Food & Business
Knowledge Platform

Applied Research Fund

Research innovations for food and nutrition security

Netherlands Organisation for Scientific Research
Food & Business Knowledge Platform

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Innovations in research for food and nutrition security

The Hague, December 2017
Netherlands Organisation for Scientific Research
Food & Business Knowledge Platform

Colophon

Food & Business Research – Applied Research Fund (ARF)

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Courtesy of projects, shutterstock.com, flickr commons

Print
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Preface

Worldwide, over 800 million people suffer from chronic hunger and 2 billion people face malnutrition. Achieving food and nutrition security for all is a global challenge, which is closely associated with efforts to end poverty, mitigate the effects of climate change and stop the worldwide depletion of natural capital.
The Food & Business Applied Research Fund aims to contribute, be it in a modest way, to tackling this urgent global challenge. Our approach is based on national and international cooperation between governments, the private sector, NGOs and knowledge institutions. The 45 projects awarded by the ARF, develop innovative, demand-driven solutions for improving food and nutrition security for the most vulnerable populations in the partner countries of Dutch development cooperation.
Now that the ARF has reached the halfway point, it seems appropriate to share some initial insights into the approach and achievements of this innovative funding instrument. This publication highlights experiences from the perspective of the project partners, focusing on two defining aspects of the ARF approach: co-creation of knowledge by multi-stakeholder consortia and integrated strategies for research uptake. This unique combination is appreciated by the consortia as it successfully supports them in developing locally embedded innovations in ongoing interaction with the farmers, cooperatives, businesses, NGOs and policymakers that are ultimately meant to implement or benefit from the innovations. Be it new products, processes, services, technologies or policies.
It is also clear from the short testimonies in this publication that co-creation between academic and practitioner organisations, as well as the continuous focus on research uptake, bring challenges of their own. One of these challenges is the considerable time investment required of all project partners to develop and maintain shared interests and project strategies, following the impact pathway that is jointly defined at the start of each project. The challenges encountered render the positive evaluation of the ARF approach by the consortia even more significant and valuable.
The past few years have been inspiring for us as collaborating partners in the design, management and implementation of the ARF. We are proud of the research consortia for embracing the ARF approach and achieving significant outcomes. We can relate to their experiences first-hand, because we have been engaged in a co-creation process of our own, which started with the design of the ARF and the setup of its calls for proposals, and which continues in our efforts to support the projects in their strategies to share and implement intermediate and final results.
In this process, it sometimes proves challenging to ensure that there are relevant connections between the ARF project outcomes and the Dutch food security policy and interventions. In the coming phase, we will step up our efforts on this front, while also exploring linkages with other programmes to maximize the impact of the ARF. We hope that the experiences and results of the ARF as described in this publication can be a source of inspiration for the future design of applied research that aims to contribute to a more just and sustainable world for all.

Cora Govers (NWO-WOTRO Science for Global Development), **Melle Leenstra** (Ministry of Foreign Affairs), **Frans Verberne** (Food & Business Knowledge Platform)

In a nutshell: The Applied Research Fund

The projects funded by the Applied Research Fund (ARF) tackle challenges related to food and nutrition security and private sector development in the 15 partner countries of Dutch development cooperation. They all stem from the knowledge and innovation needs of farmers, practitioners and policymakers. The research-driven innovations support new tools and technologies for food and nutrition security that should ultimately benefit the world's most vulnerable people, especially women and children. The ARF is managed by WOTRO Science for Global Development, which is part of the Netherlands Organisation for Scientific Research (NWO) and supported by the Food & Business Knowledge Platform.

An innovation in itself

The ARF is a pioneering funding instrument: firstly, because it focuses on innovation through applied research, and secondly, because these innovations are driven by a specific composition of multi-stakeholder consortia. In addition to research organisations, the consortia consist of practitioner organisations from both the profit, not-for-profit and public sector. In this way, different kinds of skills and knowledge – academic, practitioner, tacit and community knowledge – are brought together to address the food security challenges at hand. Importantly, a practitioner organisation from the partner country is leading the project team to ensure local relevance and uptake.

