innovate. FIPS functions as a specific body that scouts for specific technical and marketable practices that could be useful for agricultural producers and puts these promising practices to the test of reality. For the Armyworm Best Bet there is less evidence of an improved capacity to innovate, but new relationships have been established between the public extension, local administration and farmers, which can form a framework on which further improvements in pest and disease control can be pursued. Furthermore, relationships have been built, specifically in Kenya, for pre-competitive collaboration between the pest control board, the national pest control services and the pharmaceutical industry. The Maize Innovation Platform in Rwanda did result in an improved capacity to innovate. The platform has contributed to improving relations between maize producers, small traders, advisory service providers, district administration and public extension officers. The continuation of the platform itself, however, is not guaranteed now that financial resources are no longer available. The Cowpea Innovation Platform in Nigeria succeeded in embedding a stakeholder interaction approach in the ARCN strategy. The platform was most active at the state level and less active closer to the grassroots level. It has been effective in achieving technology transfer at scale; it has focused less on building mechanisms for more effective experimentation with new practices. The Pig Innovation Platform in Malawi has not resulted in an improved capacity to innovate.

Simply improving relationships between actors does not necessarily improve the capacity to innovate. Considering the different cases, it can be seen in the Rwanda platform that platform members have developed the mechanisms for trying out new things within the maize sector in the district, which can be considered as a capacity to innovate.

7.3 Validity of the Basic Assumption of the RIU Programme

From the interactions with RIU implementers, it is clear that the programme has a turbulent history and this has had an important effect on programme results. The RIU programme was born out of the desire to assure the best possible use of research outputs that had been attained using DFID funds in the RNRRS programme. Behind this desire was the assumption that research results were being underutilised generally and that results derived from the RNRRS programme, in particular, were not being used. In other words, it was assumed that there were RNRRS-derived research results lying 'on the shelf', which, given the right impetus, would deliver development results.

However, this manner of thinking about the role of agricultural research in development does not coincide with the reality of the innovation process. Innovation is hardly ever sparked or driven by new research results becoming available from 'curiosity-driven science'. More often, innovation is driven by a specific demand for the solution of a pressing problem, or the opening up of a new market opportunity or a service. Innovation processes are driven by need more than by the supply of research results.

Once there is such a need, the reservoir of research-based knowledge forms one of the possible sources from which possible solutions can be drawn – an important source, but not the only one. Observing that there is no linear relationship between research and innovation should not be interpreted as discounting the importance of fundamental and applied research, but it is essential to manage the expectation of directly measurable development as a consequence of research.

The RIU programme contained the clear objective to create value directly from research results derived from the RNRRS programme. This expectation goes against the principles of needs-driven intervention, and of making use of multiple sources of innovation. Rather than starting with the open question of needs and then engaging in a wide search for possible solutions from different sources, pre-conditions were set that reduced the chances of effective innovation. Instead of looking for solutions and options from multiple sources – e.g. existing practices, farmer knowledge or other scientific knowledge – the programme restricted consideration to a small sub-set of scientific knowledge, i.e. the insights developed through the RNRRS programme.

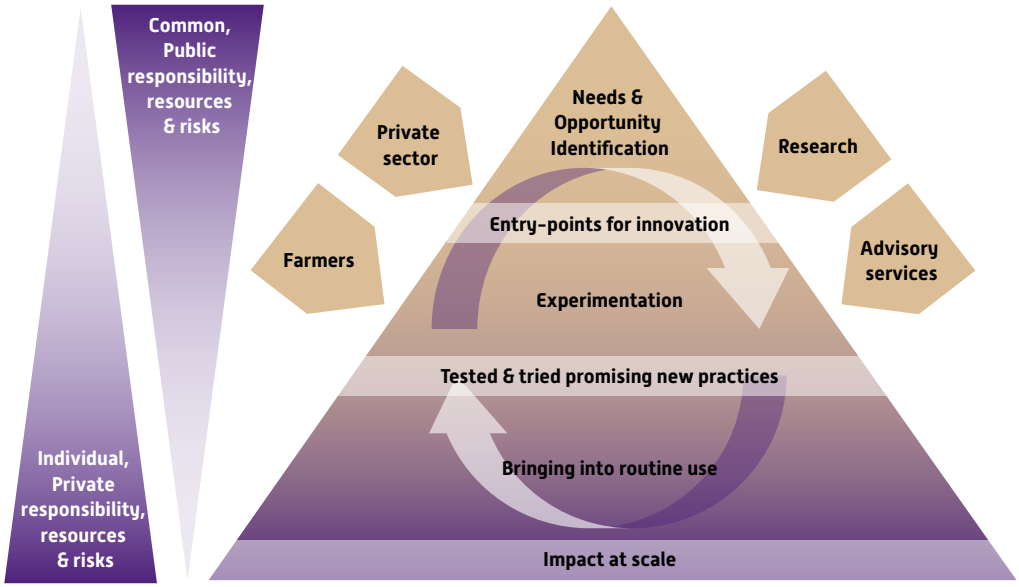
Fortunately, many of the initiatives under the RIU programme, including the Africa country programmes and the Best Bet project that received funding through RIU, did not persist in focusing exclusively on creating development value from RNRRS research results. In fact, this objective was entirely abandoned as a leading principle halfway through the RIU lifespan. Still, that original goal has had a major impact on decision-making in the programme. Until the RNRRS focus was abandoned after the mid-term review, the components of RIU that had been initiated were challenged with trying to combine the objective to promote RNRRS research outputs with the objective to create local development impact. This may have contributed to some of the decision-making with regard to the Armyworm Best Bet. It is possible that, instead of looking at what could best be done to reduce damage from armyworm, the focus was on how RNRRS research results could contribute to that goal, without giving due consideration to other intervention options.

