Research Into Use *sharing lessons to enable innovation in agriculture*

Lessons and case stories from RIU Nigeria

June 2011

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Introduction

Between 2009 and 2011, significant changes took place in the cassava sub-sector in Abia State, Nigeria: local farmers affiliated with the RIU-assisted Innovation Platform (IP), increased their cassava farm sizes and yields, adopting and using cassava mosaic disease (CMD) resistant varieties. In the post-harvest phase, a simple hand-held cassava-peeling tool which reduces labour, waste and increases efficiency, gained wide adoption and use among cassava processors affiliated with the IP.

In the cowpea subsector, the wide adoption and use of improved dual purpose varieties contributed to increased production of both beans, as well as crop fodder for use as livestock feed. In collaboration with a private sector company, bailing machines were developed to compress crop residues, providing a business opportunity to youth. Compacting the fodder enabled improvements and in three related processes: first, bales were easier and more efficient to load into transport vehicles and storage spaces; second, the pricing of fodder based on measurable weight, rather than on visual impression of the quantity, became possible; third, rationing of the fodder when feeding the animals became easier and more accurate, thereby enabling the animals to be better fed while ensuring efficient and conservative use of the fodder.

An association of widows in Cross River State, where soybean has not been grown in the past, acquired and planted improved cowpea, soybean and cassava varieties, thereby providing themselves with new income opportunities and a stronger food security potential.

The involvement of research institutes and private sector partners in the fish farming subsector, led to the successful development of a new and viable method in the local production of fish meal as ingredient for fish feeds. The new processes and products showed significant reductions in production costs, and comparable quality to the highest quality of imported fish feed. Another major innovation was the introduction of new fish species, thereby creating a niche market for the production and supply of fingerlings for the new species.

How did these changes happen? What were the driving forces? Innovation is about change or adaptation to change. Organisations that successfully innovate have one thing in common: they are good at managing change and in building linkages between stakeholders. Innovation processes, such as the ones involved in the cassava, cowpea and aquaculture value chains as described in the case stories in this volume, require focus, effective communication brokering skills, conflict resolution, determination, good timing, responsiveness and a “never give up” mentality. This volume provides the outcomes of a

write-shop in which the stakeholders reflected on their experiences and identified the institutional factors that helped or hindered their search for innovation in Nigeria.

Research Into Use (RIU) country programmes are stimulating institutional changes that take place in a number of domains including: research practice; policy process; markets and marketing systems; policy relevance and responsiveness to poor people; access to technology; access to input and output markets; financing; new patterns of partnership; and new and existing organisations playing new roles. These institutional changes not only represent a key impact of RIU in terms of strengthening of innovation capacity, but are also important indicators that country programmes can use as evidence to support the case that RIU-type programmes can be effective mechanisms for strengthening innovation capacity.

Evidence and documentation of institutional change associated with Africa Country programmes has been undertaken in various forms by both the RIU Central Research Team (CRT) and the Country Programmes themselves. However, the process of collecting such information and organising it in formats appropriate for both national and international policy and funding audiences, adds a greater value to innovation narratives which reflect the perspectives of the stakeholders.

The CRT requested the assistance of the Royal Tropical Institute (KIT) in capturing this institutional change evidence and in establishing a mechanism to help both country programmes and CRT to generate information on institutional change. During a so-called write-shop, stakeholders shared their experiences; in a three-day process, participants developed case stories that gave an overview of the innovations they have been involved in, the institutional changes that made the innovations happen, lessons learnt and best practices.

The write-shop approach

The aim of the write-shop was to document experiences of stakeholders in the Research Into Use Country Programme in Nigeria. A write shop is an intense participative way of writing publications in such a way that they are easy to understand and used by practitioners. The write-shop agenda was flexible, and the repeated presentations, comments and revision of drafts allowed for case studies to be reviewed and revised thoroughly. A team of facilitators and editors guided and assisted the participants in the writing process.

The write-shop was conducted from the 9 -12 May 2011 in Abuja, Nigeria. Participants included a wide range of stakeholders involved in agricultural innovation and institutional change processes in the RIU programme in Nigeria, including the private sector, government

extension services, research institutions and the RIU Country programme team. All of them have interesting, evidence-based, concrete and practical experiences that are worth documenting. They are the authors of the case stories, writing about their experiences from their particular perspectives. The RIU Nigeria Country Programme identified the participants. Authors worked individually or in pairs on their case stories. This resulted in 14 case-stories with unique topics.

Write-shop program

The write shop program was flexible. The RIU country team and KIT-staff continuously discussed and adapted the program to the specific needs of participants, their specific stories and the progress of the writing-process.

Day	Activity
Monday 9 May 2011	5pm: Arrival of participants Plenary: Introduction, objectives of the program, planning, preparation for case study presentations the next morning
Tuesday 10 May 2011	Plenary: Presentation of topics and key messages by participants, advice, suggestions and tips from other participants. Individual: Developing a detailed outline for the case Writing first draft of the case story
Wednesday 11 May 2011	Individual: Writing first draft of the case story Group work: Peer reviewing: feedback from participants and facilitators Individual: Writing second draft of case studies Overnight editing: peer reviewing and English and content editing
Thursday 12 May 2011	Individual: feedback from reviewers, facilitators and editors Individual writing: Writing final draft Plenary: Identifying the critical success factors for innovation and lessons learnt Evaluation and closing
Friday 13 May 2011	Final editing of the write-shop report (RIU, KIT)

The write-shop resulted in this volume which includes a series of 14 case stories, developed by 16 participants. The case stories are presented under the overarching theme of institutional learning and change as outcomes of experimental work on agricultural innovation brokering in Nigeria. The authors were drawn from diverse organisations and occupations, representing and reflecting the multi-stakeholder configurations, or innovation platforms, which the DFID-RIU Nigeria programme orchestrated as part of that experiment. Each story is narrated from the perspective of the author(s), who had also participated in various aspects of the RIU Nigeria programme activities over the past three or more years. Hence, the stories are those of the stakeholders of the programme. Collectively, the stories indicate some of the changes in diverse aspects of practices and processes that agricultural innovation brokering can engender. These aspects include old types of organisations performing new types of roles, new types of organisations performing new types of roles, changes in research practice, new network configurations, effect on donor/government behaviour, poverty relevance, market-related changes, new forms of financing rural agricultural, and changes in the agricultural policy space.

The first story, written by Adebiyi Daramola, Alphonse Emechebe and Utiang P Ugbe, provides an overview of the context of the RIU Nigeria programme. It emphasises the roles of the various actors involved in rural innovation, including Research Institutes at different levels, extension, government, private sector, as well as the Innovation Platforms.

Four case stories provide an insight on the innovations that emerged in the Cassava sub-sector. Udensi Ekea Udensi provides writes on the major research institutes involved in Cassava research and their interactions with other stakeholder in the RIU-assisted Innovation Platform. Enyinnaya F. Elekwachi writes on the extension strategy around the introduction and acquisition and distribution of improved CMD resistant varieties. The role and functioning or the Cassava Innovation Platform is described by Kalu I. Kalu in his story titled Unity in Diversity: The Driver of Innovation Platforms. Emmanuel Oti and K.I. Kalu describe the development and modification of a hand-held cassava peeling tool which led to significant efficiency gains in cassava processing.

Cases were also written on Cowpea and Soybean value chains. Tahirou. Abdoulaye, Utiang P Ugbe and Baributsa Dieudonné focus their story on the multi-agency collaborations that resulted in the facilitation of wide adoption of triple bagging technology on cowpea storage. Adduni Sanni and Grace Jokthan describe how the triple bagging storage system for cowpea contributed to a reduction in post-harvest losses and created new opportunities for farmers and agribusinesses. Agnes Ingwu narrates how the inclusion of widows in agricultural innovation activities was facilitated by the collaboration of Abanbeke Development Association and the RIU Programme. She describes how innovations in the cassava and

soybean value chains have played an important role in empowering rural widows. Grace Jokthan writes about the introduction of improved dual purpose cowpea varieties and bailing equipment benefited the availability of food for humans and feed for livestock.

Writing on the aquaculture subsector, Akande and Oresegun, from the National Institute for Oceanography and Marine Research (NIOMR), give an insight into the work that their institute has done, under a partnership arrangement with the RIU Nigeria programme, in generating innovation in fish meal development on an industrial scale. Olokor and Raji of the Nigerian Institute for Freshwater Fisheries Research (NIFFR) explain how the costs of fish feed were reduced by developing new methods in cottage production of fishmeal and fish feed production. The NIOMR and NIFFR case stories reveal the interface and overlap between industrial scale and cottage applications of fish meal and fish feed innovations. Talabi, Coker and Oni of Talon R&D Farms Ltd write on a private sector initiative to innovation in aquaculture. James O Apochi of the Agricultural Research Council of Nigeria (ARCN) explains the role of the Aquaculture Innovation Platform in the development of the aquaculture value chain in the country. In a cross-cutting piece, Yarama D Ndirpaya of the ARCN describes how the successes of the RIU programme could lead to a new agricultural research strategy in Nigeria.

RIU Nigeria hereby acknowledges and appreciates the contributions of all the authors, and their respective organisations for releasing them to attend the write shop. We trust that the stories are useful to practitioners, policymakers, donors and other development partners.

List of case stories

Case story topics	Author(s)	Organisations
Managing Agricultural Innovations: The case of RIU Nigeria	Adebiyi Daramola Alphonse Emechebe Utiang P Ugbe	Federal University of Technology Bayero University, Kano RIU Nigeria
Cassava Value Chain		
Partnership Brought Succour To Cassava Farmers In Abia State, Nigeria	Udensi Ekea Udensi	IITA Cassava Projects, South-Eastern, Nigeria University of Port Harcourt
RIU Partnership Oils The Wheel Of Agricultural Inputs Distribution In Abia State	E F Elekwachi	Abia State Agricultural Development Programme, Umuahia
Unity In Diversity: The Driver Of Innovation Platforms	K I Kalu	Abia Cassava Innovation Platform Aquada Development Cooperation
Progress In Manual Cassava Peeling: The Outcome Of Interaction Of Stakeholders	E Oti K I Kalu	National Root Crops Research Institute Aquada Development Cooperation
Cowpea/Soybean Value Chain		
Promoting An Agricultural Technology Through Multi-Stakeholders' Approach: The Case Of PICS Hermetic Cowpea Storage In Nigeria	T Abdoulaye Utiang P Ugbe Baributsa, Dieudonné	International Institute for Tropical Agriculture RIU Nigeria Purdue University
Battle Against Cowpea Weevils Finally Won: Improving Farmers Livelihood Through Promotion Of Non-Chemical Hermetic Cowpea Storage Technology	Sanni S A Grace Jokthan	Institute for Agricultural Research, Ahmadu Bello University RIU Nigeria
Widows Now Smile - A Case Story Of Abanbeke Development Association (ADA)	Agnes Ingwu	Abanbeke Development Association Ohong, Obudu, Cross River State, Nigeria
Food For Man, Feed For Animals: A Case Story Of Dual Purpose Cowpea Varieties	Grace Jokthan	RIU Nigeria

Aquaculture Value Chain		
Low Value Tilapia: New idea on an old problem	G R Akande and A Oresegun	Nigerian Institute for Oceanography and Marine Research, Victoria Island, Lagos
Tilapia fish meal harvest profit	J O Olokor, and A Raji	National Institute for Freshwater Fisheries Research
Aquaculture is not just larias farming	Dr S O Talabi Muyiwa Coker Kayode Oni	TALON R&D Farms
Aquaculture Value Chain: Innovations, Opportunities And Challenges In Nigeria	J O Apochi	Agricultural Research Council of Nigeria
Towards A New Strategy For Rural Innovation		
Successful Cross-pollination - Towards A New Strategy For Agricultural Development In Nigeria	Yarama D Ndirpaya	Agricultural Research Council of Nigeria

Managing Agricultural Innovations: The case of Research Into Use Nigeria

Adebiyi Daramola, Alphonse Emechebe and Utiang P Ugbe

Introduction

Prior to the design of the Research Into Use (RIU) Programme, the United Kingdom's Department for International Development (UK-DFID) had spent over £200m investing on developing the agriculture and natural resources research, under the Renewable Natural Resources Research Strategy (RNRRS). As a follow-up programme to the RNRRS, the RIU Programme was mandated to facilitate end-user demand for the RNRRS outputs, as part of a bigger strategy to promote innovation in rural agriculture, livelihoods and local economic development.

A country assessment conducted in Nigeria by the RIU programme, found that knowledge outputs from the nation's 18 agricultural research institutes were not being utilized by intended users of institutional and other barriers. Farmers, post-harvest processors, produce marketers and agro-allied businesses are in need of knowledge, technologies and business practices that would increase their production, incomes and competitiveness. Yet, some relevant research outputs that would address these objectives are not getting out of the agricultural research institutes and into practical, economic use.

It was agreed that the RIU Nigeria programme should attempt, on a small scale, to bridge the gap between the need (or demand) and supply for new knowledge and technology, and document the results and lessons to inform possible out-scaling and mainstreaming by the responsible national agencies and processes. In 2007, as the DFID-RIU Programme was taking off in Nigeria, the federal government established the Agricultural Research Council of Nigeria (ARCN), part of whose mandate included the management of innovation in agricultural research, extension and private sector involvement in the country. This serendipitous situation made it possible for the ARCN and RIU Programme to develop a collaboration which was later formalized by a Memorandum of Understanding (MOU). It was, perhaps, a case of being at the right place, at the right time, with the right persons who did the right things!

Process

RIU Nigeria programme orchestrated the formation of multi-stakeholder innovation platforms whose members represented associations of farmers, produce marketers, post-harvest processors, bankers and other financiers, technology fabricators, researchers, agricultural development programmes (ADPs) and some relevant development resource organisations. One innovation platform each was established for cassava, cowpea, soybean and aquaculture value chains. Members of each platform developed their own organisation structure, elected their own leadership, identified their perceived challenges as well as solutions to the development of their value chain, and priorities for addressing these.

As part of the hosting arrangements, the ARCN provided rooms for the RIU Nigeria country office, and introduced the RIU programme to relevant federal agencies, national agricultural research institutes and relevant state ADPs. These introductions gave recognition to the RIU Programme and engendered cooperation from the organisations, thereby contributing to the quick formation of the Cowpea/Soybean Value Chain Innovation Platform in Kano and Kaduna states; The Cassava Value Chain IP in Abia State, but with expanded in membership in Akwa Ibom and Cross River states; and

> *"Institutional change to forge new partnerships that will involve all stakeholders in addressing the problem of food production, agro-industrial raw materials and maintenance of resource base of agriculture for future generations . . ."*
>
> **Refocusing Agricultural Research to Achieve Food Security" ARCN, 2009. p5**

the Aquaculture Innovation Platform with expanded membership and activity points in Adamawa, Kaduna, Kano, Kaduna, Katsina, Kogi and Taraba states, in addition to the Federal Capital Territory (FCT).

Evidence

Institutional learning and change are sometimes difficult to measure or attribute for the several reasons:

- Individuals within an organisation could learn and adopt a new way of working, and this might reflect on the effectiveness of the organisation as a whole, yet the learning might not be shared by everyone in the organisation.
- An organisation might learn and adopt a new process and achieve better results without formally documenting the change in the form of a new policy or regulation.
- An organisation might be collaborating with multiple partners and learning from all of them, therefore it might be inappropriate to attribute institutional learning and change to only one partner in such a scenario.
- The institutional learning and change can occur very slowly or after the expiration of an intervention timeframe, thereby making it difficult to capture and document evidence when the experiment is still going on.

Therefore, the above-listed challenges and, perhaps, others, should be kept in mind while reviewing the evidence presented below.

The Executive Secretary of ARCN, in a nationwide broadcast by the Nigerian Television Authority (NTA) of a programme called *Periscope*, stated that the ARCN was working with development partners in championing a paradigm shift in agricultural research and extension, with emphasis on multi-stakeholder networking or innovation platforms which provide for adequate private sector participation. This type of *innovation speak* by such an important personality in the agriculture

sector reflects both institutional learning and change, and a formal commitment to mainstream the learning and change.

The ARCN has also formalized plans to integrate innovation platforms into the concept of Adopted Villages involving the participation of respective national agricultural research institutes in targeted subsectors across the country. This initiative seems to indicates an institutional learning and change, adaptation or innovation to the Research-Extension-Farmer-Inputs-Linkage (REFILs) which has been one of the key planks of agricultural research.