In other words, co-creation by transdisciplinary consortia is the driving force behind the ARF approach. This is paired with a strong focus on research uptake, which refers to all activities that contribute to the use of research results. This use of results is key, as the ARF's objective is to fund innovations that have a tangible, positive impact on people's food and nutrition security, while it also aims to improve the policy and business environment (system change). The articles on pages in this publication discuss how NWO-WOTRO and the Dutch Food & Business Knowledge Platform (F&BKP) work together to support the consortia in their efforts towards co-creation, knowledge exchange and research uptake.

Halfway and well on track

The ARF is halfway through its programme period, and the mid-term evaluation[1] shows that projects are well on track towards achieving their intended outputs and outcomes. They address relevant research needs in the target countries and, moreover, are in line with the Dutch Food Security Policy. So far, most outcomes are related to the increase of farm-level production and productivity, the uptake of new agricultural production techniques and the orientation towards local knowledge needs in the field of food security. The demand-driven and transdisciplinary approach is proving to be successful, but of course there is still plenty to learn. Based on the experiences and insights gained from the projects, such as those presented in this booklet, NWO-WOTRO and the F&BKP will continue to cooperate on further strengthening the programme and its potential for creating impact.

[1] The mid-term evaluation is based on a 2016 survey covering all of the projects from the ARF's first two calls and on case studies of a sample of projects carried out by the ARF in Benin, Ghana and Uganda in late 2016 and early 2017.

Key concepts of the ARF approach

Innovation is the process of developing new ways of creating added value to meet existing, new or unarticulated needs, which is accomplished through more effective products, processes, services, technologies, policies or ideas that are readily available to governments, markets and society.

Transdisciplinary research is a form of integrative research that not only reaches across disciplinary boundaries but also integrates scientific knowledge and non-scientific knowledge, experiences and practices in problem-solving.

Co-creation is a form of cooperation in research where different parties (stakeholders, target groups) in the knowledge (demand and supply) process interact and engage in joint learning to define problems, formulate possible solutions, design the research, conduct the research, assess the results and translate these into new practices and products.

Research uptake includes all activities that facilitate and contribute to the use of research evidence by policymakers, practitioners and other development actors.

Food & Business Research: the Dutch policy context

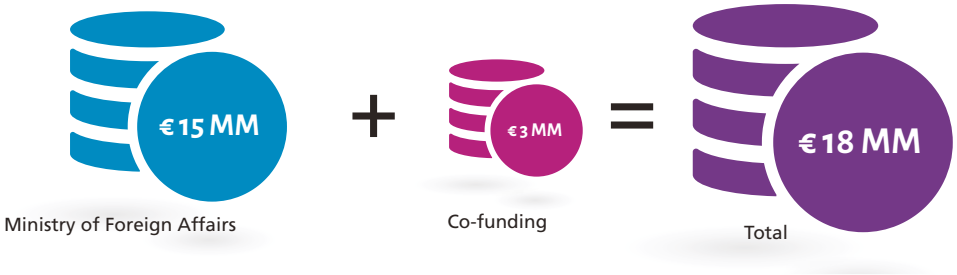
The ARF is one of two funding instruments that are part of the Food & Business Research (F&BR) programme funded by the Dutch government. While the ARF supports relatively short research for innovation in the fifteen Dutch partner countries, the Global Challenges Programme (GCP) supports more in-depth research on emerging global topics and challenges in food and nutrition security. Both funds are managed by NWO-WOTRO.

The F&BR programme is part of the Food & Business Knowledge Agenda, through which the Dutch Ministry of Foreign Affairs supports the global quest to develop and implement effective ways of enhancing food and nutrition security in cooperation with the private sector. The Food & Business Knowledge Platform (F&BKP) was established in 2013 to support the knowledge management activities on this knowledge agenda. The F&BKP is one of five knowledge platforms focusing on priority issues for Dutch development cooperation. Information and news on the ARF and GCP projects is kept updated at the F&BKP website, which also showcases the platform's other areas of work.