Some components of the RIU programme, particularly the Best Bet projects, only began after the mid-term review, and consequently have had limited time to realise impact. After only about two years of effort, it is difficult to assess the household level impact that has been achieved by these initiatives. Therefore, results should be assessed with care, and the various initiatives described should be judged on what they have been able to achieve in spite of circumstances that were not always ideal.

The efforts by RIU to stimulate agricultural innovation through the Africa country programmes and the Best Bet initiatives do provide food for thought. Based on the experiences in the five cases studied here, a different model for agricultural innovation is proposed. The model does not capture the complex reality and dynamics of the innovation process, but aims to assist in decision-making with regard to the investment of public (donor and national government) funds to stimulate agricultural innovation for impact at scale.

7.4 Alternative Model to Support Agricultural Innovation

Figure 7.1 The Deliberate Process of Agricultural Innovation for Impact at Scale



Based on the analysis of the five cases studied, an alternative model for the process of agricultural innovation is proposed (see Figure 7.1) This Figure is derived from, and serves to illustrate and analyse, the experiences of the five case studies. Depiction in a two-dimensional Figure does carry the risk of oversimplifying, but it may be helpful for distinguishing between components of the process of agricultural innovation. A number of principles need to be kept in mind when interpreting the Figure:

1. Interaction between stakeholders can add quality to the components of the process. Interaction is more inclusive at the pre-competitive top level, and more specific and exclusive lower in the Figure.
2. Although there is a general flow from identifying opportunities to bringing into routine use, there is no single possible direction of the process from the top to the bottom of the Figure. Bringing into routine use may require renewed opportunity assessment and experimentation.
3. There is a trend of shifting from pre-competitive collaboration for the common interest, at the top of the Figure, to a multitude of more competitive efforts during the process of bringing into routine use.

In the discussion which follows, the process of agricultural innovation is discussed first, illustrated by examples from the case studies. Next, the roles of the different important actors within the process of innovation – farmers, private sector participants, research and advisory services – are analysed. Finally, the question is asked: what can be done to improve the quality of the process of innovation, with a specific emphasis on the effective use of public resources?

PHOTO: GENEVIÈVE AUDET-BELANGER

Maize storage

7.5 The Process of Agricultural Innovation

The linear 'transfer of technology' model of thinking about change in agriculture has been abandoned (Arnold and Bell, 2001; Leeuwis and Aarts, 2011) and many have advocated for a shift towards innovation system thinking (Hall et al., 2001; Spielman et al., 2009), which focuses on the interaction between diverse actors, including the private sector (Biggs, 2007; Hall, 2006). An important core element in innovation system thinking is the understanding that innovation

or change usually involves a re-ordering of relationships and interactions between stakeholders (Leeuwis and Aarts, 2011). An important consequence of this realisation is that what has worked in one place cannot simply be 'copied' to another environment.

What is missing in this way of looking at change in agricultural systems is a vision for how to get to scale. The description by Rogers (Rogers, 1995, 2003) of diffusion of innovation has been criticised for being over-simplistic, assuming that diffusion of innovation is an autonomous process which happens on its own. Still, it does present an idea about how innovation gets to scale. The current discussion on innovation focuses on how to facilitate the process of innovation and its uniqueness in each environment. What is lacking is a vision of how to use promising practices that have been proven in one environment in an effective manner to realise change on a larger scale.

We conclude from the five case studies that it makes sense, especially in response to the lack of vision for getting to scale, to distinguish three different processes in agricultural innovation:

1. Needs and opportunity identification;
2. Experimentation;
3. Bringing into routine use.

Needs and Opportunity Identification

The basis of the process of agriculture innovation is the identification of needs and opportunities. The objective of a needs and opportunity assessment is to identify entry points for innovation. This process of assessment feeds the second process of agricultural innovation: experimentation. Descriptions of needs and opportunities can originate from multiple sources, who may be farmers, private entrepreneurs, researchers or others, and they are meant to trigger the initiation of local experimentation with new practices. Not all of the cases discussed gave specific emphasis to the needs and opportunity assessment.

Emphasis was put on the needs and opportunity assessment for the Rwanda maize platform. This was a two-step process: first, the RIU programme chose maize in Nyagatare as its subject; next, the platform served as the mechanism for needs and opportunity assessment. This was not a one-off exercise; throughout the life of the platform, new opportunities were selected to pursue. This was perceived by the platform to be one of its mandates, to facilitate a continuous search for entry points for innovation to improve the maize sector. Through this process, production-related opportunities, such as improved varieties, fertilizer use and better husbandry practices, were identified. Improved market access and adapted financial products were also identified as needs for maize sector improvement in Nyagatare. After the end of the project, the maize platform still exists and can continue to fulfill the function of maize sector needs and opportunity assessment.

The process was different in the pig platform in Malawi. First, livestock was selected as the main sector for intervention; within that sector, pig farming was selected as a promising subsector, with particular opportunities for improvement in the marketing system. Next, the platform identified one opportunity to tackle, the development of local slaughtering and marketing facilities for pigs. Beyond that, the platform did not continue to play any function, other than

decision-making about use of the RIU resources available. In the case of the cowpea programme in Nigeria, the stakeholder platform limited itself largely to the promotion of promising research results from the RNRRS programme. An open needs and opportunity assessment was not done, and so did not form a specific component of the platform's mandate.

In the Best Bet cases, FIPS Kenya and armyworm control, there were no needs and opportunity assessments as such. The opportunities were selected through a competitive process, with a panel of experts judging proposed innovations on the basis of a pitch by the leader of the consortium. In the case of FIPS, however, within the mandate assumed by the organisation, there is an internal continuous search for opportunities in the parallel marketing of agricultural inputs and provision of advisory services. The FIPS organisation carries on a continuous search for new inputs and farming practices from multiple sources -- including traditional farming practices, the private input industry and research -- to be tried by VBAs and farmers. However, there is no specific consultation mechanism for assessing needs of producers. What makes the FIPS approach different from using a platform for opportunity assessment is that the responsibility of gathering ideas and opinions from multiple sources rests unilaterally with FIPS, and there is no direct cross-fertilisation of ideas from different stakeholders.