Among the farmers participating in RIU-assisted IPs, there have been some observed changes in farm-management practices and business activities that indicate learning and change on their part. For example, through the Cassava IP and within a short two-year timeframe, an out-grower stem multiplication initiative enabled about 450,000 farming households in Abia State to access high-yielding CMD-resistant varieties in the 2010 planting season. This is a big increase from the small number of the IP-affiliated farmers (less than 100 households) who were planting the CMD-resistant varieties in 2009. As a result yields, the farm yield, food security, incomes and overall economy of these farmers are expected to improve after the crops are harvested. Furthermore, the Cassava Starch Mill, Ihiala was supplied with 1600 metric tonnes of fresh cassava roots by 25 cassava farmers who are members of the innovation platform.

In the Soybean IP a total of 545,000 soybean farmers in Kaduna State accessed rust-resistant soybean varieties introduced promoted by seed companies through the platform synergies in the 2010 farming season. This is just an example of the types of business improvement attributable to RIU Nigeria programme intervention.

Lessons Learnt

- Outcomes of the RIU Nigeria programme experiments have shown that bringing together key actors of a value chain into an innovation platform can enhance access to market information and business opportunities, and empower stakeholders to gain respect and influence in the policy arena where their voice can be heard.

- Working through the Agricultural Development Projects (ADPs), the RIU Nigeria programme helped to give a new meaning and relevance to the partner-ADPs who, prior to the RIU programme, had become derelict in the post-World Bank funding era. The participation of the private sector in the innovation platforms has revealed the possibility of private sector-led rural advisory services. The lesson here is that the ADPs must seek ways of remaining relevant by embracing innovation, or face the risk of becoming irrelevant actors when private sector-led multi-stakeholder approaches to innovation become the norm. Private

sector-led extension can succeed where clear financial/commercial benefits are accruable to the sector.

- It is very important to identify `quick-wins' for farmers and other stakeholders or beneficiaries in order to build their confidence and trust in innovation, thereby creating an incentive for demand for research outputs. In addition, an enabling policy environment is very necessary to the growth, commercial viability and sustainability of agricultural value chains.

- Agricultural innovation requires brokering role by a neutral party who is trusted by all the stakeholders. The experience of RIU Nigeria suggests that institutional learning and change, a key harbinger and driver of agricultural innovation, occurs slowly and, therefore, there is need for longer-term role for an innovation broker.

Section 2 Innovations in the Cassava Value Chain

Partnership brought succour to cassava farmers in Abia State, Nigeria

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A need assessment conducted revealed that cassava is a dominant component in crop mixtures in Abia State. However, at the rural level, production is still characterized by the use of non-cassava mosaic disease (CMD) resistant local varieties and traditional methods of production with the consequence of low yields and poor harvest. Sometimes farmers wonder what to do in dearth situations.

Introduction

Need assessment- revelation [Figure 1]

This report documents farmers' timely access to improved cassava varieties resistant to Cassava Mosaic Disease. Cassava is an important raw material for the country's industrial sector, and it grows well in most of Nigeria's agro-ecological zones. The dual role of cassava in the Nigerian economy as both food and industrial crop has opened up a lot of opportunities in the sector. However, challenges ranging from weak linkages among stakeholders, low productivity due to biotic stress, absence of agro-industrial market and weak seed distribution system remain major constraints to the development and expansion of the cassava sector in Nigeria.

Early access to improved and CMD resistant varieties is crucial to averting crop and yield loss due to CMD and ensuring sustainable livelihoods for farm families. However, until recently, farmers had limited access to improved and CMD resistant cassava varieties such as NR8082, NR8083, TME 419, TME 98/0505 and TMS 30572. These varieties were introduced by International Institute of Tropical Agriculture (IITA), Agricultural Development Program (ADP) and National Root Crops Research

Institute (NRCRI). Only very limited number of farmers experimented with these varieties. They preferred these varieties to their local varieties for various reasons, including early maturity, high yield, CMD-resistant, ease of peeling. The local varieties however, had the advantage of long storage in the soil (≥ 18 months).

But since 2009 major changes happened. Nowadays more than 4,000 farmer groups, consisting mainly of small-scale farmers in Abia State, are cultivating CMD-resistant improved cassava varieties. They received planting materials through the Cassava Innovation Platform, assisted by RIU Nigeria. About 70% of these farmers are women. This resulted in a 23% increase in area under cassava production and a 35% increase in productivity. This encouraged farmers to increase their land use for cassava production, with the anticipation of increased earning from the sale of cassava. Cassava root supply to Nigerian Starch Mill (NSM) industry has remarkably improved within this period, and close to 2,000 metric tonnes of cassava roots have been supplied to NSM by Cassava IP members and other farmers. Surplus stems and roots from improved harvest have encouraged the development of stem enterprises, and fresh root enterprises, since farmers cannot contain the excess for family consumption. Nearly 1,000 job opportunities have been possible in the State (including permanent and casual employment) with cassava-based interventions.

The involvement of multiple stakeholders in the distribution encouraged ownership of the processes, helped to ensure the relevance of the technologies and contributed to these impacts.

RIU-assisted Cassava IP Abia State

The RIU assisted Cassava Innovation Platform (IP) was inaugurated in Abia State as a pilot on the 5th of February 2009. The aim was to seize the opportunities in the cassava sub-sector value chain by facilitating and building effective linkages and enhancing interaction among the principle actors and stakeholders in the cassava value chain. Therefore, Abia State provided a good platform and challenge for the RIU assisted activities and intervention aimed at promoting the well-being of the rural poor.

The Cassava IP in the state consists of five categories of members: the farmers or cassava growers, processors, post harvest equipment fabricators, researchers (from NRCRI, IITA), extension agents of the ADP, confectioners and bakers, input and financial service providers.

Initially the platform's focus was on the cassava flour value chain, following the Presidential directive to include 10% cassava flour in bread and a 75% tariff on imported cornstarch. However, some of the unfolding events in the cassava sector such as poorly organized cassava industry and inconsistent and unstable policies became a major constraint to the pursuit of the Cassava flour innovation. The platform now focuses its effort on other cassava related enterprises that are not capital intensive and can empower the rural poor and improve their livelihoods.

Community need assessment

A need assessment of the cassava producing communities in Abia State was conducted as a prerequisite for the expansion of the utilization of cassava as the fulcrum for rural transformation ensuring food security especially among underprivileged sections of society, and empowering people through enterprise development and job creation.

The need assessment was facilitated by RIU and conducted by IITA with the assistance of Cassava IP members, IITA Contact farmers, and ADP extension staff, depending on the communities in the three agricultural zones of the state (Table 1).

Problem prioritization with farmers at Osaa-Ukwu during the need assessment [Figure 2]

Table 1 Local government areas (LGAs) and communities selected for the analysis

Senatorial district	LGA	Community/Communities
Abia North	Bende Ohafia Isiukwuato	Ozuitem Okon-Aku Amaba
Abia Central	Ikwuano Umuahia North Umuahia South	Amaoba/Amawom Ubaha-Oriendu Umuokorodo
Abia South	Obingwa Osisioma	Osaa-Ukwu Osisioma

The major problems identified in cassava production were the lack of production incentives and poor access to inputs (limited capital/credit, high cost of fertilizer, limited availability/ access to improved varieties); limited technical know-how; unfavorable land tenure system (which limits farmers access to land) and high cost of labour. These problems led to a poorly organized cassava industry, under-developed structures for commercialization and inadequate supply of cassava roots due to low productivity. The common problems with cassava processing were lack of machines/equipment, high transport cost for moving roots from farm to processing points and access to clean water.

Distribution of Improved Cassava Varieties - Roles of Partners

RIU Nigeria Program came in to broker a multi-stakeholder partnership in order to facilitate farmers' access to improved technologies that could enhance agricultural productivity, post harvest value addition and drive the cassava sub sector in the country. In an effort to enhance technology uptake, RIU organized a stakeholder's meeting to brainstorm on how farmers' can enhance their access to improved cassava varieties that are resistant to CMD. Present at that meeting were IITA, NRCRI, Nigerian Starch Mill (NSM), Abia ADP extension Staff and the RIU assisted Cassava IP members. RIU met with IITA, NRCRI and NSM to advice on the best CMD resistant varieties suitable for Abia state soils, industrial use as well as where and how to source them.

Farmers watch demonstration of planting technique for good harvest at Aba Zone ADP by Dr Udensi, U.E. IITA [Figure 3]

A discussion between RIU and the ADP resulted in the use of the ADP extension structure and agricultural zones for distribution. This approach enhanced farmers' timely access to improved varieties and their management, which can replace the low yielding and non-CMD resistant varieties with an ultimate aim of improving farmers' livelihoods from income generated due to excess harvest.

RIU collaborated with IITA in the organisations of an on-farm demonstration of best planting and multiplication techniques that enhance yield and encourage the development of cassava stem enterprises (Figs 3-6).

Research Institutes (IITA and NRCRI)

The CMD resistant varieties distributed through the Cassava Innovation Platform were among the 43 varieties bred and tested by IITA and NRCRI. The two research institutes facilitated the identification, characterization and mapping of best cassava varieties resistant to CMD among their collaborators and out- grower. IITA played a vital role in assembling NGOs and farmers' organisations that participated in the

Her Excellency inaugurating the state-wide stem distribution by RIU, while Grace Jokthan (RIU) and Mr Enyinaya Elekwachi (ADP-PM) were assisting [Figure 4]

distribution exercise to their members and other farmers.

Similarly, IITA conducted the on-farm training on best agronomic practices for the production and multiplication of stems. NRCRI played a role in building and strengthening of the capacity of farmers, processors and the ADP extension system in the area of post harvest value addition.

Farmers receiving their stems at Umuahia Zone [Figure 5]

Abia ADP/Ministry of Agriculture/First Lady's Office

The state ADP and Ministry of Agriculture were involved in the identification of community groups, CBOs, and Women organisations, for reaching out to farmers, using their existing extension blocks and cells within the various agricultural zones of the state. The ADP provided land for the on-farm demonstration of best agronomic practices, as well as facilitated the meeting and the participation of the Office of the Abia State first Lady in the inauguration of the state wide cassava stem distribution to farmers [Figure 8]. The Abia State First Lady, Her Excellency Chief Odochi Orji praised the effort and activities of RIU in Abia State. During her speech at the inauguration of the state wide stem distribution, she promised to replicate and continue what RIU had started in the state. This she did for the 17 local government councils of Abia State. Similarly, she sent 17 participants from her office to the training on post harvest processing facilitated by RIU in collaboration with NRCRI.

Role of RIU-assisted Cassava IP

The RIU-assisted Cassava IP is a major strategy for innovation introduced by RIU to bridge the gap in the cassava commodity value chain. Their major role is to drive the demand and supply chain of the cassava sub sector to ensure that the producers, intermediary stakeholders and the end-user of cassava based activity are comfortable so as to sustain growth of the sector.

The RIU assisted Cassava IP was

Participants preparing high quality cassava starch with Dr Oti Emmanuel (NRCRI) [Figure 6]

involved in mobilizing and sensitizing other farmers who are non platform members to come for stem collection at all the agricultural zones and communities visited during the stem distribution. Subsequently, the RIU assisted Cassava IP followed up at the rural level to educate farmers on the best planting and multiplication techniques that will boost productivity. This will mean that the first set of farmers that participated will serve as local consultants to their colleagues; and information on improved agronomic practices will ensure the dissemination of the new varieties is sustainable.

Private Sector-Nigerian Starch Mill (NSM) and Aquada Development Corporation

Nigerian Starch Mill Ltd (NSM, an industrial cassava starch processor) was established in 1975 at Uli, Anambra State with an installed capacity of processing of about 250 metric tonnes of fresh cassava roots per day. It was the first starch factory in Nigeria established to mop up surpluses of cassava from the eastern part of the country. For a long period the Mill operated below designed capacity due to inadequate and irregular supply of cassava roots. In addition to earlier approaches of other projects to boost root supply to the Mill, the RIU led approach has further enhanced their access to cassava roots for starch production. The involvement of Nigerian Starch Mill in the sourcing of the best starch yielding varieties and distributing them to farmers has already created a ready market for the farmers. NSM participated in one of the Cassava IP meetings and provided its buying schedule and tariffs to IP members and other farmers, so as to contract the root supply to them. This has encouraged farmers to increase their land use for cassava production, anticipating increased earnings from the sale of cassava roots.

Aquada Development Corporation is another private sector enterprise that processes cassava roots into hyper-fine garri named ''Scintilla''. The Corporation has been the host for the Cassava IP meetings since inception. They are also ready buyers of cassava roots from IP member farmers and other farmers. They also participated in the distribution of cassava stem to IP members and other farmers.

The involvement of private sector (Nigerian Starch Mill and Aquada Development Corporation) in the RIU led intervention automatically created market access to farmers.

Conclusions

Potentially good materials were available to farmers in target areas at the onset of the season. This means simultaneous trials of the improved varieties by farmers. Leveraging on existing structures (like the ADP extension system, IITA and NRCRI farmer clusters) effectively achieved result. The RIU approach has improved advocacy with the policy makers; this was reflected in the Abia State government involvement in the early supply of input to the farmers with the launching of the farming season

The RIU multi-stakeholders approach created enabling environment for access to production inputs, technical-know-how, market information and market. The approach allowed broad-based participation of experts and stakeholders from onset to finish. This also engendered ownership and minimized conflict.

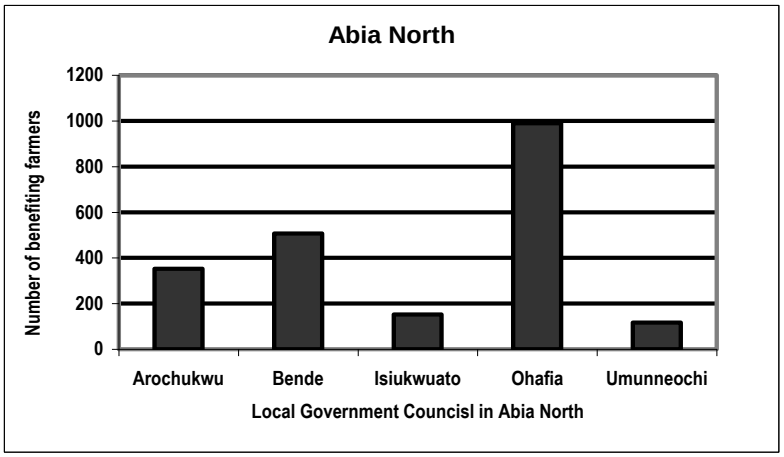
The RIU led approach encouraged commitment to technologies amongst the actors and strengthens partnerships which are essential for successful technology dissemination and out and up scaling.

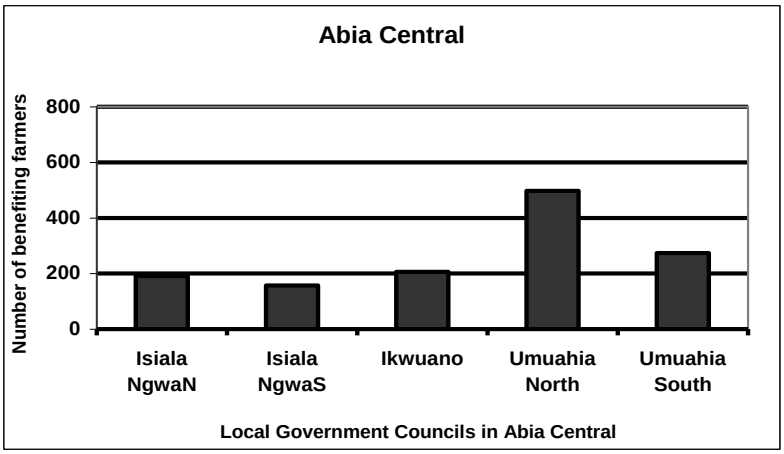
Annex 1: Area planted (000 ha) planted, total production and Yield (t/ha) of cassava in Abia State (2005-2010)

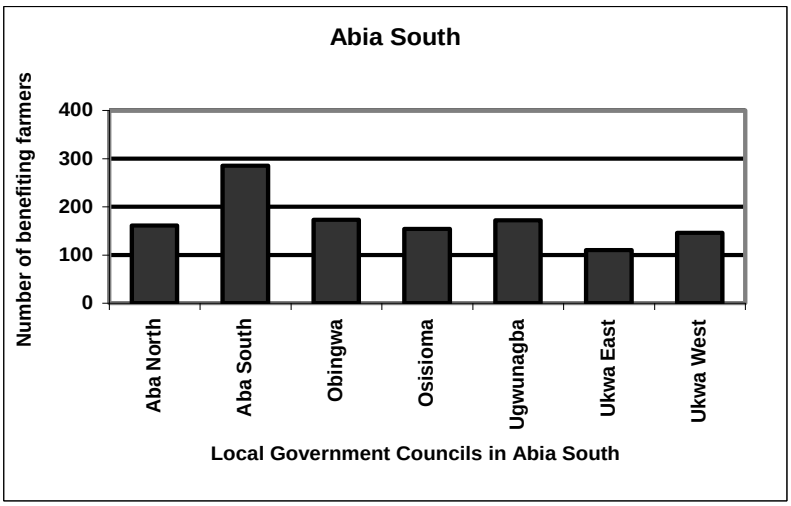
Production year	Area (000 ha)	Total production (000 MT)	Yield (MT/ha)
2005	37.638	633.824	16.84
2006	37.116	573.4	15.45
2007	35.55	635.97	17.89
2008	40.88	794.96	19.45
2009	45.79	946.00	20.66
2010	56.43	1277.1	22.63

Source: Adapted and Modified from ADP, 2010

Annex 2: Number of Cassava Stem beneficiaries in Abia State







RIU Partnership Oils The Wheel of Agricultural Inputs Distribution in Abia State

Enyinnaya F Elekwachi
Program Manager, Abia State Agricultural Development Programme (ADP), Umuahia

I assumed the leadership of Abia State Agricultural Development Programme (ADP) in June 2009. At that time, there was low staff morale and high human capital flight out of the ADP arising from non-pensionability of ADP staff on retirement, among other issues. Secondly, all donor-assisted projects had ended and the state's financial position could not attract new projects through the payment of counterpart funds. Vehicular and budgetary constraints were obvious and biting.