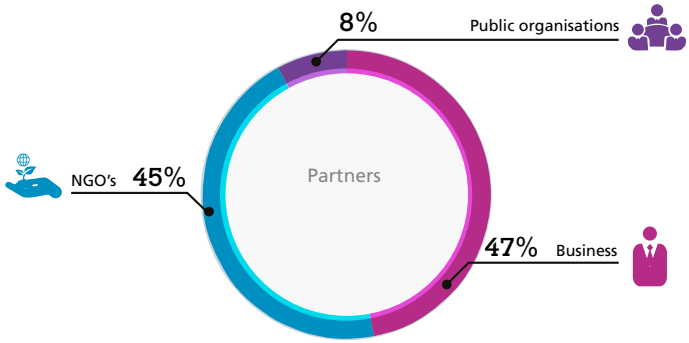
The priorities of the Dutch government's 2011 policy on global food security were the main impetus behind the first two ARF calls. In a Letter to Parliament in 2014, the government changed its focus to three priorities, which together determined the scope of the third ARF call: eradicate existing hunger and malnutrition; promote inclusive and sustainable growth in the agricultural sector; and create ecologically sustainable food systems. The earlier priority of enabling a better business climate was incorporated as a cross-cutting focus. The ARF projects are also aligned with the Multi-Annual Strategic Plans of the Dutch embassies in the respective partner countries. A clear link between the ARF and Dutch policy is ensured, moreover, by incorporating a Dutch partner in the consortia and by linking the ARF and GCP to the Dutch Top Sectors Agri & Food and Horticulture & Propagation Materials. In the coming period, policy coherence will need more attention, especially the transfer of relevant research results into other Dutch and international programmes and donor interventions.