A prerequisite for quality assessment of needs and opportunity seems to be quality facilitation of interaction between stakeholders. Understanding of the role of the platform, and quality of facilitation of the process, were higher in the case of Rwanda than in the case of Malawi, where the platform was interpreted as an unconventional way to plan the spending of project funds. Within the limited mandate of FIPS, higher management in the organisation has taken responsibility for the continuous search for new opportunities to pursue.

There is a pronounced difference between the platform approach of finding opportunities for further experimentation, and the Best Bet approach. This can be illustrated by the maize platform in Rwanda, which had needs and opportunity assessment as a specific objective. The platform provides an arena for stakeholder interaction, with the specific objective of bringing together different views and opinions, aimed at the identification of opportunities from multiple sources. Through deliberate interaction, the platform does more than collect and select opportunities, but also provides room for cross-fertilisation of ideas from multiple sources. In comparison, the Best Bet facility selected opportunities through an open call for proposals. This provides less deliberate space for cross-fertilisation of ideas, and relies on a selection process based on convincing proposals and presentations of ideas. The experience of RIU shows that both pathways can result in the selection of relevant initiatives for further experimentation. However, the cases of the armyworm Best Bet and the pig platform demonstrate that there is no guarantee for success through either approach.

Experimentation

The second process of agricultural innovation is experimentation. During this process entry points are tested and adapted under real circumstances. This experimentation can focus on farming technologies, but also on new market relations, services or collaboration models. The objective is to arrive at tried and tested promising new practices, which can be brought into routine use. The distinction between experimentation and 'bringing into routine use' is not

clear-cut. Still, when analysing the five cases, making this distinction is helpful for determining the roles of different actors, informing decision-making with regard to the use of funding, and considering the possible actions that could be undertaken to improve the quality of the process.

One characteristic that distinguishes experimentation from 'bringing into routine use' is that the process of experimentation is often 'pre-competitive'. Experimentation is in the public interest, and provides information and experience to a wider audience. It largely takes place in the public arena, with the input of a multitude of different actors interacting. Impartial process facilitation and public resources are also important, and only partial investment by the private sector – whether producers or agri-business – can be expected, as the results do not exclusively benefit a few, but are of public benefit to many. A second important characteristic is that experimentation includes room for failure and consequently carries higher risk. In experimentation risks must be taken to put untested assumptions and ideas to the test of reality. Without the willingness to recognise and accept the possible failure of practices and approaches being tested, no adaptation and selection can take place. High risk and failure are easier to accept in a pre-competitive setting, in which risks are shared among stakeholders, and which offers an important role for public funding.

In the Rwanda maize platform, experimentation was initiated from a variety of entry points. New farming practices and maize varieties were put to the test. Different financial services were also tested and introduced. In the FIPS case, two levels of experimentation can be identified. First, there has been experimentation with the combined advisory service provision and input supply through the Village-Based Advisors, as an alternative for the poorly functioning input supply and extension services. Secondly, within FIPS, experimentation with new agricultural practices and inputs is part of the ongoing activities.

In the other cases there was little focus on experimentation. The armyworm project focused on building laboratory facilities for Spex-NPV production and replicating the already tried and tested system of Community Based Armyworm Forecasting. The pig platform focused completely on building local slaughter and marketing facilities, while the Nigeria cowpea platform focused on 'bringing into use' tried and proven technology.

Bringing into Routine Use

The third process of agricultural innovation in Figure 7.1 is 'bringing into routine use'. This is the process of assuring that tried and tested practices reach their full potential in terms of scale. It is this process that moves promising new practices to impact at scale. Underestimating the importance of this process has been a pitfall, hampering learning from and replicating successful experiences. It must be recognised that this process also requires experimentation, risk-taking and local adaptation, much like the experimentation phase, but it differs in the levels of risks that need to be taken, and the amount of room for failure. The 'bringing into routine use' process is characterised by competitiveness, which provides the pressure needed to assure efficient use of resources and quality of production and service delivery. There is much less emphasis on developing new practices and approaches for the public good. The focus is on assuring sustainable and lasting, cost-effective or – in the case of private sector involvement – profitable service delivery and production. 'Bringing into routine use' almost invariably requires local

adaptation. This adaptation can take different forms, such as adapting the technology or practice ('hardware'), assuring that users have the right knowledge and skills ('software'), changing institutions and ways of organisation, or restructuring relations and interactions of stakeholders ('orgware') (Leeuwis and Aarts, 2011). There may be a need for policy changes, training or organisation of producers, traders or service providers, or adaptation of the technology or practice itself, to ensure it can exert its potential effect in an environment where it was not initially developed during the experimentation process. The process of 'bringing into routine use' may resemble the process of experimentation, with the major distinction that it is of lower risk and more pointedly focused on achieving the same result as the experimentation, but at scale. As 'bringing into routine use' happens within a competitive arena, participation of all stakeholders in initiatives cannot be expected – especially if they are competing against each other.