Abia State ADP has extension activities (on-farm trials and dissemination of new technologies) as its core mandate. The avenues for these major activities are the On-Farm Adaptive Research (OFAR) Trials, Fortnightly Technology (FNT) and Monthly Technology Review Meetings (MTRMs). These activities and field extension agents suffered the hardest from the dire financial and manpower situation. Agricultural extension work in the state was, therefore, at its lowest ebb.

RIU Partnership and intervention

RIU Nigeria Program was on ground in Abia State through its Cassava Innovation Platform (CIP). However, its presence and impact were heightened through its facilitation of the first multi-institutional agricultural inputs (mainly cassava stems) distribution activity in the 2010 cropping season. The activity which partnered Abia ADP, National Root Crops Research Institute (NRCRI) and the International Institute of Tropical Agriculture (IITA) recorded an unprecedented success in both geographical coverage and quantity of inputs distributed.

The activity was flagged off at Aba Zonal Office of Abia ADP (for Abia South Zone) and later carried out at the other two agricultural zones of the state at Ohafia (for Abia North) and Umuahia (for Abia Central). Launch of the activity in Umuahia was attended by the Abia State First Lady, the Abia State Agriculture Commissioner and other state officials. The First Lady performed the ceremonial commencement of the inputs distribution. Cooperative societies, community-based organisations (CBOs), non-governmental organisations (NGOs), farmers' and commodity associations, and women's and widows' groups were also in attendance and accessed their own inputs on the spot. The press was equally well represented in both print and electronic format, and so these activities received wide coverage on radio, television and the newspapers.

A follow-up training was conducted for about 500 farmer-processors, NGOs, CBOs, and Abia ADP's Women in Agriculture (WIA) staff, Block Extension Supervisors (BES) and Block Extension Agents (BEAs) from the three agricultural zones and the headquarters by the RIU-led new partnership. BES and BEAs are the ADPs foot soldiers who directly interact with our farmers at the village level. The

interaction was an entrepreneurial skill acquisition training on “Post-Harvest Value Addition to Cassava” which took place at NRCRI, Umudike from 5 -7 July, 2010.

This multi-stakeholder innovative approach to agricultural inputs distribution was given further boost when Her Excellency, the wife of the State Governor, Chief Odochi Orji, seized the momentum of the RIU-led publicity and undertook a women’s sensitization and input distribution tour of the 17 local government areas of the state during the 2010 planting season. The main agro-inputs of the campaign were the cassava mosaic disease (CMD) resistant, early maturing, and high yielding cassava varieties whose procurement was facilitated by RIU Nigeria Programme and IITA.

Sustainability: Post Partnership Program

To ensure the continuous production and distribution of CMD-resistant cassava varieties to Abia State farmers, the following programmes are on ground:

By Abia State ADP

After the distribution exercise by the RIU-led partnership in 2010, the Abia State ADP established a total of about 3 hectares each at its headquarters in Umuahia and at its Farm Service Center at Olori in Ikwuano Local Governemnt Area of the state. This is expected to be harvested in time for the 2011 planting season. The stems from the 6 hectares will provide enough planting materials for about 60 hectares of cassava farms. The ADP intends to continue this program until all farmers in Abia State have adopted the CMD-resistant varieties in replacement of the local varieties. Trainings on the areas of best practices in cassava cultivation and value addition are also planned for proposed new ADP extension staff and other farmer-processors.

By the Cassava Innovation Platform

Abia State ADP has allocated 4 hectares of land at its Olori farm service centre to the Cassava Innovation Platform for the cultivation of CMD-resistant cassava varieties. The production and distribution of the cassava stems will assist farmers to adopt this new variety in preference to the low-yielding, late-maturing and CMD-susceptible local varieties. The increased yield/productivity will go a long way in improving rural farm income and enhancing farmers’ livelihood in Abia State.

The key elements in the RIU-led innovative inputs distribution approach include timely procurement of inputs by launching the distribution exercise at the onset of the planting season. The combination of communication extension strategies, including multi-stakeholder approach, the wide press coverage of the launching and distribution exercises, and the state-wide coverage of the women’s sensitization and distribution campaign, contributed to the widespread awareness of the

availability and advantages of the new varieties. Through training, the capacities of key operators in the sub-sector were enhanced, leading to adoption rates that were above expectations.

Lessons learnt

Apart from providing timely inputs to our farmers in 2010, the partnership provided a lifeline and infused a fresh breath into the Abia State extension system. The process is being adapted for use in the 2011 input distribution exercise. More importantly, the exercise improved the extension agent-farmer ratio gap in the villages. Abia ADP has proposed to embark on a comprehensive survey of extension field staff in June 2011 with a view to updating the extension agent-farmer ratio to conform to the recommendations of development partners like the World Bank, FAO, etc.

Unity in diversity: The driver of Innovation Platforms

K I Kalu
Chairman Abia Cassava Innovation Platform, Aquada Development Cooperation, Mary's Court, Behind WAEC, Umuahia.

Members of the platform being introduced to the NRCRI cassava peeler [Figure 1]

Old The word for "change" in Japanese – nemawashi – also means "transplanting". While change may be slow in coming, when it does come, it takes root deeply.

RIU – Nigeria facilitated the Cassava Innovation Platform (IP) to change from our old ways of doing things and to acquire the potential to identify new ways and 'transplant' them in our farming, processing, fabricating and research practices.

A practical story of a cassava processor

As a processor of cassava, the peeling of cassava roots is an important component of my processing activities. Until recently, peeling was done using knives and this tends to be time and cost demanding. I export Sentilla (a brand of a cassava based staple) to the US. This requires high quality standards and large quantities which is difficult to meet using peeling knives. As a member of the Cassava Innovation Platform, I attended training at the National Roots Crop Research Institute (NRCRI), where the cassava peeling problem was addressed. A hand-held peeler, a simple technology that has been developed years ago, but never found its way to local processors was introduced. We started to use the proposed peeler and discovered that the handle was too big thereby causing palm blisters. With the help of local fabricators, who were also members of the platform, the handle of the hand-held peeler was modified to make it more convenient to use.

In order to show the effectiveness of the hand-held peeler to the members of the platform, a practical demonstration was carried out in Aquada Development Cooperation factory. Two groups of ten processors each were given 5 head-pans of cassava to peel with one group using knife and the second group using the hand-held cassava peeling tool. The group with the hand-held tool finished first, while the ones with knives had 1½ head-pan left. This means a time reduction of about 30% by using the hand peeler instead of knife.

Based on the outcome of the demonstration, as well as my own experience in trying the hand peeler, I believe that the technology will encourage local processors to expand on their business. Currently, the tool is being used in Aquada Development Cooperation and it has increase our productivity, reduce peeling loss, save us a lot of time and reduce labour costs significantly.

Functioning of the Cassava Innovation Platform (IP)

The Abia Cassava IP was inaugurated in Umuahia, Abia State by RIU Nigeria on 5 February 2009. The IP since its inception has been collaborating with governmental and non-governmental agencies in developing cassava production in Abia and other neighbouring states.

Over the past two years we have expanded our membership from 25 to 82 members, comprising various farmer co-operatives and associations, processors, fabricators, agro-allied private companies, researchers and marketers. Together, these various organisations represent over 500,000 individuals.

Members of the platform testing the efficiency of the cassava peeler [Figure 2]

The platform is registered as a limited co-operative federation representing all the member organisations affiliated with the platform. We have a corporate bank account and a well-developed financial accounting system. In addition, we have acquired an office and employed a secretary. We have introduced a membership admission fee and a compulsory monthly thrift savings contribution. All initial and new members have to fully comply with these prerequisites to ensure financial sustainability and autonomy.

We created a good communication plan within the IP whereby plans, targets, activities and expected results are clearly communicated. Members have a say in planning so they will be more committed to the planned activities. The IP has meetings twice a month where experiences are openly shared and issues discussed.

Through continuous interaction, we have been able to establish a very good relationship with the government of Abia State. For instance, we have been invited by Abia State governor's office to attend various events related to cassava. We also involve Abia State governor's office, the Agricultural Development Programme (ADP), the Ministry of Agriculture and other high-ranking policy makers in the state in our platform activities in various ways. This has raised our profile and we have been publicized in state and national newspapers,

Chairman of the Platform, K I Kalu, during the inauguration of the platform [Figure 3]

radio and television over the last two years. This has further given us various opportunities to interact with high-level policymakers. In recognition of our efforts and contributions, the Abia State government through the Abia ADP, allocated some hectares of land to the platform for agricultural purposes. The platform plans to partition this parcel of land among various members to plant different crops, including seed yam, cocoyam, potatoes, cassava and vegetables.

Members and RIU representatives pictured during the inauguration of the Platform, 5 February 2009. [Figure 4]

Achievements

The International Institute of tropical Agricultures' (IITA) Integrated Cassava Project (ICP) also supports the platform in its efforts to develop the cassava value chain. The project has three main aims: to sustainable increase food availability, reduce rural poverty and unemployment and enhance agro-industrial and socioeconomic growth in Nigeria. This will be achieved by deploying high yielding resistant cultivars, adapting improved and profitable post harvest processing methods, and facilitating policies to ensure that problems along the commodity chain are reduced. ICP aims also to increase private sector investment in production, processing, storage and marketing. Several other activities have been initiated as a result of the ICP. While the Cassava Mosaic Disease (CMD) project primarily looks at mitigating the impact of cassava mosaic disease and increasing productivity in Nigeria, Cassava Enterprise Development Programme (CEDP) focuses on utilization and the development of agribusiness. The expected outcome of these initiatives will be to improve income and the livelihood of farmers.

RIU also assisted the platform to acquired 250 bundles of CMD-resistant varieties of cassava stem for our members who are serving as commercial out growers to propagate the improved varieties,

in line with the missions of RIU, National Root Crop Research Institute (NRCRI) and International Institute of Tropical Agriculture (IITA). The Abia State First Lady supported the IP in the distribution of cassava stem to the platform members and over 500 farmers groups.

About 210 members were trained at NRCRI on post-harvest value addition on cassava where they acquired various skills which enable them to earn money from processing cassava into various end products, including odourless fufu and industrial starch. Each of those trained went back to their representative zones and successfully trained other members of their groups.

Potentials and Prospects

Nigeria produces enough cassava to meet the need of its population as well as to be able to export to other African countries. Cassava is an excellent crop that can be used to enhance food and income security. In addition, waste from cassava can be used as livestock feeds, especially for pigs.

We recognize our individual differences and allow people to specialize in their area of interest and still communicate and work together in the platform. The Cassava Innovation Platform can play an important role in developing the cassava sub-sector through establishing unity among members of the platform.

Lessons Learnt

Collaboration amongst stakeholders is a vital ingredient for effective functioning of the Innovative Platforms. This collaboration was an initiative by RIU Nigeria. We were able to bring together our diverse expertise and resources to innovate and achieve common goals.

Progress in manual cassava peeling: The outcome of interaction between stakeholders

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K I Kalu
Aquada Development Cooperation, Old Umuahia, Abia State, Nigeria

Peeling: a very time-consuming activity

Peeling is one of the most laborious, critical and time-consuming activities in cassava processing. The activity has constituted a serious bottle-neck in cassava processing because of the irregular shape of the roots and the concave surfaces. This implies difficulties for the peeler. Mechanical peeler devices have been developed but their performance is far from perfect and usually needs to be complemented with manual peeling.

Knife peeling of cassava [Figure 1]

The tool commonly used for manual peeling of cassava in Nigeria is the knife. But even the use of a knife is not very efficient and, in addition; time consuming. This is a difficulty faced by many Nigerians working in the cassava sector, including the farmers and processors involved in the Cassava Innovation Platform (IP) of Abia State.

A peeling tool from NCAM

The Cassava IP in Abia State was initiated with support from RIU Nigeria in February 2009. The Cassava Platform consists of many different stakeholders operative in the cassava sector of Abia State, including local fabricators, researchers, but also farmers and processors. The difficulty and time-consuming activity of peeling cassava was a problem often heard in the platform and it was felt necessary to address this. Thanks to RIU, the link was made between the platform and me, Dr E Oti. I am a researcher working at the gari processing factory of the National Root Crops Research Institute (NRCRI).[1] Being a research institute and one of the IP members, RIU commissioned the NRCRI to address the peeling problem brought up by the Cassava Platform.

[1] Gari is a free flowing granular cassava product.

The investigation

To understand the difficulty of the peeling activity, I discussed the issue with researchers, fabricators as well as processors from the Cassava Platform. After having heard the exact difficulties involved in cassava peeling, I approached the National Centre for Agricultural Mechanization (NCAM), a Nigerian research institute situated in Ilorin, Kwara State. They provided me a cassava hand-held peeling tool which could be produced at N500 (Nigerian Naira) (US $3-$4).

Peeling cassava with a hand tool [Figure 2]

In comparison, a stainless steel knife suitable for peeling cassava, costs N150 to N250 (US $1 - $1.5). In view of the prohibitive costs of the NCAM-developed cassava peeling tool and in order to introduce a more efficient manual peeling tool to cassava processors of the Abia Cassava IP, I carried out a preliminary investigation with other staff members of the gari processing factory of NRCRI.

The NRCRI gari processors affirmed that they could use this device as a substitute for the knife for peeling cassava. After this investigation, NRCRI engineers went to work and came out with a modified version of the NCAM-developed tool. The engineers estimated the cost of production and fixed the selling price at N150 (US $1).

After the processors of the gari factory had familiarized themselves with the newly developed peeling tool of the NRCRI, I conducted another investigation to compare this modified version with the knife. What I found, was that:

- There is not much difference in peeling time between the peeling tool and a kitchen knife.
- The peeling quality (the ability to peel the cassava roots properly) of the modified tool was also similar to the usage of a knife.
- However, less peeling loss was incurred by the use of the hand-held peeling tool.

Cassava peeled with knife (left) and cassava peeled with NRCRI-modified peeler (right) [Figure 3]

After that, RIU organized a workshop on entrepreneurial skill acquisition which took place at the NRCRI. A total of 210 IP members; cassava farmers, processors and marketers from Abia and Cross Rivers States, attended the workshop. During this workshop I asked participants to peel cassava with the peeling tool. Members were generally positive about the tool and found it a suitable device for peeling cassava.

The result of interaction: an improved hand-held peeler tool

After the workshop, a processing equipment fabricator, one of the Abia Cassava Innovation Platform members, adjusted the equipment further. For the comfort and convenience of the users he narrowed the handle of the peeler. In follow up, the chairman of the Abia Cassava IP, engineer Kalu I Kalu, did another investigation to determine the efficiency of this fabricator-modified peeler in comparison with the knife. From his test, he found that, in comparison with the NRCRI-modified tool the use of this tool led to:

Left you see the NCAM-developed manual cassava peeler and on the right side NRCRI-modified manual cassava peeler . [Figure 4]

- A significant reduction in peeling time, as well as,
- A reduction in peeling loss.

The NRCRI, in collaboration with the Cassava IP, is now planning to organize trainings in several villages of Abia State to create awareness and popularize the use of the tool.

A useable peeling device; the outcome of interaction

Nigerian research institutes need to be more proactive in disseminating new technologies developed. The hand-held cassava peeling tool was developed by NCAM many years ago and was just lying on the shelves of the institute until NRCRI was commissioned by RIU to develop a manual cassava peeling tool. The intervention by RIU caused NRCRI to take a look at this NCAM manual cassava peeling tool with a view to putting it into use. NRCRI realised that the NCAM peeling tool was not within the reach of the Abia IP Cassava processor because one unit costs N500 (US $3.2). In consideration of the prohibitive cost of this tool NRCRI decided to modify it (without compromising its efficiency) and make it affordable to the IP cassava processors. In this way NCAM, the NRCRI and Cassava Platform members have collaborated to develop a manual cassava peeling tool and booked advancement in manual peeling of cassava in Nigeria.