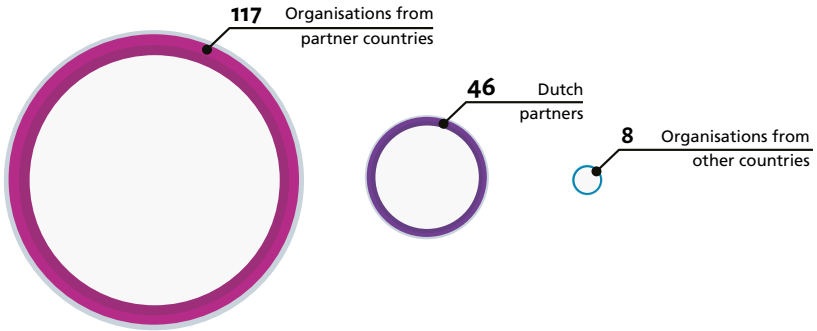
The ARF in numbers

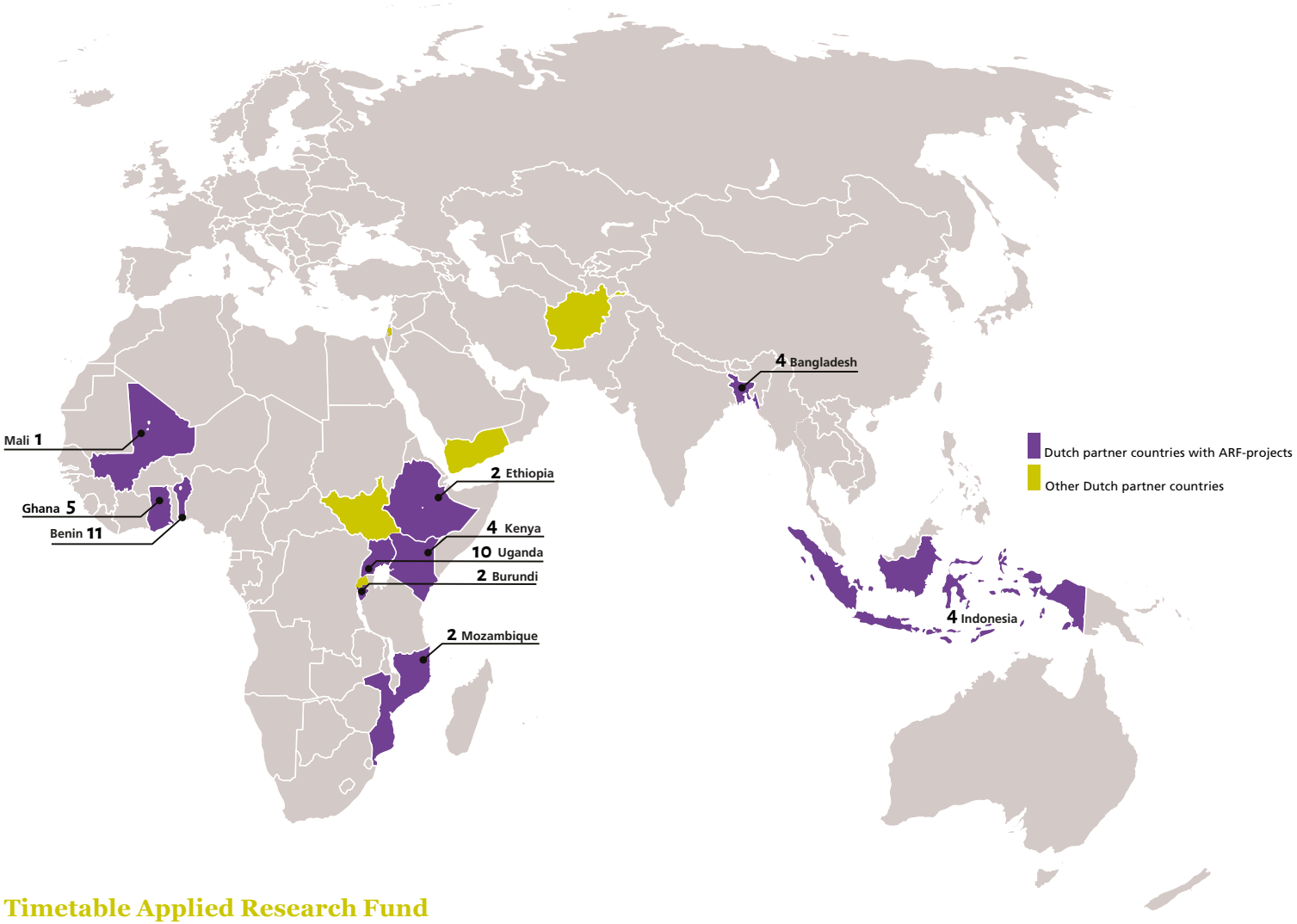
Budget



Partners







Timetable Applied Research Fund

Start ARF programme	CALL 1	2014	2015	2016	2017	CALL 2	2015	2016	2017	2018	CALL 3	2017	2018	2019	2020	End ARF programme
April **2013**	**2013-2014** Round 1	February			February	**2014-2015** Round 1	April		April		**2016-2017** Round 1	January			January	June **2021**
	Round 2	August			August	Round 2	September		September		Round 2	September			September	
	Round 3	October			October	Round 3		January		January						

Project highlight

Traceability technologies help small-scale fishers in Indonesia get a fair price

At the crack of dawn a fisherman steers his 7-metre long, azure blue-painted boat to open sea. He stops the diesel engine 8 kilometres off the coast of North Seram Island and throws his line. The hook drops to a depth of 80 metres. In no time, he pulls in three yellowfin tuna. No easy task, as these ocean predators easily weigh 40 kg each. At a nearby beach, other fishermen who have been out at Seram Sea that morning also offer their catch to the trader. A small pickup truck takes the lifeless giants to a ferry, and from there on to the processing plant 300 km away in the province's capital Ambon. There the yellowfin tuna is trimmed, weighed, coded, packed, and stacked – ready for its final journey to the United States.