The cowpea platform in Nigeria was committed to 'bringing into routine use' tested and proven technology. It successfully brought dual-purpose varieties and triple bagging into routine use, taking the pilot success from experimentation to scale and thus realising development impact at scale. FIPS specifically built a service provision system intended to bring tested and proven technologies into routine use. It contributed successfully to bringing soil tillage technology and improved varieties into routine use in Kenya. This required building an organisation purposely designed for service delivery and also adapting the technologies available, mainly by reducing the size of the packages. In the armyworm case, community-based forecasting was brought into routine use, although with more success in Kenya than in Uganda. The objective of the Spex-NPV component was to bring it into routine use, but the technology was immature and not yet suitable for promoting routine use. Even the choice of this technology as the best solution for armyworm control could be considered premature. In the case of the pig platform, there was not enough reflection and interaction between pig chain stakeholders before building the markets. It was decided too quickly that a physical slaughterhouse and marketplace would be the solution for marketing problems. Furthermore, four markets were built at the same time. It might have been more effective to assess marketing constraints with stakeholders and, if a slaughterhouse and marketplace was ultimately considered the best solution, to build one market initially, according to specifications determined by the private sector, farmers and experts, and test its functioning. The Rwanda platform focused mainly on experimentation, and some of the results of that experimentation have been 'brought into routine use'. Experiences with both the maize Inventory Credit System and the maize trading company, NYAMIG, are now being used as a basis for larger-scale similar interventions.

In order to bring promising new practices into routine use to achieve impact at scale, it is useful to build on experiences from the experimentation phase. The experimentation phase should not be seen only as a necessary step for moulding the promising practice into its final form. This phase can also provide essential information about the process required for successful adaptation in a different environment, and the circumstances that are prerequisites for success. The experience with Community Based Armyworm Forecasting in northern Tanzania provided information for a faster implementation of the same process elsewhere, although it may be argued whether enough was learned from this earlier experience. Similarly the experience of the Inventory Credit System and NYAMIG, the maize trading company that spun off from the maize platform, provided important information to the larger-scale efforts to establish similar financial

services elsewhere. Both earlier and current experiences in training community-based advisors in the FIPS Best Bet have been useful to inform and guide similar efforts in other countries.

7.6 The Role of Different Stakeholders in the Agricultural Innovation Process

The Role of Research Organisations

Research can play an important role in agricultural innovation. One contribution is providing entry points for innovation during the needs and opportunity assessment. This is not equivalent to providing solutions, as there are multiple possible entry points for innovation; research is an important one, but not the only one. Secondly, research can contribute to the process of experimentation, as researchers are trained to objectively assess the merits of different options, based on measurable performance. Knowledge of structured experimentation to bring a level of objectiveness into this process can assist decision-making in all types of experimentation.

PHOTO: FEMKE VAN DER LEE

Smallholder producer, Kenya

Finally, research could play a role in identifying which elements of the experimentation process led to a 'promising practice', as well as the specific circumstances in which success was possible, to inform the process of 'bringing into routine use'. In other words, researchers can be of use in the identification of those components of the experimentation process that were essential for success, and which need to be repeated when bringing the new practice into routine use.

In none of the five cases studied did research fulfill a role in all three processes of agricultural innovation. Its main role was as a provider of entry points for innovation. In the case of armyworm, research was basically the sole provider of ideas, which was not very successful in terms of realising impact at scale. However, in the cowpea platform in Nigeria, research was also the main provider of 'promising new practices' with proven success, which did lead to impact at scale. In the pig platform in Malawi, research did not play a role, but it is possible that professional knowledge of the pig marketing system could have increased the success of the intervention. In the maize platform in Rwanda, the contribution of research was modest, through participation in meetings and by providing technical expertise. In the case of FIPS in Kenya, research was one of the sources of promising new ideas to be promoted by the programme.

The Role of the Private Sector

The private sector is defined here as agri-business: trade, wholesale, processing and retail. Participation of the private sector is important in all three processes of agricultural innovation. The pig platform in Malawi lacked private sector involvement during a critical stage, resulting in an intervention that did not solve the major constraints of the sub-sector. For both FIPS in Kenya and the cowpea platform in Nigeria, involvement of the private sector has contributed to success. In the case of armyworm, private sector interest was limited, as the commercial prospects for marketing armyworm-specific products are poor; still, private sector involvement was achieved, and this was instrumental in changing policies for semiochemical registration in Kenya.

During the needs and opportunity assessment the involvement of the private sector is important to avoid placing too much emphasis on production constraints. Other problems may be just as – or even more – critical, but may not be identified as such by producers and their organisations. During the process of experimentation the private sector participation is of similar importance, especially to assure that experimentation takes place under realistic circumstances. For example, the participation of the private sector was missing in the Rwanda maize platform when new varieties were being tested for their agronomic traits. At the same time, testing of the desired qualities by the industry is also essential. In the case of maize trading and the Inventory Credit System, an entirely new company was set up, rather than using existing private sector actors.

Furthermore, the participation of the private sector takes experimentation from being exclusively production-focused to being focused on production, quality and deal-making. However, it cannot be expected that private sector partners will invest significant resources during the experimentation phase. Given that this phase is characterised by discovery for the public interest, it is difficult for private sector to contribute. It may become possible under conditions in which the investments in pre-competitive collaboration are shared among different private partners and complemented with resources from other stakeholders, such as producers and government or donor funding. Another possibility would be a situation in which one private company has a

virtual monopoly in a certain sub-sector, which provides a guarantee that the benefits of the innovation process accrue fully or almost fully to the investing party, and not to the competition.

An essential role for the private sector is ensuring sustainability of a practice put into routine use. The best guarantee for continued delivery of a service or product is that it provides a profit to a company or an individual. Private enterprises seeking profit from promising new practices can be an important driver for bringing them into durable routine practice, thus sustaining their impact over time. It must be kept in mind, however, that private delivery of services or products is not the only possible sustainable mechanism, nor is it always an option.

Continued armyworm monitoring, for example, seems to be assured through the public extension in Kenya, in collaboration with producers. In the case of FIPS, one could consider the organisation to be a not-for-profit company; it depends to a large extent on public resources, which can be justified as it is providing services in the public interest.