Cassava processors readily accept an innovation which they clearly see to be an improvement on the way they have been processing cassava. Abia cassava IP processors did not accept the NRCRI-modified cassava peeling tool because the handle made its use inconvenient. When the handle was made narrow by an Abia IP fabricator, the tool was preferred by processors above the knife for in manual cassava peeling.

Section 3 Innovations in the Cowpea and Soybean Value Chains

Promoting an agricultural technology through multi-stakeholders' approach The case of Purdue Improved Cowpea Storage (PICS) hermetic cowpea storage in Nigeria

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"Storing cowpeas without any chemicals; How is this possible?" said Musa Dan Ladi a farmer attending an Open the Bags Ceremony in the village of Yalwa in Misau Local government, Bauchi State. During an OBC, cowpeas stored in Purdue Improved Cowpea Storage (PICS) bags are publicly opened in a village. The ceremony is part of the PICS project executed by international Institute of Tropical Agriculture (IITA) in collaboration with RIU Nigeria. The use of no-chemical hermetic storage of cowpeas by using PICS bags was promoted in more than 10,000 villages in Nigeria. This was a collaborative effort of the PICS project along with a coalition of stakeholders including CGIAR centre, federal, state and local government agencies, private organisations, media, farmers, marketers associations and other resource persons. All of these stakeholders worked at different levels with the common focus of getting the information out and allowing farmers the opportunity to try and potentially buy the PICS bags.

Background

Cowpeas in storage are destroyed within several weeks by insects, called Bruchids, if they are left unprotected. Protecting cowpea harvest against Bruchids has always been a great challenge to farmers in Africa. The most common method used currently involves the application of chemicals. The great disadvantage of chemicals is the fact that they are often mishandled or the wrong chemicals are used which leads to health problems of consumers. Several cases have already been documented in the press of Nigeria.

The PICS technology was developed about 20 years ago by a scientist at Purdue University and their counterparts from several African countries. It is a three layers bags (the inner two plastic and the outer nylon) which keeps air from penetrating in the grain, thus preventing the development of the Bruchids. PICS bags make the use of chemicals unnecessary and allow the farmer to store its cowpeas until the right moment for consumption or sale. This creates on its turn the possibility for farmers to benefit from seasonal price increases while protecting the general public from chemical misuses.

The PICS project was initiated by the Purdue University and funded by the Bill and Melinda Gates Foundation (BMGF). The project was implemented in 10 West and Central African countries. In Nigeria, the International Institute for Tropical Agriculture (IITA) was the main implementing agency. In Nigeria, the programme covers 19 northern states and the Federal Capital Territory (FCT), places where significant cowpea production exists.

RIU Nigeria made small-scale attempts at facilitating agricultural innovation and development through fostering multi-stakeholder collaborations and networks around selected crop value chains, targeting farm productivity, post-harvest value addition and policy arenas. Based on a request for better post-harvest technology by the cowpea sector stakeholders during their meeting, RIU Nigeria approached IITA in November 2009 with the intention to contribute to the dissemination of the PICS technology. A meeting was then held to determine the best strategy to achieve project goals. The strategy developed, builds on the PICS approach which is based on the following steps:

- Training of extension agents
- Village sensitization
- Village bags opening ceremony

Once a village chief's consent was obtained for conduct of demonstration, five volunteers are identified to bring in their cowpea for storage inside PICS bags. The bags are filled publicly and kept in an agreed location in the village. Four to six months later, the extension agent calls another village meeting for an Open the Bags Ceremony, during which stored bags are opened publicly for the audience. Then they can themselves see the quality of grain after the months of storage. At each of these steps, media and local leaders are involved to relay the message. Parallel to this, efforts were being made for the development of a supply chain to ensure consistent availability of PICS bags at village level. Extension materials in English and local language were subsequently developed and distributed to extension agents, bags dealers and farmers.

Getting all on board; the approach

Key stakeholders were identified based on a need assessment exercise conducted by the project management team. The technology needs to be extended in villages thus extension services are needed. Second, bags needed to be produced and sold to farmers once they have experimented and seen the bags, so bags producers and suppliers were identified. IITA, RIU and PROGREEN were in charge of monitoring the extension and media to ensure quality and effectiveness in different parts of the country. A monitoring system based on reports after each activity for the extension agent made it easier to ensure that demonstrations were being conducted. Once a list of demonstration villages were given, teams were sent out to verify the information on the ground. The extension agents were trained by a core of trainers that received initial training from IITA and Purdue. These trainers were empowered to train extension agents as well as agents from other programmes that bought into the project. For example when RIU came in those trainers were ready to hire to train the agents who handled the RIU villages. Agricultural Development Programmes

(ADPs)[2] and their extension agents were responsible for implementing the programme using its three step strategy. PICS bags were manufactured locally by Lela Agro Enterprises using a 50%-50% joint venture with the project for the first year. This arrangement allowed reducing initial risk which made the manufacture to embark in production of this new product.

Stakeholders and their roles

All stakeholders were assigned different tasks and responsibilities based on their comparative advantage and their current activities (see Table 1). The facilitation role was limited to identification of the right partners and inviting each when the need arises.

Table 1: Roles and responsibilities of PICS stakeholders

Stakeholders	Role in the programme
Purdue University	Project initiator and donor representative
IITA	Overall coordination, training, technical backstopping and evaluation in Nigeria
RIU	Coordination and funding activities in additional villages in some states
PROOGREEN	Coordination is selected states
Federal government agency	Receive information for possible policy formulation
State level agencies - ADPs	Extension services
Local government agencies	Extension services
Resource persons	Training of extension agents
Bags' producers and suppliers	Produce and sell PICS bags
Local community and religious leaders	Reinforce message on health benefits
Mass media	Broadcast PICS messages
Farmers' associations	Relay PICS message
Marketers' associations	Selling PICS Bags

[2] ADPs provide the extension services in Nigeria.

Achievements

Through the programme, traditional research partners worked effectively with non-traditional partners such as private sector and community leaders to ensure adoption of the PICS technology by farmers in northern Nigeria. This was achieved through formal contracts (such as memorandum of understandings) and informal arrangements (like verbal agreements between farmer organisations and extension agents). The participation requires that a farmer brings in his/her own cowpea and also agrees to leave it sealed and untouched for at least four months until the Open the Bags Ceremony is held. The agreements were flexible enough to allow each stakeholder to contribute to the programme while continuing their normal activities.

Adoption of the technology has addressed a major public health objective; The PICS bags made it unnecessary to use chemical preservatives and thereby eliminated the chance of health problems caused to consumers. In addition, the PICS bags contributed to increased income for many farmers thanks to drastically reduced post-harvest losses to cowpea farmers and marketers. In 2009 following the pilot phase of the project, a survey of 1078 farmers was conducted in three Northern Nigeria states of Kano, Katsina and Jigawa to assess awareness and adoption of the technology after the first year of pilot phase. In the participating villages, farmers that participated in demonstration of the PICS bags had higher adoption rate (44%) than those who did not participate (6%). Results by type of farmers indicate that pilot farmers had an adoption rate of 64% while it was only 13 % for non-pilot farmers (Abdoulaye *et al.*, 2010).

Another important achievement of the programme was the empowerment of rural farmers and agro marketers. They were asked to evaluate the technology, hence demystifying technology evaluation as something that only 'experts' can do. Farmers and potential bags dealers were able to observe results of the demonstrations and evaluate the efficiency of the bags in protecting cowpea directly by themselves during open the bag ceremonies. They therefore had the opportunity of making an informed decision about buying the bags.

Finally, it was determined at the beginning of the PICS programme that integrating a market-led supply chain can contribute to the sustainable supply of the technology, while enabling the consumers (cowpea farmers and marketers) to potentially bargain for lower prices of the technology. The programme has tried to establish direct links between the end-users of PICS bags and the wholesaler and retailer of the bags, thereby eliminating the role of extension agents beyond the initial sensitization phase. A supply chain (from producer to retailers) was set up in the country to sale bags in at least each local government area where demonstrations were conducted. At each level of distribution, a margin was added to remunerate the contribution of each type of bag dealer.

Challenges and way forward

Despite being able to work closely with manufacturers to produce good quality bags in Nigeria, the development of the distribution networks of PICS bags in all regions continue to be a challenge. The

producer of bags favours to limit its activities to densely populated (generally urban) areas, while the actual demand for the bags is in the villages. The programme is still trying to identify local dealers in order to bring the supply of the bags closer to the buyers.

The PICS project has shown that with the right partnerships research outcomes and development projects can reach several thousand villages with a given technology in a relative short time. Despite its ambitious targets, the main challenge turned out to be the supply chain development rather than reaching farmers in remote villages. With the setting of the correct partnerships, it was relatively easy to reach several thousand villages in one year. The development of the supply chain could be strengthened; the bag costs could be reduced and supply made more reliable. Already many farmers are trying the bags with other crops. In conjunction with researchers and the private sector, we might develop storage bags in the future which could be used for other crops than cowpeas only.

Battle against cowpea weevils finally won

Improving farmers livelihood through promotion of non-chemical hermetic cowpea storage technology

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Grace Jokthan
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Hauwa Mohammed is a small scale bean cake (kosai) processor based in Kwalli, Gombe State. When she volunteered to provide some cowpea for demonstration using Purdue Improved Cowpea Storage (PICS) bags during a training session, other women laughed at her saying her cowpea will be fed to chicken after the storage period as a result of high weevil infestation. They asserted that it is not possible to store cowpea in a bag without chemical. During the 'open the bag' ceremony six months later, they observed that the quality of the cowpea was retained after storage and that the quality compared favourably with that of cowpea with chemical. Hauwa made more profit from her business last season (2010) because she bought cowpea at harvest time when price was low, stored in PICS bags and used it for her business throughout the year. The high demand for PICS bags by farmers, traders and even extension agents is an indication of the effectiveness of the technology in solving cowpea post harvest problem and increasing farm income.

Purdue Improved Cowpea Storage (PICS)

Post-harvest infestation with weevils is often identified as the key challenge for small scale cowpea producers and traders. Thus, farmers sell most of their cowpea grain at harvest when prices are low to avoid storage loss due to insect infestation thereby reducing income. The result of the baseline study conducted in the Cowpea/Soybean Crop-livestock Integration Innovation Platform revealed that farmers stored for longer period if the storage loss is low and thus took advantage of price increase later in the year. A variety of commercial and traditional methods are used by farmers to control cowpea weevils. However many of these have restricted value because of cost, labour, storage loss and potential hazards to the consumers. Excessive use of chemicals render the cowpea toxic resulting in several reported cases of sickness and even death across Nigeria. A safe and affordable alternative is the use of non-chemical, hermetic storage technology - known as 'triple bagging' or 'Purdue Improved Cowpea Storage (PICS)'. PICS or triple bagging cowpea storage is a technology developed by Purdue University in collaboration with African researchers. The 'triple bagging' technology consists of an outer layer of woven polypropylene or nylon bag and two liners of 80 micron high density polyethylene bags [Figure 1].

Cowpea stored in PICS bags in a volunteer farmers' house. [Figure 1]

Inadequate post harvest management was conceived as a problem that needed to be dealt with to boost cowpea production within the Cowpea/Soybean Crop-livestock Integration Innovation Platform. RIU Nigeria partnered with the International Institute of Tropical Agriculture (IITA), the Purdue University (Agriculture Faculty, USA), the Bill and Melinda Gates Foundation, State Agricultural Development Programme (ADP) in six states, independent trainers and resource persons, a private sector bag producing company, selected radio and TV stations, community/religious leaders, and associations of cowpea farmers and marketers. The use of this technology has enhanced cowpea production, income and profit margins of end users by reducing storage loss, improving health and reducing environmental hazards.

How the innovation happened

RIU Nigeria facilitated demonstration of triple bagging technology to end users at various levels. First demonstration sessions were organized for ADP extension agents (EAs) in six states (Kaduna, Gombe, Bauchi, Kano, Katsina, Jigawa) using resource persons trained by IITA [Figure 2]. This activity was carried out in July, 2009 at designated state ADP offices. The objective was to facilitate 20 EAs in each state to learn the technique of triple bagging and then train farmers at community level. Each extension agent was mandated to sensitize and train farmers in ten communities thereby giving a total of 1200 communities in the six states. Trainings at the community level consist of sensitization and demonstration on the use of the PICS bags and the final 'open the bag' session 4 – 6 months later [Figure 3]. RIU and the resource persons were represented at the community level trainings and 'open the bag' ceremony in at least two of the

Extension workers learn the techniques of triple bagging in the ADP office in Bauchi, Bauchi state. [Figure 2]

communities covered by each EA. The process of demonstration at the village level was monitored by RIU, EAs, resource persons and the farmers throughout the storage period to ensure that the bags were properly kept and not tempered with before the 'open the bag' ceremony.

Figure 3. 'Opening the bag' ceremony in Kwalli, Gombe state

There was also media dissemination through radio broadcast, news papers and television to facilitate wider coverage and reach more audience. A total of 17 million persons were reached (assuming 30% of the population in each of state) using these mass media. About 600,000 cowpea farmers and traders have adopted the innovation by 2009/2010 season.

Farmers' evaluation of PICS bags for cowpea storage during the 'open the bag' ceremony revealed that the technology is easy to use and effective in eliminating both post-harvest losses and poisoning usually associated with chemical cowpea storage. Cowpea stored in PICS bags appeared fresher and attracted higher prices resulting in increased income (30 – 50%) for farmers. Evaluation of cost implication of the triple bagging technology showed that though the initial cost of the PICS bags (₦300 or US $2) is slightly higher than the costs of chemical storage (₦220 or US $1.4). Considering the fact that the PICS bags can be used more than once if properly managed, and the effectiveness in eliminating storage loss and toxicity to, humans, use of PICS bag is more cost effective and safer, compared to the chemical storage. Chemical storage might require repeated treatment and the stored cowpea may still be exposed to damage by weevils in addition to potential toxicity of the cowpea, making it unfit for human consumption. Though the technology was specifically developed for cowpea storage, some farmers have adapted it in storing other crops like cereals and pepper.

Figure 4. Jigawa women bean cake (kosai) *processors learn to use PICS bags*

Collaboration with private sector bag producing company (LELA Agro)

In order to ensure availability of correctly specified PICS bags and avoid adulteration, IITA identified and contracted a private sector bag producing company (LELA Agro) to produce specified quality bags for cowpea storage. RIU liaised with the company to make available the required bags for demonstration and also to be sold to farmers through the extension agents. Local dealers identified by IITA were also contacted in case the EAs run out of bags. The extension agents were given twenty bags at a time to sell, refund the money before collecting another batch.

Farmers' suggestion for improving triple bagging technology

During the 'open the bag' ceremony, farmers were asked to suggest ways of improving the triple bagging technology. They, particularly women, said there is need to introduce smaller sizes of the PICS bags so that one does not have to open the bags frequently. Storage in smaller bags would also enable them store the seed required for planting in the next season. Wholesalers on the contrary asked for bigger bags. They also suggested that the quality of the outer bags should be improved to prevent damage during handling and also protection from sun. The contract between IITA and LELA Agro has expired; it is now up to LELA Agro and other emerging bag companies to address these needs.

Conclusions

The experiences of the Cowpea/soybean Crop-livestock Integration Innovation Platform revealed that multi-stakeholder collaboration in problem solving facilitated easy access of innovation to tackle cowpea farmers post harvest problems in a relatively short period of time. The involvement of a private sector bag producing company and their collaboration with extension agents ensured availability of the PICS bags and linkages with farmers. This, in combination with demonstration and training at various levels, and use of mass media enhanced wider adoption of PICS in Nigeria.

Widows now smile: A case story of Abanbeke Development Association (ADA)

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'It's odd. There is a powerful consensus that billions of small farmers, especially rural women living in poverty, have not been reached with farm inputs and research results' (Uma Lele, 2011). Everyone agreed that rural women's empowerment is vital in agricultural innovations and must be reached. It is there in countless NGOs proposals, donor agencies and governments. It comes up in countless politicians manifestoes all over the world. And yet the question, 'how do we reach them?' remains unanswered.' RIU pro-poor and social inclusion friendly approach has set the pace that other organisations could follow. Within a very short period, RIU reached 3,000 widows in 24 communities of Northern Cross River State.