In January 2018, the new Seafood Traceability Rule will take effect in the United States. It stipulates that certain seafood, including tuna, needs to be fully documented and traced from the fishing vessel or farm before it can enter the US. This also applies to the yellowfin tuna caught in the Seram Sea. The European equivalent of this US law to combat illegal, unreported and unregulated (IUU) fishing took effect in 2010. It is not only governments demanding

transparency: consumers, especially in Europe, the US and Japan, are increasingly insisting on knowing that fish comes from a legal and sustainable source.

As a result, 'traceability' has become a hot topic in the fisheries sector. The ARF project in Indonesia responded to this new reality by developing and piloting technology-based traceability systems. The research focused on solutions for small-scale fisheries. This is a unique approach, considering that the fast-growing worldwide technology business for traceability mainly focuses on the large fishing vessels, which are able to pay for the expensive solutions. The fishermen who singlehandedly steer their boats through Indonesian waters, on the other hand, cannot afford a satellite tracking system. They may not even have a fishing license, which means that they do not exist on paper.

The ARF project thus set quite ambitious goals: developing technologies that are affordable for small-scale fishermen who operate as part of a widely dispersed and remote fisheries sector. The relevance is indisputable: if these fishermen want to keep selling their fish to traders who export to the US or Europe, and if they don't want to lose their livelihoods, they need to make sure the traceability is in order.

Under the leadership of the Indonesian NGO MDPI, the project consortium piloted four innovative technologies, which together create digital records of key information needed for traceability throughout the value chain: the GPS-based Spot Trace® technology for use by the fishermen, OurFish and DOCK applications for traders and dock-side enumerators, and the Tally-O app for processors. The technologies not only generate traceability data, but also offer other services. Consultations with fishermen revealed their desire for technology that helped them predict issues at sea, such as smartphone apps for weather and emergency signals. Traders wanted a technology that helped them eliminate paper-based monitoring, and processors requested support for greater automation of existing logistics. To various degrees, the developed technologies meet those different needs. Wherever legally possible, moreover, the technologies are based on the open source principle to make them widely accessible and affordable.

The next challenge is to upscale the technologies. A great boost in this respect is the grant that the NGO MDPI received from USAID as part of their Oceans and Fisheries Partnership Project, to further develop the Tally-O app and promote its use by other industries. For the fishermen, the project has had an important side-effect in terms of impact: they have a much better awareness and understanding of the supply chain, which strengthens their confidence, not least to ask a fair price for their fish. Traditionally, the local fishermen rely on the middlemen traders, which is often seen as a questionable patron-client relationship. Because the fishermen now realise how much in demand their yellowfin tuna is in the rest of the world, the project has helped to turn this around.

Project: *'Technology innovations towards sustainability in Indonesia's tuna supply chains'*
Project lead: *Aditya Surono, Masyarakat dan Perikanan Indonesia (MDPI).*
Consortium: *BHLN Technical Services, Bogor Agricultural University, PT Harta Samudra (HARSAM), Wageningen University & Research*

Co-creation in local hands

ARF's innovative solutions contribute to solving the challenges of food insecurity and inequity that millions of people face today. While the value of scientific research in this endeavour is unmistakable, the ARF's vantage point is that combining different sources of knowledge and perspectives is indispensable for tackling complex food security problems. This is what led to the creation of the transdisciplinary research consortia in which Southern and Northern research organisations, NGOs, businesses and government agencies participate. Coordination by practitioner organisations from the South ensures local relevance and capacity strengthening.

The task of the consortia is co-create knowledge for a tangible development impact. This means that all partners should work together in a joint learning exercise that entails defining the problems, formulating possible solutions, designing the research, conducting the research and assessing the results, as well as translating these into new practices and products. Knowledge co-creation transcends the conventional boundaries of research. Not only because it involves non-scientific stakeholders, but also because a core part of the effort involves working towards the actual use and application of new insights and technologies.