The Role of the Public Sector

The role of the public sector is more prominent in the needs and opportunity identification and experimentation processes than in the process of bringing into routine use. These more pre-competitive steps require independent coordination and arbitration for the public interest. It is helpful if public institutions can take on responsibilities, provide resources and take risks. They can be more credible as impartial coordinators, as well as advocates for collective action, than either producer organisations, which represent a specific stakeholder group, or agri-business, whose first objective is economic self-interest.

Public institutions, however, are not known for their capacity to assure cost-effective and quality routine services, which are the basis for impact at scale. Therefore, the role of public institutions in bringing promising new practices into routine use is more limited, and tends to be related to creating circumstances under which the private sector, farmer organisations and NGOs can provide quality services and products.

This can be illustrated by the cowpea platform in Nigeria. Promotion of the promising new practices of triple bagging and use of improved cowpea varieties was strongly publicly-driven, using RIU resources and public extension services (ADP). This created awareness and a resulting demand for triple cowpea storage bags and seeds of improved cowpea varieties, which is met by commercial companies on a for-profit basis. In the case of Rwanda, in response to the first pilot successes of the Inventory Credit System in Nyagatare, the government has adapted its legislation to accommodate the development of similar warehouse receipt systems country-wide and in other crops, by commercial financial service providers.

An exception is the Community Based Armyworm Forecasting, in which the public sector does play a leading role in routine implementation, and is likely to continue to perform this role. Even in this case, there remains some question as to which routine tasks could possibly be performed more efficiently by other actors. However, the volume of produce needed is fairly limited and the routine activities are highly erratic, meaning these services are hard to perform commercially on a for-profit basis. Currently, the community-based forecasters are playing an impor-

tant role without remuneration in any form. The apparent lack of incentive for the forecasters to continue in their role was highlighted by both forecasters and public extension staff.

The case of FIPS may be the clearest example of limited responsibility of the public sector in bringing into routine use. The role of the public sector (in this case the international donor community) is largely that of providing resources to FIPS to perform its function on a not-for-profit basis. Furthermore, public research contributes to the search for new ideas to test and develop within FIPS. It remains important, however, to monitor whether and how services that do not provide the advisors with a direct income can and will be sustained over time.

PHOTO: GENEVIÈVE AUDET-BELANGER

Interview with platform member in Rwanda

The Role of Producers

The role of producers is essential in the agricultural innovation process, given that agricultural production is obviously the basis of the entire agricultural economy. As such, producers are the most important target audience for agricultural development initiatives, which makes them the prime stakeholders, as well as essential participants in the entire innovation process.

During the needs and opportunity identification process, high quality farmer participation is essential, to assist in prioritisation and as a reality check. For example, it could be hypothesised that, with a more pronounced farmer participation in decision-making, the armyworm Best Bet would have not have focused on a single technology-based solution for a single pest, and would instead have focused on effective control of a number of pests threatening maize and possibly other crops as well. The FIPS Best Bet provides for continuous interaction with producers to test

and seek for opportunities. In Rwanda, the maize platform provides producers with a mechanism for needs and opportunity identification.

During experimentation, producers are automatically the main implementers when the opportunity for innovation being tested is production-related. For bringing into routine use of innovations, less input of opinion is required than during experimentation. Still, considering that bringing into routine use often requires a repetition of steps that were essential during experimentation, producer participation is still critical.

Strong producer participation can also lead to strong producer-dominated decision making, however. Strong producer participation is essential, since the producers are the main target audience, but this should not result in the undesirable narrowing of options or a lack of decision- making power by other economic stakeholders, such as labourers, traders, processors and retailers, or chain support actors, such as advisory services, researchers and financial service providers. Two underlying mechanisms are thought to contribute to flawed decisions. In the first place, producer representatives naturally defend the interests of those they immediately represent. Their first and most important loyalty is towards their own organisations; consequently, they make decisions to benefit their own organisations before considering the wider interests of the entire sub-sector. Secondly, producers or their representatives, as single stakeholders, will not be able to accurately identify all the needs and opportunities that the sub-sector may have.

The pig platform in Malawi could be seen as an example of flawed decision making, in which farmer domination played a role. The platform was dominated by producer representatives, resulting in decisions which did not coincide with the needs and opportunities of pork trade and processing. The producer representatives, who were leaders of cooperatives, took decisions they believed were in the best immediate interest of their cooperatives, without considering the needs of pig traders or the wider pork sub-sector. This led to an intervention with little relevance for anyone other than the cooperative members close to the slaughter and market facilities – and even of minimal relevance to the totality of cooperative members, as the facilities did little to solve the difficulty of providing traders with a constant supply of large volumes of carcasses. In Rwanda the platform was also producer-dominated, which also led to a producer-dominated view of intervention needs. This resulted, for example, in the establishment of a farmer-owned maize trading company. However, it does appear that in Rwanda the producer domination in the platform was at least to an extent counterbalanced by the representation of other actors, and by intensive facilitation.

Good representation is an important prerequisite for quality participation of producers in the agricultural innovation process. As seen in the Malawi pig platform, and to a lesser extent in the Rwanda maize platform, cooperative leaders represent producers, but not necessarily the larger public interest of an entire sub-sector. In some cases, the cooperative leaders do not even represent the interests of all their members, but only a minority of active members. To protect the interests of a wider class of producers, other representatives than cooperative leaders could be considered, who have an eye for the larger public and producer interest, beyond the immediate beneficiaries. In the case of the cowpea platform in Nigeria, and also in the cases of FIPS and armyworm, there was a strong focus on the larger producer and public benefit.

Stakeholder Interaction

Stakeholder interaction is an important element in the process of agricultural innovation. High quality interaction can contribute to improving the capacity to innovate. The interaction of different, converging opinions and experiences can result in new ideas that would not have developed autonomously. Facilitation of such interaction should be considered in all three stages of the agricultural innovation process.