Introduction

Widows are the most excluded and neglected people in the agricultural innovations in Northern Cross River State. They suffer awful levels of deprivations and poverty, principally as a result of harmful traditional laws and customs that discriminate against widows. Widows are farmers, but they lack land to farm and cannot access farm inputs. Whilsts generally, women depend primarily on subsistence agriculture as their main source of livelihood, poor widows labour on peoples' farms to get rewards that would then represent sustenance. However, in collaboration with RIU Nigeria, the Abanbeke Development Association (ADA), an umbrella organisation of widows based in the rural community, has begun to break this cycle of exclusion by providing the enabling environment for widows to move beyond supplying farm labour.

Abanbeke Development Association (ADA) is a membership association for rural widows in Obudu, Cross Rivers State. ADA was formally registered with the Local government in 2007 and became registered NGO with corporate Affairs commission (CAC) in 2009. It has an eight-member board that governs that affair of the association. The association seeks to break the social and economic barriers that hinder the development of widows, orphans and other people in need by empowering women to take action to attain economic self-reliance and overcome barriers such as lack of access to land and discrimination from local economic opportunities and participation in local economic and social decision making.

The method in which this RIU-ADA was brought about was unique. It was not like the long, bureaucratic conventional method that many big international NGOs use in selecting their partners. The collaboration started from a junk mail in a mailbox.

It is marvelous that just a response to a junk mail has resulted in improving the lives of many excluded and neglected rural people. I just saw a mail that bears a common name in my clan in my inbox. I was curious and instead of deleting, I decided to open it. But the mail had no message. So I replied to the address on the mail asking why did you send this to us? This started the communication that resulted in the collaboration with RIU.

ADA was linked to the cassava IP through the post harvest value addition to cassava and entrepreneurial skill workshop held at Nation Root Crop Research Institute, Umudike, Abia State. This workshop has laid foundation for the success of some ADA's activities. The workshop was motivational. For the Cowpea/Soybean innovation platform, ADA participated in the 2010 seed acquisition. Certified Cowpea and soybean seeds were supplied to the widows through ADA. ADA also participated in the learning event in November 2010 where leaders of different platforms shared experiences and finally RIU sponsored the leader of ADA to attend the AgriGender and market-oriented agriculture workshop in Ethiopia in 2011.

By including ADA in the cassava and cowpea/soybean innovation platforms long after the inception of the platform, RIU agricultural innovations has reached socially excluded groups in Northern Cross State. We are now members of the platforms, but we do not attend meetings because the distance is too far and expensive. However, the linkages with Platform Members proved to be of great importance for the members of ADA. The following tells the story of the benefits that have occurred to rural widows.

Widows' access to land

Access to land is a major prerequisite for innovations to happen. An important part of ADA's work is facilitating negotiations for widows' access to arable land. Access to land is the major constraint for women in order to engage in agricultural production to make a living. Traditional laws and customs hamper widows' possibilities to own land. We use an activity group method to enhance land negotiation and community talks. The groups consist of 5-20 widows with an interest in a particular type of crop. ADA then connects them to community chiefs and elders or with persons who own land. The initiative is usually with widows to start the negotiation. We see where and what is difficult, and if necessary, ADA will help in the negotiations with local chiefs and landowners. ADA also comes in as a witness to the land agreement and pays the rent, which the groups will pay back later. ADA provides trainings to the widows for these negotiations.

In addition, training underpins our work. We offer leadership training to widows and enhance their confidence and ability to negotiate so that they can speak for themselves. Membership is opened to all the poorest of the poor and the poor widows, orphans-youth. We get an expert to train selected members and staff, thereafter those trained begins to train others.

Below, I will tell the stories of ADA's involvement in the RIU initiated Cassava and Cowpea/Soybean Innovation Platforms. Both platforms have been equally important to the members of ADA and for improving their incomes and livelihoods. Let me start with the Cassava Innovation Platform.

Group members sharing household items [Figure 1]

Widows' gains from Cassava

Before RIU introduced ADA to the Cassava Innovation Platform widows could not access training even within the locality. Through RIU, ADA became a member of the Cassava IP and was invited to participate in the post harvest value addition to cassava and entrepreneurial skill workshop held at National Root Crop Research Institute, Umudike, Abia State. 450 women benefited from this workshop. This was the first time widows with a very low level of education participated in a workshop of that nature. Furthermore, because it was facilitated by professors and academic doctors and in the university environment the widows referred to it as the 'University workshop'. It was a wonderful experience for the participating women to interact with professors and highly educated people. This made them felt recognised and important. During ADA's feedback sessions, the women shared their workshop experience with other members. This workshop has become foundation for the success of many ADA's activities.

The apologetic and fearful attitude usually displayed by poor widows in terms of demanding for farm plot is changing. This is seen in their boldness to secure a five-hectare farm plot for cassava farming.

During the workshop, the 450 women attended the shared their workshop experiences with other group members. This has spurred many women into commercial cassava farming. ADA encourages and facilitates group farms. There are 8 women groups venturing cassava. Two groups planted a fairly large cassava farm early August 2010. Early May 2011, six groups have tilled large farm plots which are ready for planting: one group has prepared a five-hectare plot, while the other 5 groups have prepared 3.5 hectare each. The increase in farm size is as a result of the trainings from the workshop attended by women representatives outside their domain and the capacity development of the Umbrella association, ADA.

During the workshop, ADA leaders interacted with IITA personnel. The interaction led to the introduction of ADA to GODILOGO. GODILOGO is a big commercial cassava production company in Obudu. This relationship has resulted in widows accessing cassava mosaic disease (CMD) resistant cassava cuttings reduced price. In addition staff from the company is providing technical advice to the widow farmers.

With the knowledge gained from the Umudike training, some women now are engaged in cassava trading. They buy cassava tubers from neighbourhood markets and sell. This has led increase food supply to the village. The women involved form a thrift group where the weekly profit is invested in household items.

Few months after the Umudike trip, our participating widows demanded for adult literacy classes. They wanted it badly so that they will be able to sign their signatures, speak English like women in other places.

Women in an adult literacy session. [Figure 2]

Widows harvest the grains from soybean innovations

For the Cow/Soybean innovation platform, ADA participated in the 2010 cow/pea seed acquisition campaign. Certified cowpea and soybean seeds were supplied by RIU to the widows through ADA. These seeds were distributed to mainly poor widows, women married to very poor men and orphans spread across seven villages in Obudu, Cross River State. Twenty four communities make up these villages. A total of 2,880 women and men benefited. It is necessary to note that the common crops grown within ADA communities are carbohydrate based such as cassava and yams. Farmers intercrop cowpeas with other crops, but soybean is not grown. Even the cowpea is not grown on a substantial level. However, these communities (Obudu and Obanlikwu LGAs) are almost within the same ecological zone where soybean thrives in Nigeria. Therefore, ADA introduced the soybean principally as a trial to find out whether soybean can grow well in the area. Trials on the ADA demonstration plot, and on farmers' plots showed that the area is suitable for soybean cultivation.

One of the widows said: *'fear catch me when I was asked to sign for money because I didn't know how to write. I just draw something on the paper. But, stood and saw another woman like me sign without trouble. Right from there, I told myself that I will attend evening school.'*

Soybean being a relatively new crop in this area was not immediately accepted. Many farmers were sceptical about planting soybeans and raised the following questions: Does it do well in our soil? Who will buy it from us? How do we use soybeans? Few farmers have had previous access to it.

Soybean liquid milk processing. [Figure 4]

RIU identified the potentials in ADA to take on the role of facilitating rural women into commercialization of agriculture products currently promoted in the world markets. RIU sponsored the leaders of ADA to the Gender and Market-Orientated Agriculture Conference in Ethiopia early 2011. Experiences from the conference have helped to improve ADA's training methods. For example, the training language is simplified and the women's' performance has improved.

A scene in one of the awareness campaign sessions. [Figure 3]

Based on the above, ADA carried out an awareness campaign on the uses and utilisation of soybean and facilitated a workshop for participating groups and individuals. ADA facilitators went round to sensitise groups and villages. To reach a wide audience, not only widows, we organised public campaigns around formal village meetings where many people would attend. Seeds of soybean varieties were distributed, not only to the widow members of ADA, but also to other poor people in the communities.

To address the question, *How do we use soybeans,* earlier raised by sceptical farmers, training workshops were conducted in three villages over a one week period. A total of 500 widows were trained. They were taught on how to make 3 products of soybean, namely liquid soybean milk, soybean powered milk and soybean soup. They were also taught the different ways they can used it as protein food additives for children and the very old.

Some widows have taken liquid soybean milk as a micro enterprise. In morning they sell hot soybean milk and bread at the motor cyclists parks and by roadside. This is generating cash income for the women. The soybean soup has opened a way for the widows in the wider village setting to

interact with other women. Our community burial ceremonies are usually a burden for many poor women because they must contribute by cooking for the ceremonies. Cooking generally is not a problem, but the problem lies in the type of soup that must be prepared. This soup is quite expensive for many poor widows who, who, very often, are forced to pay fines for not meeting the requirement. The soybean soup has come as a ready solution because it looks like the recommended *egusi* soup, but it comes at low costs. In addition, the widows teach some other women in the community how to prepare it and in the process they make friends because they now have something to offer. This simple contribution to me is very important because apart from providing a source of quality protein to the diet of the widows, it is serves as a channel for inclusion of the widows.

This collaboration in itself is an innovation process for us in ADA. It is the first time in this area that certified seeds have been distributed to wide audience including widows. Before, most women did not perceive soybean as an important since soybean cannot be cooked as like the cowpea for food. ADA stimulated women to plant soybean for its various products that would generate income within a short period. In order to change their perception ADA organised training workshops as well as awareness campaign.

Conclusions: innovation as vehicle for empowerment of rural widows

Due to the innovation described above, there is a shift in the perception of the widows in many regards. Generally, due cultural norms, widows self-exclude themselves from many social and political gatherings. They think of themselves as inferior. Now, they have abandoned self-exclusion. The widows demonstrated this during the last electioneering campaigns. They overcame self exclusion by going out to the community centres to listen to the politicians delivering their manifestoes. The widows had the confidence to demand for information about *social giving* by the politicians.

The power behind this RIU pro-inclusive approach was the small grants to cover the cost of inputs and the trainings. Enhancing widows access to land and essential inputs such as planting materials and training, has created the enabling conditions necessary for increased food production and the commercialisation of agriculture. RIU has contributed to moving the socially excluded from subsistence to semi-commercial agriculture.

Food for man, feed for animals

A case story of dual purpose cowpea varieties

Grace Jokthan
RIU Nigeria

"Eh..... Now I have cowpea for the children to eat, fodder for my 3 lactating does and my son earns money bailing fodder in the community!"
Tabawa Audu – a female subsistence farmer in-Garko Local Government Area of Kano State

Introduction

One of the major challenges limiting the integration of crop – livestock agriculture in Nigeria is the absence of crop varieties that satisfy the needs of both humans and livestock. This is in spite of a population of 150 million humans and 22 million sheep, 34.5 million goats and 13.9 million cattle. Crop varieties developed by research institutes often concentrated on grain yield with little attention to the potentials of the crop residue for livestock feeding. Most often, the little crop residues obtained after harvest are left on the farm to rot, or grazed on the field and, in a few cases, stored on roof or tree tops where they are exposed to unfavourable environmental conditions and consequently lose feeding valued.

RIU Nigeria through the Cowpea/soybean Crop-Livestock Integration Innovation Platform brokered a collaboration between relevant stakeholders in the cowpea/soybean value chain that enhanced farmers access to high yielding dual purpose varieties of cowpea (IT277-2 and IT98K-205-8) in Kaduna and Kano states. About 570,000 farmers, 450 of whom are widows, adopted these varieties which resulted in improved farm productivity in terms of both grain and fodder (218.88 tonnes). The introduction of fodder bailing equipment to farmers resulted in a better way of storing fodder and ensured efficient management in fodder utilisation by livestock owners who now have a weight bases for feed rationing. A small Micro Enterprise Scheme has emerged and 10 hitherto unemployed youths are engaged in bailing hay at ₦30/bale (US $0.2) in some communities in Kaduna State. About ₦4,320 (US $28.15) is generated as income per day in an 8 hours working day by these hitherto unemployed youths.

In the first year (2009) of sensitisation of farmers on these dual purpose cowpea varieties, 300 farmers adopted the varieties in Kaduna and Kano states. In the 2010 planting season, 570,000 farmers planted at least 0.1ha of dual purpose cowpea.

These varieties were also evaluated by 2880 widows in Obudu area of Cross Rivers State in 2010 indicating a new geographical spread of the varieties to areas where cowpea was not traditionally

grown. Traditional cowpea varieties yield between 200–500 kg of grain/ha while these improved varieties yield between 1000-1200 kg/ha.

There was a huge demand for fodder by Fulani pastoralists settled in Kachia grazing reserve. These settled pastoralists have had to move their livestock to the southern part of the country at the peak of the dry season due to over grazing at the reserve and encroachment by crop farming communities. To meet their demand for feed about 7.2 tonnes of a combination of cowpea, groundnut and soybean baled hay and concentrates have been supplied through the services of business entrepreneurs such as Feedmasters Nig Ltd and ProValue Associates Ltd.

What Made Innovation Happen

The Platform through the research Institutes -Institute for Agricultural Research (IAR) and International Institute for Tropical Agriculture (IITA) - in the platform identified cowpea varieties developed specifically for grain and fodder yield suitable to the savannah agro-ecological zone. Private sector Input dealers in the platform (Premier Seeds Plc and The Seed Project Ltd) provided the certified seed at ₦ 250/kg (US $1.63) to farmers. Even though the local cowpea seeds are cheaper (₦180-200/kg) or (US $1.17-1.30) farmers were willing to pay more to acquire certified seeds with dual potential. Other inputs such as chemicals for spraying were available through Jubaili Agro and Candel Coy. Two resource persons (agronomist and animal scientist) from Ahmadu Bello University, Zaria built the capacity of farmers on how to apply appropriate management practices such as recommended planting dates, planting rates and spacing distance as well as recommended fertilizer type and rate, and their application methods for the chemicals and control of insect pest. Farmers' capacity was also built on how to efficiently manage and utilize crop residues for livestock feeding. This ensured that farmers knew what management practices to carry out, when to do it and how it should be done to obtain optimum yields of both grains and fodder.

Farmers observed that the compacted hay [Figure 3] looked good and was more manageable to store. The sellers on the other hand agreed that even though it looked good, it was doubtful whether buyers would agree to pay the appropriate price per unit weight because the baled fodder looked much smaller than the non-baled fodder [Figure 2].

A baling equipment was developed by Wetlands Nig Ltd in consultation with RIU Nigeria [Figure 1]. An evaluation of the equipment was conducted by farmers in the platform at crop residue selling points in Kano and Wudil.

On the design, farmers suggested that bolts should be placed at two ends to help keep the equipment steady and allow for easy handling by the operator. A hinge should also be provided at four places towards the rim for ropes to pass through to ensure easy tying of the fodder after the compaction. These observations were incorporated in the final design of the baler. The collaboration between RIU Nigeria and Wetlands Nig Ltd resulted in the production of six locally fabricated manual balers capable of producing 18 bales of 10kg/hour. Ten unemployed youth are now engaged in the commercial activity using the baling equipment. The balers were sold to the youths at the cost of N38,000 and the money remitted to Wetlands Nig Ltd account as baling was effected in the communities.

Bailing equipment developed by Wetlands Nig Ltd and RIU-Nigeria. [Figure 1]

Traditional method of crop residue storage. [Figure 2]

Baled hay by one of the self employed youth. [Figure 3]

Lessons Learnt

- Active involvement of all the stakeholders in the Cowpea Value Chain helped to identify one of the major bottle necks in crop-livestock integration. Addressing the challenge as a platform brought synergy of action.
- The Independent brokering role provided by RIU Nigeria created an enabling environment for trust and confidence building among stakeholders in the value chain.
- Stakeholders working together ensured ownership of ideas by the platform members and a sense of belonging.
- For the introduction of weights as a measure of value to be widely accepted demonstrations and sensitisation is necessary, especially considering the level of literacy of most of our subsistence farmers.

Section 4 Innovations in the aquaculture value chain

Low Value Tilapia: New idea on an old problem

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Fish feed in aquaculture represents between 60–80% of the variable cost of fish production. Fish meal is the most expensive of all the ingredients and critical to good quality fish feed production. About 90% of the currently used fish meals are sourced through importation. The remaining 10% are sourced either as fragments of smoked fish or sun-dried clupeids. In most cases the fish meal are infested with beetles and contaminated with sand from various locations which limit their quality.

Low Value or Stunted Tilapia [Figure 1]

The use of low value or stunted Tilapia as possible local alternative in fish meal production will go a long way to increasing the profitability of aquaculture through the production of cost-effective fish meal. Low value Tilapia spp. are mainly used in fish farms as food for carnivorous species such as catfish and megalops. Some of the drawbacks that we noticed in Tilapia culture in ponds are their early maturation and prolific breeding nature which results in stunted growth as a result of competition for food and space. Fresh stunted Tilapia attracts little commercial value to fish farmers due to their small size and bony nature which does not attract consumers, who prefer fleshier and less bony fish.