The mid-term review shows that the established mechanism of co-creation indeed facilitates the generation of new knowledge and innovation. Moreover, the survey among all ongoing projects reveals that the consortia strongly appreciate the co-creation approach. But while the ARF approach creates exciting opportunities for impact, the multi-stakeholder process is not without its challenges (see box). Recurring issues are: how to resolve the different interests and professional routines of the consortium partners; how to best take advantage of the input of private sector partners; how to make use of the strengths and overcome the possible weaknesses of leadership by local organisations; and how to face the challenges and share the rewards of joint learning. A selection of thoughts and insights from different ARF partners on these topics is presented below.

Bridging differences of interest and routines

Projects are jointly developed by all consortium partners. However, during implementation it may turn out that they do not share the same ideas on approaches or priorities, and at times their interests may even clash. It is therefore vital to maintain an open dialogue on how to proceed, while never losing sight of the initial goals. Experience shows that the cultural, professional and institutional differences that challenge transdisciplinary partnerships, including practical challenges such as coordinating with international partners across time zones, are much easier to deal with when the partners have worked together before embarking on the project. New partners need to consciously invest in building up their relationship and mutual understanding.

Dealing with the challenges of co-creation

Practical and cost challenges Working with partners across different continents and time zones requires strong coordination and planning skills. Organising face-to-face knowledge-sharing activities is important but also very costly, which means that considerable budgets must be earmarked to facilitate the co-creation process;

Knowledge-sharing challenges Partners in the co-creation process may value differently the kind of knowledge that they consider useful, relevant or trustworthy, not to mention notions of value-free or ideologically-inspired knowledge;

Communication challenges Not only do researchers, business people, practitioners and policymakers use different terminology and concepts, or similar ones that have a different meaning, they may also have their own ways of sharing knowledge, which are also influenced by cultural and social differences;

Challenges concerning goals and interests Even when the project's goals of societal and policy relevance are shared, partners may have different expectations about the actual results of the research (e.g. short-term success versus long-term benefits and impact) as well as different interests, e.g. the need for scientific publications for researchers versus the need for practical output for practitioners.

Wim Simonse – Away4Africa, the Netherlands "Our project was driven by the enormous enthusiasm of different parties to address the cashew value chain in Uganda together and bring a new product onto the market. The reality proved quite thorny, however, and cooperation wasn't always easy. The NGOs quickly realised that cashew processing was a potentially profitable business and subsequently considered setting up their own processing unit – independently from the Ugandan private party in the consortium. Each party had their own interests to look after and we learned that it's important to be transparent about this. These processes have their own dynamics. A Dutch partner, who operates from a distance and is sometimes only provided with information selectively, will not always be able to recognise these dynamics."

Daniel Asare-Kyei – Eucharia Farms, Ghana "Businesses and research organisations have several reasons for taking part in an ARF project. As entrepreneurs we are in the first place driven by commercial motives, while the researchers' primary incentive is to publish about our innovation in peer-reviewed journals. We found a very pragmatic solution to make sure these differences of interest wouldn't hamper our collaboration: as individuals involved in the project, we have made commitments at project start-up to allocate shares to each partner in case our innovation starts making money. So all the partners benefit equally. This commitment to allocate commercial shares during the commercialization phase of the project offers enough incentives for all partners, both private operators and researchers.

I also recommend that you know each other well before embarking on a venture like this. Valentijn Venus and I met years ago when I did my MSc at the University of Twente. We quickly discovered our shared fascination for how technology can help to reduce post-harvest losses in Africa, and we have stayed in touch ever since. For the ARF project, we brought two other Ghanaian parties on board that I knew very well. Knowing each other for a long time has been instrumental to our success. Whenever there were differences of opinion or interest between the partners, I took on the role of intermediary. For example, a few one-on-one phone calls after a joint Skype session had become a bit tense was enough to clear the air. If people value the personal relationship, they won't want to jeopardise it and will be more willing to look for compromises."

The private sector accelerates impact

In the ARF consortia, business partners work closely together with universities and other research organisations. Their collaboration shows how much they are used to playing a different ball game, with very different time frames. This can cause some friction, especially when the businesses keep pushing their research partners to keep up the pace. Yet it is clear that the businesses make a key contribution to the success of the projects in terms of achieving tangible impact. They are the driving force that ensures the innovation is tuned to the demands of the market and the wishes of the end users.