The innovation platforms specifically aimed at cultivating this interaction. In the case of the Rwanda platform, the objective of blending multiple sources of experience for the purpose of coming up with new entry points for innovation, and putting these to the test under real circumstances, was explicit. In the case of the Nigeria cowpea platform(s) the overarching objective was coordinating interventions to bring promising tried and tested practices into routine use. The Malawi platform did identify a single opportunity through stakeholder interaction, but abandoned the interaction in the course of pursuing this idea. In the FIPS Best Bet, interaction is never between all actors, but is channeled through FIPS. On the one hand, there is interaction between FIPS, industry and research, and on the other, between FIPS, community-based advisors and producers.

7.7 Agricultural Innovation Process Management

Facilitation

When comparing the pig platform in Malawi and the maize platform in Rwanda, it becomes obvious that quality facilitation added value to the process of innovation. In Rwanda, different entry points for innovation were ultimately tested, and there was reflection on the role of the platform and its future sustainability. In Malawi, the platform did not manage to establish a mandate beyond the division and use of the resources available through the RIU programme.

The challenge is to assure quality facilitation over time. Facilitation is and must be without immediate benefit, and as impartial as possible. This means that resources to assure effective facilitation must be levied either through the direct beneficiaries of the interaction, or through public channels, whether government or donor funding. Whatever the source of the resources, it puts some pressure on the objectives of the interaction, because any funder will have an idea about what it is meant to achieve. Part of good facilitation would be to make these expectations explicit, and to seek joint interests and compromise with the immediate interests of interacting stakeholders, through a platform or in some other way.

Essential throughout the innovation process is multidisciplinarity. Facilitation needs to be able to bring in expertise from different fields. In addition, the facilitation should have the capacity to provide system overview, understanding and being able to connect the constraints and opportunities and the interests of different stakeholders. The quality of the process and of the decisions taken need to be checked by looking at them from different angles, in the context of the wider agricultural system; this requires skilled individuals and organisations. Such skills might have assisted the pig platform in taking more sound decisions at crucial moments. Similar capacity can assist in Rwanda, in seeking lessons from the current experience which are important for 'bringing into routine use' some of the results from piloting with the Innovation Credit

System and a farmer-run maize trading company. It is possible that such a capacity has not been available to the armyworm project in Tanzania, leading to a less than optimal process that aimed at replicating the Community Based Armyworm Forecasting success in northern Tanzania in the central part of the country.

It remains hard to see where to best find this multidisciplinarity and these system overview skills. Research organisations may be best placed to develop these particular skills, to improve their contribution to the process of innovation discussed here, which is not specifically research-led. This requires recognition that expert facilitation is essential to accompany agricultural innovation processes, and a clear distinction from the more readily recognised role for research of developing and testing the validity of theory.

Position in the Process of Innovation

Figure 7.2 shows the reviewers' interpretation of the position of the five studied cases in the process of innovation. It assists in explaining how the different cases strived to realise impact at scale, during and beyond the RIU intervention.

The cowpea platform in Nigeria was mainly focused on bringing tried and tested promising new practices into use. These practices had already proven their merits through experimentation under real circumstances, outside of the RIU programme. For the new practices of triple bagging and improved varieties, sustainability has been assured by creating a demand for commercial service supply, and promoting private enterprises to provide these services on a commercial basis. The embedding of the platform into the ADPs at the state level provided a level of continuity to the platform, so that other promising new practices of interest to the cowpea sub-sector can be identified and promoted to bring into routine use. The platform does provide for space to experiment with new entry points for innovation, on the basis of other needs and opportunities identified.

The maize platform provided the function of needs and opportunity identification, as well as the space for experimentation, during and also beyond the lifespan of the RIU programme. The maize platform facilitation did consider the bringing into routine use of promising new practices, such as the Inventory Control System and the farmer-owned maize trading company; however, this function is not fulfilled by the platform itself. Especially now that the RIU programme has ended, attention to the interests of the wider maize sub-sector may well become less pronounced, as this was largely safeguarded by the facilitation from RIU Rwanda.

The pig platform was not successful in achieving impact at scale. In hindsight, one of the contributing factors may have been the attempt to bring solutions into routine use without due attention for experimentation before or during the building of the slaughterhouses and marketing outlets. Apparently the participants were fully absorbed by the practicalities of construction, such that there was not enough space for reflection and adaptation to the actual needs and opportunities present in the pig supply system.

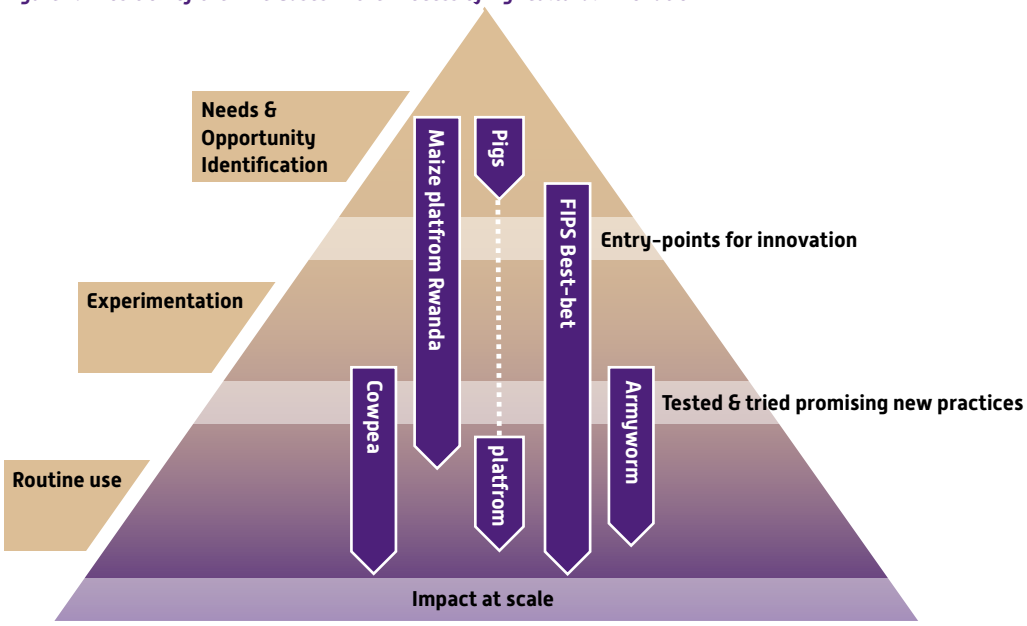
Two levels of innovation can be identified within the FIPS Best Bet. The first of these was the service provision system through Village Based Advisors. This system had been the subject of