Therefore RIU through NIOMR facilitated the development of strategies for the utilization of these small sized Tilapia to reduce losses to the fish farmers and to enhance their capacity to provide inputs to fish meal cottage industry that are expected to emerge. The innovation is towards presenting Tilapia as a more acceptable high protein fish meal to satisfy the growing demand for this product. Farmers are now encouraged to mass produce stunted Tilapia since they are aware of the availability of a market to absorb their production.

RIU supported innovation is directed towards presenting low value Tilapia in a more acceptable form designed to satisfy the growing demand for fish meal and increasing their utilization in fish feed production.

The Story

For so many years, NIOMR has been involved in fish meal and fish feed production. Our effort to use "stunted" Tilapia for fish meal production as alternative to the marine species finally came to fruition with the intervention by RIU. Activities put in place by RIU Nigeria preceding the take off of the work included a series of meetings and "Building Capacity of different stakeholders in fish feed production in Nigeria". In executing the project we involved specialists along the value chain: post harvest technologist in the production of the fish meal, a nutritionist to test the fish meal compounded diets for feed conversion rates, a chemist with the responsibility of chemical analysis and a socio-economist to determine the cost benefit analysis of the production system.

Press and complete cottage plant. [Figure 2]

Cooking of Tilapia [Figure 3]

Pressing of slurry after cooking[Figure 4]

We adapted an in-house proven technology to fish meal production from locally-sourced Tilapia and involved the use of a prototype model of a commercial fish meal plant. Test cropping of one of the ponds at the Institute's Badore fish farm and a private collaborating fish farmer, Big Fish Farms in Lekki, gave us a total of 300kg of stunted Tilapia which was used to test run the fish meal plant equipment. The 300kg Tilapia was processed into fish meal using the prototype fish meal plant. The processing method used involved feeding raw Tilapia into a cooker through the hopper situated above it. In the cooker, the raw fish was cooked at a holding temperature of about 80^0C. The coagulated mass then entered the screw press where water and oil are squeezed out. The press cake was then dried in a steam jacketed drier while the press liquor was allowed to run off. The product (coarse meal) was then hammer milled to produce finely ground powdered fish meal. The fish meal realized from the production was 60kg resulting in ratio of 5:1 for the stunted Tilapia and finished fish meal respectively. The present effort at producing Tilapia fish meal using normal

processing procedures and under hygienic condition produced high quality meal with a crude protein content of 60%. Feed compounded using Tilapia fish meal was found to reduce the cost of feed by about 30 per cent compared with imported fish feed.

Solar drying of Tilapia fish meal [Figure 4]

In addition, through RIU and counterpart funding from NIOMR, four outstations of NIOMR were empowered to start mass production of low value Tilapia. The stations are located in three sates of the Federation as follows: ARAC in Aluu and Buguma both located in Rivers State, NIOMR, Sapele in Delta State and NIOMR, Badore in Lagos State. The outstations had a total of 10 earthen ponds under cultivation. The outstations were involved in mass cultivation of low value Tilapia for fish meal production with the intent of introducing the cottage level production of fish meal to farmers in their community and also within the catchments areas of the states they operate. Although the project is sited at NIOMR headquarter, it is actually running in three states of the Federation. During the last visit by the RIU project coordinator, we decided to explore the possibility of designing a cheap cottage level fish meal plant that can be used at all NIOMR outstations to reach out to farmers in their locations to expand Tilapia production for producing fish meal. We came up with fish meal processing equipment made from oil drum (as presented in the accompanying pictures)

The major attributes of the technology that might enhance its acceptability and adoption is the simplicity of the design, affordability of materials used and the demand for fish meal which is a major component of the fish feed. This technology will empower farmers to produce low value tilapia on a large scale to service the fish meal cottage industry. The drawback of Tilapia fish meal is the high ash content compared with imported fish meal. A simple process of demineralization, i.e. sieving out the bones of the fish meal will be carried out after drying before milling to reduce the ash content.

The present effort at producing Tilapia fish meal using normal processing procedures and under hygienic condition produced high quality meal with a crude protein content of 60%. Feed compounded using Tilapia fish meal was found to reduce the cost of feed by about 30 per cent compared with imported fish feed.

The expected benefit of this project which is linked to aquaculture development will help increase farmer's income, improve their livelihoods in rural areas, create employment; lower operating costs and invariably provides fish to consumers at affordable price.

Conclusion

Low value Tilapia represents an under-used nutritional and socio-economic resource of great potential benefit that can be brought into the food security chain through a process of using fish as a natural feed for fish. The production of fish meal from stunted Tilapia was facilitated by RIU in collaboration with NIOMR and fish farmers. The project has been out scaled to three additional states of the federation.

Tilapia fish meal harvest profit

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Aquaculture production in Nigeria grew more than five times from 16,619 metric tons in 1995 to 85,087 metric tons in 2007 making it one of the fastest in Africa. This phenomenal growth depended heavily on feed which constitutes about 70% of production cost. In Nigeria, fish meal which accounts for more than half the cost of fish feed is imported at very exorbitant prices. For this reason the cost of fish feeds has gone beyond the reach of many farmers. In addition, when obtained locally, millers have complained of fish meals mixed with bones and other useless materials which makes it highly substandard.

Consequently, in 2010, RIU Nigeria brought different stakeholders in aquaculture (including the two fisheries research institutes in Nigeria, feed millers, fish farmers, policy makers, private sector representatives and non-governmental organisations) together to find lasting solutions to the problem of fish feed. Series of meetings were held in Abuja by the stakeholders under the auspices of RIU to deliberate on the way forward. Acting as facilitators RIU guided the discussions which happened to be one of its kind, all key players in the industry were able to sit at a round table to find solutions to a common problem.

Harvesting low value tilapia from a pond for processing into fish meal [Figure 1]

After these meetings, it was agreed that a cost effective fish feed should be developed to bring down the high cost of aquaculture production. Since more than half the cost of a viable fish feed is derived from fish meal, it was agreed that efforts should be geared towards producing fish meal locally that can be used by farmers and feed millers to produce high quality cost effective fish feed.

Sorting harvested Tilapia for fish meal production. [Figure 2]

To this end, the National Institute for Freshwater Fisheries Research (NIFFR) was mandated to explore the possibilities of using some freshwater fishes for producing fish meal at cottage level, since majority of the stakeholders operate at cottage level. Two fish species, freshwater Tilapia (*O. niloticus*) and Clupeid (*P. afzeliuzi* (Freshwater sardines)) were identified as potential fish meal sources. Proposals were then written and submitted to RIU for funding. Research Into Use officials also visited the institute to carry out site verification of the institute's capacity to achieve the targeted goals. Thereafter, RIU awarded a grant to the institute to execute the mandate. Production of the fish meal from Low Value Tilapia and Clupeids and subsequent growth trials were done at NIFFR in New Bussa.

Clupeids were already in use by local farmers as fish meal and fish feed before this exercise commenced. However, the use of tilapia as fish meal was not practiced. The production of fish meal from Clupeids was done according to what was already in practice, while Tilapia had to be cultivated and harvested for the purpose. Tilapia was cultivated in ponds along with cat fish (Polyculture, commonly practiced by fish farmers in Nigeria) to reduce cost of feeding. This brought cost of raising one kg of Tilapia to N43.67. The harvested Tilapia was later processed into fish meal.

Cooking of tilapia in traditional pot.[Figure 3]

Clupeid fish meal was produced by buying dried clupeid fish from the market and grounding into powder. Both tilapia and clupeid fish meals were compound into fish feed. These two types of feeds along with imported feed which is widely used by farmers and whole dried clupeids sometimes used by farmers around New Bussa was fed to catfish to determine feed quality using growth rate as a determinant and cost of production .

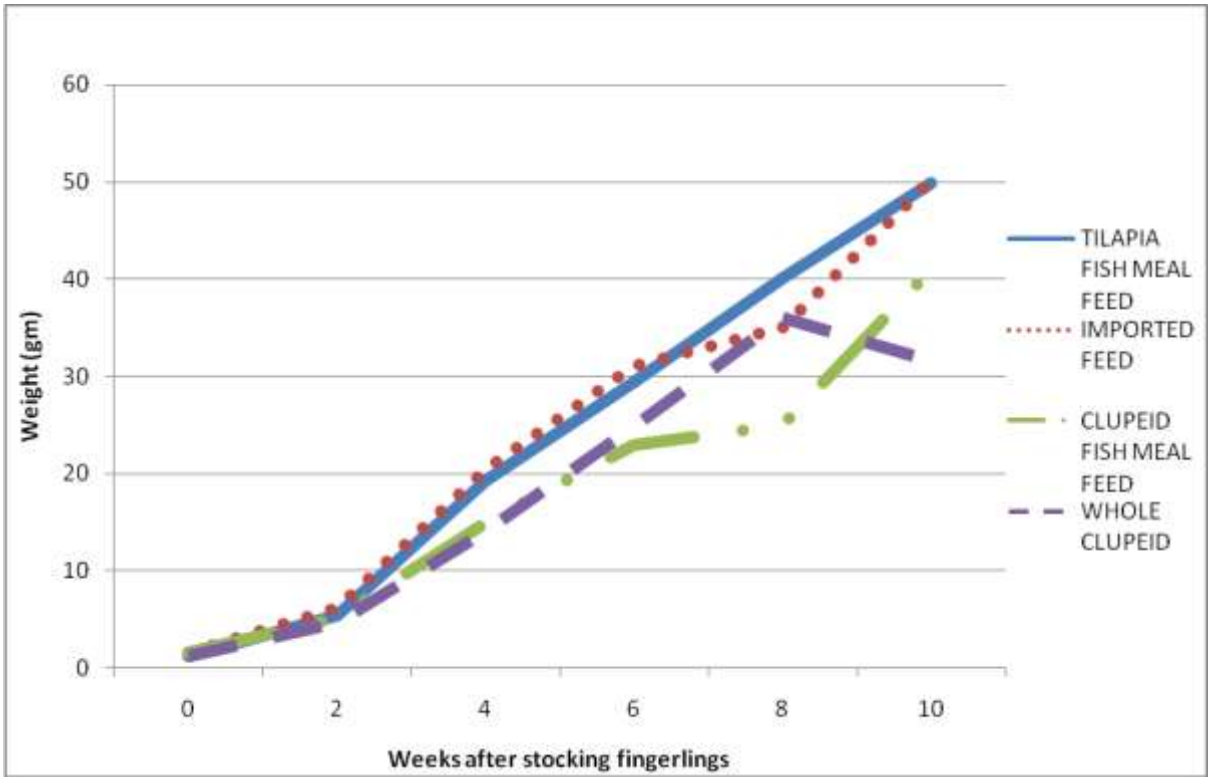
Feeding trials

Four ponds of 10 x 5 meters each, were used for the trials which took place at the hatchery complex of the National Institute for Freshwater Fisheries Research, New Bussa. Each pond was stocked with 550 catfish fingerlings. Their growth was monitored over a 10 week period by taking bi-weekly weights. Each set of fish in the four ponds was fed the following diets:

Pre-cooked and minced Tilapia awaiting drying and grinding. [Figure 4]

- Fish feed compounded with tilapia fish meal prepared at cottage level.
- Imported feed representing the control.
- Fish feed compounded with Clupeid fish meal.
- Whole dried clupeid fish.

Results of the trial [See figure 1] shows that fish fed with Tilapia based fish feed had the highest final mean weight gain of 97.2 gm, followed by imported feed with 97gm, Clupeid based fish feed gained 78.8gm and fish fed with whole Clupied gained 60.8gm.



Weight gain of cat fish fed different fish meal based diets over a 10 week period [Figure 5]

Table 1 showed that Tilapia based fish meal had the least cost compared to all four feeds (N209.65/kg), followed by Clupeid based fish meal (N241.50), imported fish feed (N350.00) while whole Clupeids cost N400.00. Table 1 also shows that, the Tilapia based fish meal is the most cost effective (N53.92), followed by feed compounded with Clupeid fish meal (N76.62), imported feed (N90.21) and whole Clupeid with N164.40.

Table 1: Cost and feed efficiency of fish feed obtained from locally produced fish meals

Feed	Cost /Kg (N)	Cost for feeding fish (N)	Weight gain/ fish (gm)	* Feed Efficiency (N/kg)
Whole Clupeids	400	10,000	60.8	164.48
Imported feed	350	8,750	97	90.21
Clupeid based fish Feed	241.50	6,037.5	78.8	76.62
Tilapia based fish Feed	209.65	5,241	97.2	53.92

*Cost of feeding fish / Weight gain

The result affirms the wisdom behind the growing trend among Nigerian farmers to compound their own feeds. From this study, farmers feeding whole clupeid to their fish will also be advised accordingly since it will be a drain on their resources.

The difference in cost between the imported feed and Tilapia based feed as shown in table 1 is N140.35 indicating about 40.1% reduction in price of feed if a farmer used Tilapia fish meal grown in a polyculture system to compound his feed, instead of buying imported fish feed. This is an innovation that will bring relief to Nigerian farmers and conserve the enormous foreign exchange earnings used in feed importation. Thanks to the intervention of RIU, Nigerian farmers will smile when eventually this finding is taken to them during the next phase of the work.

The next stage of this innovation is to move to the field and repeat the exercise along with fish farmers and feed millers to motivate them to adopt it. Fortunately, the stakeholders brought together by RIU at the inception stage, have organised themselves into an aquaculture platform consisting of feed millers, fish farmers, NGOs, scientists and fish processors. Some members of this platform have agreed to be part of the next phase of the work and have pledged some of their facilities like farms, milling machines, staff etc. despite all these commitments, funds are still required to meet other logistics and overhead cost that stakeholders may not be able to afford on their own. Like many beautiful research findings, this innovation could lie on the shelf for the next decade or more if after the winding up of this phase, funds could not be sourced to continue this work.

Aquaculture is not only about Clarias

Dr S.O. Talabi, CEO
Talon R&D Farms Ltd
Mr Muyiwa Coker, Production Manager
Talon R&D Farms Ltd
Mr Kayode Oni, Farm Manager
Talon R&D Farms Ltd

"We are an R&D farm, always seeking to innovate in order to increase efficiency and profitability; there has been uncontrolled entry into the fish farming sector, and everyone was growing clarias; hence we wanted to innovate a niche and thereby a market advantage."

Introduction

Over 98% of fish farmers in Nigeria are raising clarias (a catfish species). The remaining 2% or less are raising tilapia. This may have created the erroneous impression that aquaculture is synonymous with clarias. But the truth is that other species of fish, such as the *labeo* (African carp), grass carp, common carp, tilapia and heterobranchus are cultivable on a commercial scale in tropical conditions, including Nigeria. Pangasius, another catfish species, is just as easy to raise, and as profitable, as clarias. Nigerians need to diversify and expand the base of its cultivatable species by promoting and sustaining efforts at developing gene banks for all these species.

As the foremost multi-million Naira profit-making research and development farm in Nigeria, Talon R&D Farms Ltd has been advocating the need for Nigerian fish farmers to be aware that clarias is not the only commercially cultivable species. In other words, our company believes that Nigerian aquaculture should embrace product diversification so that fish consumers nationwide and, indeed, worldwide can have multiple choices. Product diversification is a common business practice in almost all sectors of the economy, and the aquaculture sector should not be an exception.

Pangasius fillets [Figure 1]

In pursuit of product diversification, Talon R&D Farms Ltd sought for and studied various cultivable fish species in China, India, Bangladesh, Egypt, Thailand and Vietnam, where credible records of various fish progeny are available. Consequently, we identified pangasius as a suitable candidate for commercial application in Nigeria.

Pangasius is suitable for the Nigerian context because:

- it is herbivorous, therefore the risk of stock loss due to cannibalism, as in clarias (which feeds on fish), is absent
- it has no known diseases, unlike clarias;
- it is able to tolerate low oxygen in the water, and it is resistant to other adverse environmental conditions
- it grows faster than clarias, and therefore would command higher prices and be more profitable to farmers
- it has high export potential and is currently one of the top ten fish species in the world market
- its flesh is so good that it can be used in the production of sausages and hamburgers.

"The commitment of the Talon staff in raising clarias, tilapia and pangasius, and documenting multivariate performances and indicators enabled us to understand what we are doing, in both research and business terms. However, we have to combine research and business because we know that agro-business in Nigeria lacks timely and effective support from national agricultural research system. So, for us, innovation is part of self-help if we want to stay in business."

After concluding the necessary partnership arrangements with an research and development (R&D) farm in Thailand, our company farm obtained an import license from the Nigerian government and took delivery of a batch of pin-head fries of pangasius. We raised the fish while carefully studying and documenting multi-variant performances under different scenerios. When the fish were 9 months old, we gave some to two other farms for trials.