Shahid Akbar – BIID, Bangladesh "As owners of an enterprise we look at the project in a different way than the researchers. Ours is a more human-centric perspective. A great deal of our time has gone into understanding the needs and wishes of the farmers, our potential customers. That's the starting point for our IT developers, because even though we have a social heart, at the end of the day – and rather sooner than later – we want to exploit a commercially viable innovation."

Momo Kochen – MDPI, Indonesia "As an NGO we like working directly with industry partners because this enhances the potential impact of our work. And though challenging, it's a good thing that they constantly pressure us to work more quickly. For the industry partners, a project like this is rather taxing too. They join because they want to be ahead of the curve, but at the same time, testing technology from a research perspective is a headache as it slows down their business process. But they stuck with it because they realised that in the long-term the outcomes of this R&D process will be beneficial for the Indonesian fishery sector at large."

Worlali Senyo – Farmerline, Ghana "During the development phase of the weather stations, it was our role as an enterprise to ask the farmers for their feedback on how the technology could be improved. If they said: 'the daily weather forecast is useful, but what we really want is a monthly forecast', we would tell the researchers, 'this is what the customer wants, how soon can we have it?' So often we were taken by surprise how long the technical developments took, and impatiently we thought, 'come on, this can be done faster!' The researchers kept perfecting the technology, which eventually meant the project had to be extended. It was well worth the wait though, because after three years we now have a robust and compact weather station that costs a tenth of the price of conventional

weather stations. I still believe that having an enterprise as lead partner is very helpful, because they are driven by bringing the innovation to the market. By always putting the pressure on them, we may have caused some tension at times, but I don't think that's a bad thing: there are already far too many excellent innovations dying on shelves."

Practitioners in the lead

The ARF requires that a Southern practitioner organisation leads the consortium. The reason is to ensure that the innovations are truly demand driven, or in other words, that they have a strong potential to solve real food security challenges of poor and vulnerable people locally. For some practitioner organisations, acting as the lead is a challenging undertaking, however. The Dutch partners in a consortium can bring in additional technical expertise for developing the innovations, leading to capacity strengthening. And in turn, they get a much better insight into what food security challenges really look like on the ground, possibly inspiring new research questions.

Anita Linnemann – Wageningen University & Research, the Netherlands "The best assurance that the research topics address issues that the overseas partners feel enthusiastic about is that *they* take the initiative to formulate the ARF proposals. The effect is a noticeably positive attitude of passion and perseverance throughout the execution of the projects. I'm convinced that, exactly because the practitioner organisations are in charge from the very start, the results of these projects will not evaporate after the projects end. The partners in Benin and Uganda are proud of their achievements and love to share their experiences with others, be it in local newspapers or during gatherings with friends and relatives. Because they chart their own paths – and I advise only when asked – the returns in terms of learning are so much bigger too. There are benefits for our department at Wageningen University too: the findings from the applied research may raise new questions that are exciting new areas for fundamental scientific research."

Momo Kochen – MDPI, Indonesia "For a relatively small NGO like ours, taking on the responsibility of coordinating the ARF project proved harder than foreseen. Especially drawing up solid contracts with the software developers took much more time than anticipated, as we lacked the necessary background in IT and IP law, which are critical when working with industry and confidential data. I recommend that WOTRO advises project partners on the importance of incorporating such issues into their project timelines and budgets, especially if external expertise needs to be hired. On a positive note, despite delays and occasional friction, as an organisation we have definitely come out a little wiser."

Wim Simonse – AWay4Africa, the Netherlands "It's definitely a great principle: have the organisations there be the lead applicant for the ARF and let them set the tone. Of course, it's risky. The NGO that ran our consortium in Uganda had no experience managing a multi-stakeholder project, or with methods to share information or reporting tools. Their capacities have been substantially reinforced as a result of this process. I have to admit, it would have been much more efficient if we, as a private Dutch party, had taken the lead, but there are certain things that you're not privy to or have control over from a distance. My suggestion would be not to make it obligatory to have a local lead organisation, but to have the consortium put forward arguments suggesting which partner should take the lead and why."