experimentation before the RIU programme, and RIU supported bringing the approach into routine use of. The second level was the technology-driven innovation of agricultural production, which is an objective of FIPS. Its approach incorporates specific attention to identification of entry points for innovation, and to bringing tried and tested promising new practices into routine use. FIPS does provide for a formal needs and opportunity assessment. It relies on the Village Based Advisors identifying needs through their advisory service practice and the identification of entry points for experimentation from research and private input suppliers.

The armyworm Best Bet relied on earlier experimentation work. A tried and tested new practice, Community Based Armyworm Forecasting, was brought into routine use in Kenya and Tanzania. This was achieved – more successfully in Kenya than in Tanzania – but so far has not resulted in impact at scale. This is not because the forecasting does not work but because forecasting, as such, does not seem to result in the behaviour change by producers that would be required for a reduction in yield losses.

The biological control of armyworm using the NPV formulation (Spex-NPV) was presented as a technology that would be brought into routine use. However, the technology was insufficiently mature. In the first place it is not known whether armyworm is the most important concern for maize producers, which would most merit investments and potentially result in impact at scale. It was selected as an entry point for innovation without much consultation or reflection on this potential. Also, considering the specific needs of those producers actually suffering from recurrent armyworm attacks, it is unclear whether a biological control option is the solution they need. At this point, it cannot be considered a tried and tested promising new practice. If alternative control options, other than chemical, are an important need of the producers suffering from armyworm attacks, Spex-NPV is one among several possible solutions to pursue further.

Figure 7.2 Position of the Five Cases in the Process of Agricultural Innovation



Capacity to Innovate

It is a common tendency to consider the process of innovation as a pipeline process: starting with a problem, performing research to solve the problem, and ending with the dissemination and adoption of the solution. The visual representation of the process, as shown in Figures 7.1 and 2, risks reinforcing this tendency. However, it is essential to understand that agricultural innovation is not a pipeline process, but a continuous process, in which needs and opportunity identification, experimentation and bringing into routine use can take place in parallel and repeatedly. The quality of the process of innovation is determined by the quality of the three underlying processes presented here. A system with a high capacity to innovate can initiate and sustain the processes shown in the Figure with a high quality – i.e. it can support processes that lead efficiently to desired results.

A high quality needs and opportunity assessment, considering multiple sources of needs as well as ideas for change, results in the identification of potentially relevant entry points for innovation. A quality process of experimentation, under real circumstances, with broad participation of stakeholders, results in locally tried and tested promising new practices. A second result consists of valuable knowledge gained about what is needed to bring the promising practice into routine use. This knowledge assists in efforts aimed at realising impact at scale, which means realising similar results as during the experimentation, in different environments. The ability to fulfill these three functions determines the quality of the innovation process or, in other words, the capacity to innovate.

The five cases of the RIU programme demonstrate that impact at scale can be achieved without specifically intervening to improve the quality of all three of the processes that together constitute the process of innovation. The cowpea platform in Nigeria realised impact at scale by focusing only on bringing tried and tested promising new practices into use. The Rwanda maize platform concentrated successfully on the needs and opportunity assessment and experimentation. The Nigeria platform relied on earlier work which fulfilled the needs and opportunity identification and the experimentation processes, while the Rwanda platform made efforts to communicate its experiences and advocate for considering their routine use. The cases of armyworm and the pig platform demonstrate that not considering the three processes can lead to disappointing results.

A continuous impact beyond the lifespan of a project could best be obtained by not only considering the realisation of routine use of promising new practices for impact at scale, but at the same time aiming for a lasting improvement of the capacity to innovate. The maize platform in Rwanda can continue to assure a quality needs and opportunity identification and to provide an environment for experimentation. An important challenge is to maintain a focus on the larger producer and public benefit, beyond the needs of the platform's direct members, and to continue to advocate for bringing experiences into routine use outside the platform. The Nigeria platform can continue to promote the routine use of tried and tested promising new practices but it will continue to rely on needs and opportunity identification and experimentation done by others, if it maintains its current way of operating. Venturing into these processes might further increase its impact and improve the capacity to innovate. FIPS has developed a mechanism that fulfills both experimentation and brings into use the tried and tested practices that are emerging.

It may contribute even more to improvement of the capacity to innovate if the needs and opportunity identification from multiple sources is considered more prominently.

7.8 Implications for Policy and Practice

The RIU programme has tried out different approaches to stimulate agricultural innovation. A number of lessons can be drawn from this programme which have a bearing on the implementation of agricultural development initiatives, as well as on the use of public resources, whether through governments or donors. The review presented here, of five selected cases of the RIU programme in Africa, provides insights for future decision-making with regard to the investment of public – government as well as donor – resources for achieving impact at scale.