Cascadia sedimentation tank of water recirculatory system. [Figure 2]

We are currently experimentally raising 15,000 as brood stock in plastic, earthen and concrete tanks, as well as in a large body of water, i.e. a 0.5 hectare reservoir. In September 2011, our pangasius brood stock will be 2 years old and ready for breeding. We project a production of at least 15 million fingerlings per year from 2012. We will be selling both fingerlings and table size fish for consumption. We are marketing our products through distributors. The strategy is to sell in bulk to make it profitable for retailers. We sell fingerlings to farmers and also give some free to reputable research institutes such as NIOMR.

Our optimism on the acceptability of pangasius stems from the fact that it is already one of top ten selling fish in the world. Current sales are encouraging. As for Tilapia, we have produced more than 9 million over the last year. The product is selling now.

Talon R&D Farms Ltd joined the RIU-assisted Aquaculture Innovation Platform (IP) in order to explore the market for our tilapia and pangasius farm outputs. As a research farm, we are using the RIU-assisted IP as a cost-effective extension and marketing channel for our company.

"As businessmen, we understand that innovation works when there is a clearly-expressed need and a strong market potential. The RIU-assisted Aquaculture IP is a potentially powerful channel for us to sell our farm products, particularly tilapia and pangasius fingerlings, to thousands of fish farms across Nigeria. But such a market cannot be achieved if fish farmers do not know about the competitive advantages of alternatives to clarias. So our company would like IP meetings to channel education and information on this."

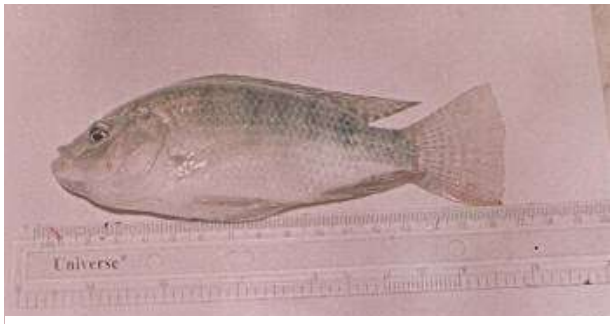
At the same time, our company has also been serving as a technical resource to the Aquaculture IP and to the two national research institutes that are collaborating with the IP on building local capacity for the production of fish meal for fish feed in the country. We have also been a resource organisation to the RIU Nigeria country programme in general. For example, we were among the key stakeholders who participated in the RIU Nigeria Learning Event in November 2010, and in the Programme Evaluation which was conducted by international consultants in February 2011. I, the founder and CEO of Talon R&D Farms Ltd, was a pioneer scientist at the National Institute for Oceanography and Marine Research (NIOMR) in Lagos. Therefore, my knowledge of the institutional history of agricultural research in Nigeria has been an invaluable resource to the work of RIU Nigeria programme in its interactions with both NIOMR and NIFFR (Nigerian Institute for Freshwater Fisheries Research).

Initially, when RIU proposed that fisheries researchers should work with the private sector in addressing the challenges of high cost or adulteration of imported fish feed, the researchers and the private sector did not want to work together because there was mutual distrust. Each side felt that the other side would steal their knowledge and not give credit or financial benefit for it. But we later realized that working together was in the interest of everybody as well as in our own business interest.

Pangasius [Figure 3]

So far, everything has gone well and we have extended our business contacts and potential market network through the Aquaculture IP. As the RIU programme is winding up in June 2011, our

company would want the IP network to remain active so that market information could be useful to all stakeholders. Talon R&D Farms Ltd would support any collective action that can sustain the network, as long as it is in our business interest to do so.



Tilapia [Figure 4]

Lack of financing options is a major challenge to our work. It is very difficult to obtain a bank loan for agribusiness ventures in Nigeria, but it is simply impossible to get a loan for agricultural research. We pay huge taxes every year from our earnings, and our research outputs are duly recognized as essential public goods. We believe that instead of our farms being taxed, we are supposed to be recipients of federal tax credits and even grants. Of course, we are registered and rightly classified as a profit-making business entity, but should we not be getting some financial benefits for producing public goods in the agriculture sector?

We are therefore interested in partnering with, or getting assistance from, any resource organisation that would enable us to cushion these financial challenges, or have access to soft loans for our operations. The platform could help us acquiring funds for research and development.

Aquaculture Value Chain: Innovations, opportunities and challenges in Nigeria

J. O. Apochi
Assistant Director (Fisheries), Agricultural Research Council of Nigeria

As a young boy, I heard that fish farming is very lucrative so I began to imagine when I will have the opportunity of becoming a fish farmer. Later in life, the opportunity came when I got admission into the University to read fisheries. On graduation, I got employment with the Federal Ministry of Agriculture. To fulfil my dream, I then started my own fish farm in 1996 but this was not as easy as I thought. I was faced with series of problems namely: Where and how to get fast growing fish fingerlings, Where and how to get good quality fish feed and after harvest, will I get good market for my table size fish?

Beside my personal problems, Nigeria is confronted with how to improve the quality of life in the rural areas and address the level of poverty. The level of poverty in Nigeria is clearly manifested in the low level of protein intake. To make up for this protein deficiency, massive importation of fish became necessary which resulted in a huge drain on our foreign exchange. To address this challenge, there is an urgent need to produce enough fish for local consumption and even for export. The most viable sustainable alternative that can ensure the bridging of the yawning gap between fish supply and demand lies in aquaculture, which offers vast opportunities for investment that can guarantee good returns.

With the inauguration of the RIU Nigeria Aquaculture Innovation Platform in 2009, I became a member of the platform. RIU Nigeria has facilitated and built effective linkages and interactions between and among members of the value chain and my story has changed. I can now get fast growing fish fingerlings, buy fish feed from reliable source and sale my table size fish with profit margin.

What made innovation happen?
RIU Nigeria organized a meeting in 2009 in which all relevant stakeholders in the aquaculture value chains, at the national level as well as various regions in the country were invited. Over 60 people from farmer organisations, cooperatives and companies attended the meeting. During this meeting, the Aquaculture Innovation Platform was inaugurated. The innovation platform was formed as a result of the need to:

- bridge the supply and demand gap in fish production in the country
- supply and Create awareness and link farmers to sources of good quality fish seeds
- reduce post harvest losses and encourage value addition to fish products
- ensure good market price for farmers through coming together as a cooperative society.

For easy facilitation by RIU, the IP was grouped into four zones and one contact person was appointed to lead in each zone. The IP in each zone consists of different actors along the aquaculture value chain; from fish breeders to fish farmers' association, post-harvest fish processors to fish feed millers, fish marketers, Banks and other financial service providers, community development organisations and various related micro-entrepreneurial groups. One representative from each of these groups directly communicates with the contact person from and feedback to other members of the group.

In the event of any forthcoming meetings, trainings, workshops, seminars etc, it is the contact persons in the zones that RIU Nigeria link-up with to pass information to the relevant value chain group.

Except when RIU call for a general meeting, meetings were organized alongside specific value chain actors. The breeders organised themselves and meet as the need arose. There are no regular fixed meeting days and each time the group meets, individuals sponsor themselves and no financial contributions are made. During the IP meetings, we interact and share ideas on best ways to manage our farms and share experiences. The capacity of IP members have been enhanced on stocking of ponds with fish, water quality requirements for fishing, best feeding methods, identification of diseases and treatment, harvesting and how to minimize post harvest losses in order to maximise profits. When any farmer in the platform has problems in his or her farm, such a farmer is linked to a consultant who provides technical advice. We have consultants in the group that provide training and technical advice to members. The breeders interact with other value chain groups by giving them fast growing fish fingerlings and also the consultants in the breeder group provide support services to farmers.

As a member of the platform, I belong to the breeder's group of the value chain. I have collaborated with other breeders and linked farmers to them when my supply of fingerlings is exhausted. Through the platform, I have interacted with over 50 farmers and this has increased the sales fingerlings from my hatchery. Prior to the formation of the platform I supplied about 25,000 fingerlings to different farmer across the country but now my supplies has increased to over 70,000 fingerlings.

Evidence

The farmers in the platform who have access to good source of quality fast growing fish fingerlings have increased are now getting higher yield. Prior to the intervention by RIU Nigeria, farmers were getting about 500g to 1kg b.wt/fish in 6 months but now they are getting 1 to 1.5kg b.wt/fish in 4 months using high quality fish feed obtained from RIU recommended source of fish feed. This has resulted in higher income for fish farmers.

Fish farmers now have better ways of value addition in fish processing to maximise profit. Fresh fish sells for about N 450 – 500/kg (US $2.93- 3.26) but with valve addition by smoking, 1 kg now goes for about N 1,500 –2,000 (US $9.77-13.03).

Lessons learnt

There are lots of lessons to be learnt from the RIU Nigeria aquaculture innovation platform. These include the followings:

- The linkage in the platform has brought many farmers together and has enabled them to have access to good sources of fish fingerlings; quality fish feed and post harvest handling techniques. These have led to higher productivity, much lower post harvest losses, higher income to farmers and safer environment.
- Many Nigerians are now aware of the nutritional values of fish. A regular and continuous supply of the key inputs, especially; fingerlings and feed has led to increased production, reduced cost and greater accessibility of fish to consumers.
- The coming together of farmers has helped them to have access to market information.

Section 5 Concluding chapters

Successful cross-pollination – Towards a new storage strategy for agricultural development in Nigeria

Yarama D Ndirpaya
Agricultural Research Council of Nigeria

Improved technologies can only be beneficial to end-users when put into use. For decades, many technologies developed by the research institutions in Nigeria have remained on-shelf. The coming of Research Into Use to Nigeria led to the adoption of some on-shelf technologies leading to increased productivity and improved livelihoods of resource poor stakeholders. Inspired by these experiences, the Agricultural Research Council of Nigeria (ARCN) made tremendous progress in changing its policies and strategies to agricultural development.

Introduction

At the beginning of its programme in Nigeria, RIU Nigeria signed a memorandum of understanding (MOU) with the Agricultural Research Council of Nigeria (ARCN). The Council hosts the RIU programme's country office in Abuja. This made cost sharing very effective in our partnership although the overall goal of our partnership was to enhance an effective interface for getting agricultural research outputs and technologies into use in Nigeria.

Activities of RIU Nigeria Programme in the Cassava Innovation Platform in Abia State and Cowpea/Soybeans Platform in Kaduna and Kano States of Nigeria were evaluated by a team from the Agricultural Research Council of Nigeria in September, 2010. I am an Assistant Director/Head of the Natural Resources Management Programme of the Agricultural Research Council of Nigeria, and was a member of the evaluation task team. Stakeholders of the RIU-supported Cassava Innovation Platform in Abia State and the Cowpea/Soybeans platforms in Kaduna and Kano States applauded RIU's intervention in Nigeria, which in addition to introducing improved crop varieties also brought about linkage to market outlets, leading to increased productivity and better livelihoods. The results of the evaluation created awareness at ARCN of the importance and effectiveness of the programme and its approach to innovation. I would like to share some of these results through this write-up.

The Cassava Innovation Platform in Abia State

"RIU-Nigeria brokered the procurement of cassava stem cuttings of the high yielding CMD-resistant varieties from the IITA out-growers, enabling more than 3,900 farming groups to acquire planting materials in Abia State alone."

The state-wide cassava innovation platform, with its secretariat at the state capital, Umuahia, had its members drawn from the three senatorial zones of the State (Abia South, Abia Central and Abia North). The executive officers of the platform were selected from members of the platform at the first meeting of the platform after inauguration and included a chairman, vice chairman, secretary, treasurer, financial secretary and provost. They comprised of four men and three women. The membership of the platform consisted of six groups, namely: i) Producers, ii) Processors, iii) Confectionaries, iv) Fabricators, v) Researchers and vi) Extensionists. All the members of the executive committee were from the private sector. Members of the platform paid the sum of five hundred naira (₦500 or US $3.26) only as registration fee.

The Platform was registered as a corporate body and had a bank account. The platform members met once a month, the last Thursday of every month. At the monthly meeting, each member paid a membership due of one hundred naira (₦100 or US $0.65). Members agreed that the activities of the platform were driven by team spirit, as each member had equal opportunity to contribute to issues at stake within the platform. The platform members considered their union to be a result of:

- access to facilities available to the platform
- need to eradicate poverty and ensure food security, and
- sharing ideas among members.

Farmers in Abia State were enabled, through a procurement facility brokered by RIU in collaboration with the International Institute of Tropical Agriculture (IITA) and National Root Crops Research Institute (NRCRI), to purchase and use Cassava Mosaic Disease (CMD) resistant varieties of cassava in order to solve the perennial problem of low yield due to CMD attacks in the Abia and other south-eastern parts of Nigeria. The five released varieties used were TME 419, TMS 98/0505, TMS 980581, TMS 98/0510 and TMS 97/2205. Farmers adjudged these improved varieties to be superior in vegetative growth than the local varieties in use, as they were found to be more robust with high foliage density.

The platform members were trained on ''entrepreneurial skill acquisition'' along with extension agents and block extension supervisors from the Agricultural Development Projects (ADPs). Over 100 participants attended the training from Abia and Cross River States. The training covered topics such as production management practices, processing, value addition, preparation of high quality cassava and wheat composite floor, capacity building for the fabricators, for perfecting the available machines (graters, pressers, dryers, sieves and peelers).

RIU facilitated the linkages of the Cassava Innovation Platform members with government institutions, credit institutions and the private sector. The platform has established partnership linkages with the IITA-Ibadan, NRCRI-Umudike, Abia State ADP, First Bank of Nigeria PLC, National Poverty Eradication Programme (NAPEP), Nigeria Starch Mills at Ihiala and Projects Development Institute (PRODA), Enugu.

RIU Nigeria was initially the sole funding agency of the platform at its inception. However, the platform members and their collaborators have been contributing to the growth and progress of the platform. Fund raising within the platform was from registration fees and monthly dues. Members agreed to increase registration fees to ₦1,000 (US $650) in order to access opportunities that are available from partners like NAPEP in provision of tractors. The Abia ADP was ready to partner with the platform in areas of land acquisition and financial support through budgetary allocation.

The Cowpea/Soybean Innovation Platforms in Kaduna and Kano States

Cowpea/Soybean platform activities were implemented in Kano and Kaduna states. The activities in Kano state focused on cowpea value chain only while that of Kaduna state focused largely on the soybean value chain, which grow well in the Guinea savannah agro-ecological zone. Kano state is the largest producer and market for cowpea among Nigerian states as the entire state is located in the Sudan savannah agro-ecological zone, which is considered the best for cowpea production. The platform activities in Northern and Southern Kaduna state were located in the northern and southern Guinea savannah respectively, with soybean being a major enterprise in Southern Kaduna state.

The farmers in the platform who were beneficiaries of improved varieties of cowpea and soybean were optimistic of a bumper harvest. The platform members were also introduced to the Triple Bag Storage Technology, the Purdue Improved Cowpea Storage (PICS), for safe keeping of their produce. They acknowledged that the grains were no longer attacked by insects; rather, they were cleaner and brighter, thereby reducing post harvest losses and increased their income. In addition to using the PICS sacks for cowpea and soybeans, the farmers were also using them for storing cereals and pepper on trial basis. The linkage between farmers and input suppliers were very cordial, hence, most farmers in the states no longer use pesticides for storage of their farm produce.

RIU facilitated the linkages of the Cowpea/Soybeans IP members to IITA, Kano Agricultural and Rural Development Programme (KNARDA), National Stored Products Research Institute (NSPRI), Garko Local Government of Kano state, Bayero University Kano, LELA Agro Industry and Jubaili Agrotec Limited. RIU Nigeria fully funded the platform initially, but later KNARDA and KADP partially

supported the platform by making available their facilities at no cost during RIU Nigeria platform activities.

Lessons from RIU Innovation Platforms

Strong partnership and linkages exist in the RIU-supported innovation platforms in Abia, Kano and Kaduna States. This enabled the farmers have access to good sources of certified seeds, used genuine herbicides and appropriate technologies (farming system and post harvest handling techniques), which led to higher productivity, much lower post harvest losses, increased income to farmers and safer environment. One area where assistance might be justified is in developing and piloting new institutional arrangements between input dealers, industrialists, commercial banks and farmers, which are mutually acceptable in terms of risk-sharing and benefits sharing.

Assistance could also be provided directly to groups of farmers in the form of training, especially in organisational and business entrepreneurship skills, in order to improve their ability to negotiate effectively with contracting companies. Responsibility for the provision of training services needs careful consideration. If RIU Nigeria does this directly, through its own project staff, then when the project ends, the institutional capacity to continue training disappears with it. A more sustainable approach is to involve an established institution. In some countries, this might be the farmers union where this has a wide membership, for example the Zimbabwe Farmers Union. In some cases, the government agricultural extension system might be involved, but inappropriate motivation and outlook may present problems.