PHOTO: GENEVIÈVE AUDET-BELANGER

Maize cooperative - post harvest

Once more it has been demonstrated that seeking a direct linear relation between agricultural research results and agricultural development can easily lead to an unnecessary limitation of options being considered as entry points for innovation. Research is an important source of potential entry points, but not the only source. Therefore, a distinction needs to be made between funding research initiatives, which aim at enriching our knowledge through developing and testing theory, and promoting agricultural innovation. The first will ultimately assist research to contribute to the innovation process, as it can propose new, formerly unavailable entry points for innovation. The latter process of agricultural innovation does not put research at its centre, but focuses on needs and opportunity identification, experimentation under realistic circumstances, and bringing the insights gained into routine use. Research organisations have an important role to play in the latter process, but are not the essential drivers of the process.

With respect to the process of agricultural innovation it is important to acknowledge the three processes that underlie agricultural innovation: needs and opportunity identification, experimentation and bringing into routine use. Only focusing on one or two of these processes does not necessarily mean no impact can be achieved; however, this would assume that the other functions are well taken care of. This assumption should not be made lightly, with the cases of armyworm and the pig platform serving as evidence that it may hamper achieving impact at scale.

Next to an immediate and measurable objective of realising impact at scale during the lifespan of a project, improving the capacity to innovate should be considered an objective of equal, or even higher, importance. The demand by funders to assure a measurable result at household level by the end of a project is understandable, and also justified, as public resources need to be accounted for through development impact that can be felt by the targeted resource-poor beneficiaries. A singular focus on such impact at household level alone, however, does little to promote a sustainable improvement of the targeted agricultural systems. To address that objective, an increased capacity to innovate is needed. Thus, an intervention programme would do well to invest in assuring impact at scale in the short run, while simultaneously investing in the capacity to innovate.

The needs and opportunity identification and the experimentation are especially difficult to fund through direct economic actors, as they are pre-competitive tasks, with an indirect and unsure return on investment. Funding from public sources, be they governments or international donors, can make an important difference here, as seen in the case of the maize platform in Rwanda, for example. Both of these processes require impartial facilitation, which is costly and merits the continuous use of public resources. Furthermore, the process of experimentation under real conditions contains high risks and is often for a public, rather than specific stakeholder, benefit. The high risks of this experimentation can be reduced by using public funding. Public resources can be invested in providing suitable incentives for the participation of private agribusiness, and also of private service providers and producers, in the process of experimentation with identified entry points for innovation. The intended result of these investments is tried and tested promising new practices, with a 'beyond local' potential, as well as knowledge on how to promote these practices outside the environment in which they were tried. Ideally the pre-competitive efforts are funded jointly by the stakeholders in the system, i.e. farmers, traders and industry; such mechanisms for funding of pre-competitive collaboration are often considered more sustainable than public funding. It has to be recognised, however, that voluntary contribution to initiatives primarily in the common, public interest are hard to sustain, possibly even harder than investment of public resources.

For the third process, bringing into routine use, more attention must be paid to the financially sustainable and lasting delivery of products and services. This means that much more care has to be taken in deciding what to fund with public resources. Funding the routine services themselves is only justified if it provides a continuous public benefit and cannot be funded otherwise, such as through the users of the service. In the case of FIPS, for example, the continued service delivery by Village Based Advisors does not seem to be fully assured through their income from selling inputs. At the same time, however, FIPS is making a difference and is realising household level impact. It could be justifiable to seek avenues through which the Village Based Advisors

receive incentives to continue to provide the services desired by producers, especially those that have no direct relation to generation of their own income. In the case of Nigeria, public resources were used to promote awareness about promising new practices, while at the same time assuring a commercial service delivery, allowing for withdrawal of public resources.

7.9 Conclusions

The five selected cases of RIU in Africa show mixed results in relation to household level impact at scale. Some show the promise of contributing to future impact (maize in Rwanda, Community Based Armyworm Forecasting), others have realised impact at scale and are likely to contribute to further impact in the future (cowpea in Nigeria and FIPS), while the pig platform is unlikely to deliver future results, although the pig sub-sector does continue to hold promise for development.

The combination of the five cases did allow for the development of a model that can assist in decision-making about intervention design and investments in agricultural innovation. Interventions aimed at agricultural development through innovation would do well to consider two types of results: household level impact at scale, and an improved capacity to innovate. Three different processes, which together determine the capacity to innovate, need to be considered, both to realise impact at scale during the lifespan of an agricultural development intervention and to improve the capacity to innovate.

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BRINGING NEW IDEAS INTO PRACTICE

Experiments with agricultural innovation

African smallholder farmers need to intensify their production systems and adapt to continuous, often unforeseen and sudden changes in their environment, which requires continuous innovation.

An important question for policy makers and managers in the field of agricultural development is how to best invest resources to support agricultural innovation. In this book, we document lessons from Research Into Use (RIU) in Africa, a United Kingdom Department for International Development (DFID) funded programme. The programme aimed at stimulating rural economic development by enhancing agricultural innovation.

RIU explored different approaches of promoting innovation in agriculture. This book analyses the experiences of three RIU Africa Country Programmes, which used innovation platforms to facilitate innovation, and two best-bet projects, which used a competitive funding mechanism to support private sector driven initiatives to get research outcomes into use.

The analysis of the five cases did allow for the development of an analytical model that can assist in decision-making on investments in agricultural innovation. Interventions aimed at agricultural development through innovation would do well to consider two types of results: household level impact at scale, and an improved capacity to innovate. Three interlinked components, needs and opportunity identification, experimentation and bringing into routine use, were distinguished to analyse the process of getting from new ideas to impact at scale. The roles of different stakeholders are discussed.

Royal Tropical Institute

Research Into Use

ISBN 978-9460222337