The partnership along the RIU-supported Commodity Innovation Platforms are fostering synergy and resulting in increased wealth and improved livelihoods among the stakeholders and should be strengthened and supported by both RIU and the Nigerian agricultural sector. In spite of the success story, the platform members experienced some challenges to their activities in the areas of Input supply, processing equipment (Flash drier), credit facilities, capacity building for fabricators, labour cost (weeding) and meeting export standard.

Towards a new ARCN policy on Agricultural Development

Over the years, the uptake of technologies emanating from National Agricultural Research Institutes (NARIs) by the farmers has been a major problem. The intervention of RIU Nigeria in the uptake of the five CMD resistant cassava varieties, some cowpea/soybeans varieties and related technologies, is a lesson to emulate by ARCN and other government bodies.

Consequent to these successes, the Agricultural Research Council of Nigeria (ARCN) has adopted the RIU platform approach in its strategic plan as operating mechanism for agricultural development in Nigeria. In addition, the ARCN will use innovation platforms in resuscitation of the Adopted Villages innovation platforms of the NARIs. ARCN will increase its facilitation to the Agricultural Research Outreach Centres (AROC) in the Adopted villages and Schools of the NARIs so as to enhance the uptake

Innovation Platforms as major intervention strategy in new programmes

The West Africa Agricultural Productivity Programme (WAAPP) is a World Bank Assisted Project formulated by the Economic Community of West African States (ECOWAS) in response to the African Action Plan (AAP) document designed by the World Bank towards achieving the goals of the Comprehensive Africa Agriculture Development Programme (CAADP) of the New Partnerships for Africa Development (NEPAD) and the achievement of the Millennium Development Goals (MDGs) in Africa. The WAAPP has as its goal the need to get at least two million (2,000,000) farmers adopt new technologies directly via WAAPP in a period of 5 years.

The WAAPP project will help provide enabling conditions for Nigeria to cooperate with countries in the West African sub-region in Technology Generation and Dissemination. In addition, the programme aims to improve farmers' access to improved agricultural technologies and promote the culture of demand-driven technology generation and adoption in the country. To assist in realizing agricultural potential, the strategic thrust of the WAAPP project is establishing an effective coordination, management and Monitoring and Evaluation system. The RIU approach to rural innovation, through Innovation Platforms will be a key strategy to the success of this new programme.

of proven technologies from the NARIs, by the resource poor farmers as done by the RIU. Furthermore, the West Africa Agricultural Productivity Programme (WAAPP) adopted innovation platform approach as operating mechanism for agricultural development in Nigeria. The close ties between RIU and ARCN proved to be very important. The fact that ARCN was hosting RIU played an important role in this.

In Nigeria, the momentum to adopt innovation platforms as the new strategy for agricultural development is gaining momentum. And ARCN will make it happen.

Section 6 Conclusions

Lessons on institutional change

The successful outcomes of RIU programme hinge on the ability to spur changes in institutions and processes, as well as lesson-learning on how such changes can be provoked and supported. The logic behind this is that the task of putting research into use concerns changing a cluster of habits, practices, rules, norms, routines, networks and policies – i.e. institutions – that govern the effectiveness and direction of a wide range of processes associated with the demand, generation, transition adaption and utilisation of new information and technology in agriculture (Andrew Adwera et al, 2011, forthcoming).

As evidently clear in several of the case stories in this volume, institutional learning and change are sometimes difficult to measure or attribute to one specific partner or intervention. An individual within an organisation could learn and adopt a new way of working, and this might reflect on the effectiveness of the organisation as a whole, yet the learning might not be shared by everyone in the organisation. The absence of such a person from the organisation could alter the behaviour or performance of the organisation in learning and changing. Furthermore, institutional learning and change can result from multi-agency collaboration, whereby it is difficult to attribute the learning to the contributions of a single partner.

In 14 case stories, authors have made clear that rural innovation necessarily comprises changes in institutions. The following institutional change domains will be discussed in this concluding chapter: new forms of financing rural innovation; relevance for poverty reduction; market-related institutional change; new types of organisations doing new types of roles; old types of organisations doing new types of roles; new research practices; new network configuration; and policy change.

New forms of financing rural innovation

Funding of research by RIU triggered increased financial contributions and commitment of government to agricultural research through research institutes, with government financing up to 80% of the costs associated with the large-scale adoption of CMD-resistant cassava varieties in Abia State in 2010. Yet, without the RIU's relatively small investment in orchestrating the formation of the Cassava Value Chain Innovation Platform, the attention of the Abia State government might not have drawn to that cause, and hence, the state would not have contributed.

Private sector contribution and participation was also due to the opportunities offered by the innovation platforms. Hence, the private sector has demonstrated willingness and ability to invest in agricultural innovation, if there are indicative potentials for niche markets or profits as outcomes of demand-driven and market-oriented innovation. In addition, Nigerian agricultural researchers expressed their expectations that other donors will show increased interest in research for

development as a direct result of the RIU programme. The key lesson is that the pooling of state support, private sector investment, responsive research practice and appropriate brokering roles by an independent agent – and all these elements in the right mix and proportion – is necessary to agricultural value chain innovation and development.

In the different stories, the readiness of private sector partners to invest in research and development is revealed. For example, Talon R&D Farms Ltd invested in testing new fish species; cassava processors invested in the development of a new peeling tool and in the production of new *odourless fufu* varieties; and fish feed producers expressed a commitment to invest in the adoption of locally developed fish meal. These represent win-win outcomes because they contributed to increased profits for both the suppliers as well as the users of innovation.

Relevance for poverty reduction

The cassava production in Nigeria, like in many other countries in Africa, is hampered by the mosaic disease, leading to reduced productivity. Especially the rural poor had no or limited access to resistant varieties. The successful introduction of CMD-resistant varieties through the Cassava Innovation Platform led to increased production and productivity which directly benefited the income and food security of rural smallholders. A simple hand-peeling tool contributed to increased processing capacity, providing increased opportunities for smallholders to market their products.

The introduction of improved cowpea and soybean varieties and new ways of storing cowpea, contributed to significant improvements in income of smallholder farmers. It also provided income opportunities. The introduction of fodder bailing equipment or compactors provided employment opportunities to rural youth and improved storage possibilities and availability of animal feed. Traditionally excluded groups such as widows got an opportunity to engage in farming and thereby increase their incomes through processing and marketing of produce. This processes, in addition to contributing to improved livelihoods, also brought about s*ocial inclusion* of the previously marginalised groups rural widows.

In the aquaculture sector, the availability of low-cost but high-quality fish feed increases the profitability of fish farming, and the cottage application of the innovation offers enterprise opportunities for the rural poor to engage in fish farming. Successful diversification of fish species offers fish farmers and consumers with new options besides clarias.

Market-related institutional change

In the general, the RIU-initiated platforms provided opportunities for market orientation and value chain development by facilitating linkages between stakeholders, including the private sector. The high demand for cassava roots and the interaction between private sector and farmers, enhanced the adoption of improved and CMD-resistant varieties. This led to an expansion of cultivation area

and productivity. The establishment of the Cassava Innovation Platform contributed to improved linkages between cassava producers and processing companies. This resulted in new market supply arrangements providing a guaranteed market to farmers.

The triple bag technology for cowpea storage made it possible for cowpea to be stored in rural conditions for upwards of six months without weevil attack. This made it possible for cowpea farmers and marketers to sell the cowpea at a time of their choosing, rather than under pressure for fear of losing the stored products to weevil infestation. Hence, farmers and marketers get better prices in the off season, thereby increasing their incomes. At the same time, local processors are able to buy cowpea at harvest time, and store it for a long time, thereby increasing their cost-effectiveness and profit margins. The market-driven supply chain for the bags demonstrates the possibility and potential benefits of private sector participation in agricultural innovation processes.

Rural widows in Obudu, Cross Rivers State seized the market opportunities for soymilk production by processing soybean. ADA established contacts with the private sector to ensure sales of harvest by its members. This provided important income and food security for the participating widows. In the cassava value chain, contracts between producers and processors were established, thereby providing advantages to both parties.

New fish species were introduced based on clear market demands. This applies for cassava varieties, fish species, cowpea as well as soybean.

New types of organisations doing new types of roles

As a new organisation, RIU played an important role in brokering innovation. RIU's major role was in the establishment of new linkages or revitalizing existing relationships among diverse stakeholders in selected value chains, facilitating interaction, learning, and innovations around key challenges identified and prioritized by the stakeholders themselves.

RIU initiated Innovation Platforms in three value chains, i.e. cassava, cowpea/soybean and aquaculture. As clearly illustrated in the case stories, only the cassava platform became formally incorporated as cooperative umbrella body, thereby becoming a legal entity and formal organisation. The other two platforms chose to remain loose networks of stakeholders (see also *new network configurations)*. A major function of the platforms is the establishment of relationships among members, facilitating communication and the exchange of information, and joint problem solving. Furthermore, the platforms play an important role in facilitating linkages between its members and other stakeholders such as research institutes, development organisations, government and donors. The platforms played an important role in the dissemination of information and the acquisition and distribution of improved seeds and planting materials. Ultimately the multiple roles of the Platforms were leading to rural innovation.

The development of the Innovation Platforms catalysed the organisation of stakeholders and other parties in the targeted aquaculture value chains in the different geographical zones of operation. Platform memberships included farmer organisations, post harvest processor organisations, input producers and suppliers, produce marketers, and agro-allied companies or secondary producers.

The Agricultural Research Council of Nigeria (ARCN) was established shortly before the start of RIU programme in Nigeria. From the beginning, RIU and ARCN developed strong relations and worked together during the programme development phases of RIU in the country. ARCN provided an office space of the RIU programme within its Abuja head-office, thereby increasing the proximity between the parties. ARCN and RIU developed in a strong relationship due to their close interaction and mutual commitment to collaboration. ARCN is responsible for the governance, regulation, coordination and strategic management of agricultural research in the country. ARCN adopted the multi-actor approach to innovation, promoting Innovation Platforms and institutionalising this as illustrated by the use of IP model in Adopted Villages.

Old types of organisations doing new types of roles

The RIU programme engaged with a large number of existing organisations in order to promote the uptake of technologies and to facilitate rural innovation. These included research institutes, government agencies and authorities on different levels, private sector, NGOs, extension services, etc. By their involvement in the programme, and as members of the platform, most of these organisations engaged in new activities or new ways of doing things.

Participating research institutes, particularly NRCRI, NIOMR and NIFFR, adopted new approaches to demand driven research for innovation development. This is further discussed under *new research practices.* The ADP in Abia drastically changed its extension approach from linear tops-down systems to networking among diverse stakeholdes as co-equals under the RIU-assisted Cassava Value Chain Innovation Platform.

ADA engaged in new activities, facilitating the inclusion of rural widows in commercial agricultural activities (including processing and marketing) for its members by providing access to land, seeds (new varieties), training/workshops, and linkage to researchers.

Private sector Talon R&D Frams Ltd, for the first time, started sharing its research results with government research institutes and other partners. It realised that sharing its research results would benefit the enterprise by increased awareness among scientists and other stakeholders on new aquaculture technologies and practices which it has a niche in. Also in the cassava sub-sector, a major agro-allied factory and other post-harvest processors started sourcing agricultural products through the platforms.

New research practices

Another major achievement of the RIU initiated Innovation Platforms was the inclusion of farmers and the private sector in Agricultural research. Through the innovation platforms, farmers and researchers collaborated in the identification of problems and articulating the demands for research. On cowpea storage and cassava hand-held peeling tool, for example, research results were tested and evaluated by farmers and other stakeholders whose opinions, in the past, would not have been considered because they were not seen as 'experts'. Modification of these new technologies happened through close collaboration between farmers, researchers and the private sector. Inclusion in research and the evaluation of research results empowered smallholder farmers and other groups of rural poor. The rural widows, members of ADA, engaged in political discussions in their locations, something that was not done before.

Participating research institutes worked in demand-driven and participatory ways within the pilot activities. The Innovation Platforms were important vehicles for farmer participation in research and facilitated demand-driven and market-oriented research and innovation. This new concept was adopted by ARCN in its national strategic plan for agricultural research, in its Adopted Villages approach and in the new World Bank funded WAAPP project.

Another important change was the involvement of the private sector in research. In the aquaculture sector, collaboration between research institutes and TALON R&D Farms Ltd emerged. Talon R&D Farms has been pioneering market-oriented research based on profit motives. The introduction of new species of fish (having the only parent stock in Africa) is benefiting the company itself as provider of fingerlings to other fish farmers as well as of fish ready for consumption.

Under the triple bag storage system for cowpea, researchers in Nigeria and the United States collaborated with each other and with an investor in Nigeria to produce the bags. In the cassava platform, researchers and processors jointly developed and modified a cassava hand-held peeling tool.

New network configuration

Thanks to the RIU Nigeria programme, three platforms were initiated in the country: the national aquaculture platform, the cassava platform in Abia state, and the cowpea/soybean/livestock platform in Kaduna and Kano states, but with operations in Bauchi, Gombe, Katsina and Jigawa states.

Though the level of formalisation differs, each one of the IPs provided opportunities for involved stakeholders to interact, undertake joint activities and meet their own objectives. As is shown by the case of E Oti and K I Kalu, understanding the needs of end-users, as well as the contribution of private sector actors, can contribute significantly to the development of a new device (as the solution to an old problem).

Network configuration was an important targeted output of the RIU programme, through the well-elaborated plans and strategies developed beforehand as well as during the programme. Most of these took shape as platforms at different levels; ranging from local or zonal level, to state and even national levels. Occasionally, RIU served as a place for fruitful, though unplanned and unanticipated relationships and ideas. For example, during breakfast at the write-shop for these case stories, Agnes Ingwu and James Apochi, who happened to sit next to each other, discussed the possibilities of ADA getting into fish farming. Under the pleasure of a cup of tea on the last day of the write-shop, James agreed with Agnes to provide the ADA members (widowed rural farmer) with fish fingerlings, equipment and technical advice to start fish farming. This shows how innovation ideas can sometimes emerge as unanticipated outcomes stakeholder interactions.

Besides the interaction between different stakeholder groups, the groups themselves got to know and linked up with each other through the platforms. As illustrated in the aquaculture platform, though it is a relatively loose network of different stakeholders, the platform generated a major incentive for value chain actors to become organized. The organisation of actors in groups in the aquaculture value chain (from hatcheries, to fish farmers to end consumers) has opened up many new opportunities for individuals involved. Like James O. Apochi, thanks to the membership of the breeder's group he currently collaborates with other breeders and linked them to farmers in case that his own supply of fingerlings was exhausted.

Hence, platforms contributed to the configuration of networks of actor groups as well as the establishment of relevant linkages between various actor groups. In addition to this, the platforms demonstrated a possibility for various economic actors to be better known and heard by parties outside the platform membership. For example, the cassava platform organized a meeting with a local cassava processor (Nigerian Starch Mill Ltd), leading eventually to the IP member farmers entering into contract farming arrangement with the company. Contract farming has provided the farmers with a secure off-set market for their produce, while the NSM was secured of input through the organisation of small scale farmers who could provide cassava roots in bulk quantities.

Policy change

On a local level, ADA facilitated negotiations between small groups of rural widows with local leaders in order to gain access to five hectares of land. Although small, this represents an important change in terms of social inclusion, specifically the question of who can gain access to, and use land in such patriarchal rural communities. Social inclusion in this case opened up a range of occupational (agricultural production) and income opportunities for the widows and their households.

Based on the experiences of RIU-assisted IP, the extension services in Abia State responded and worked differently with diverse stakeholders. The state government, through the Office of the First Lady and the Abia State Ministry of Agriculture, adopted the multi-platform approach in 2010, and demonstrated their commitment by financially sponsoring the mass-scaling of the adoption of CMD-resistant cassava varieties, fertilizers and other farm inputs.

Policy change is normally preceded or premised on stated or unstated paradigm shift. This is why the statement, on national television (*Periscope* on NTA) by the ARCN's executive secretary, that the ARCN is committed to championing a paradigm shift in agricultural research and extension, is very important. The statement illustrates the changes in thinking that have occurred or are occurring within the arena that the RIU Nigeria has been involved in. The paradigm shift is evidenced by ARCN in developing a new strategy for agricultural research, the formation of strong links with a wide range of international resource organizations with interest in agricultural innovation and development, and adoption of innovation platform model in designated Adopted Villages. In this way, ARCN has initiated the institutionalisation of some of the key processes that RIU Nigeria used, thereby creating the optimism that the innovation platforms will remain strong drivers of agricultural research for development (AR4D) and rural innovation in Nigeria.

Further information

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