A steep learning curve for all

Transdisciplinary work is challenging, but when it succeeds, the learning curve for all participants is steep. And that is exactly one of the ARF's objectives: to build the capacities of all consortium partners by combining the knowledge and skills from different backgrounds, whether research,

commercial or societal. The mid-term evaluation underlines that consortia members take advantage of the complementing competences to distribute roles and responsibilities within the projects.

Shahid Akbar – BIID, Bangladesh "As a private company in Bangladesh, we would never be able to invest in this level of resources for a technical innovation. We recognise that there are great social needs in the agricultural sector, but from a purely commercial perspective it would not have been feasible for us to hire the expertise to develop an IT solution like this from scratch. It is wonderful that the ARF allows researchers to focus on the broader perspective and stimulates us to work as partners. Working together with scientists from the Twente University has enormously strengthened the technical capacities of our team of software developers."

Momo Kochen – MDPI, Indonesia "The transdisciplinary partnership is a model that we will most certainly take forward. Firstly, because the research aspect of the project lends a lot of credibility to our work as an NGO. The project gave us the opportunity to work with interns from Wageningen University, who made very useful recommendations to improve the huge amount of fishery data we are collecting through the online platform. In terms of building the capacity of our MDPI team, it was hugely beneficial to have professors from Wageningen come to Indonesia and sit with us for 4 or 5 days at a time to analyse the data. This cooperation has added depth to our work. The researchers in turn love that they get a chance to work with us, the NGO, and as an additional benefit they get access to the real 'on the ground' data of our intricate supply chains."

Worlali Senyo – Farmerline, Ghana "The last two years have been a crash course in working in partnerships. Despite all the hiccups and differences, I strongly believe that multi-stakeholder partnerships are the way to go. The collaboration has made our innovation much more solid. Our company has learned a lot too: a team from Delft University in the Netherlands and scientists from Kwame Nkrumah University of Science and Technology in Ghana joined us for a 3-day brainstorming workshop in Accra. We worked together on creating one-page business models that define our value propositions and activities for opportunities we identified for the weather station project. We have learned about exploring new opportunities and thinking big. The whole experience has put us in a different space."

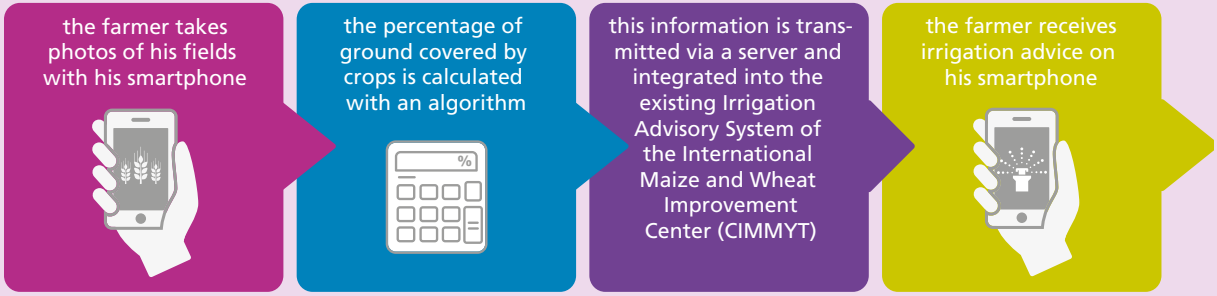
Wim Simonse – Away4Africa, the Netherlands "I'm convinced that the ARF approach to multi-stakeholder partnerships is the way forward. It creates a stimulating momentum. When you bring together different parties based on one theory of change, you have no choice but to work together and share. You question each other, and that gives the process much more focus. And it forces people to think out of the box. You're challenged to crawl out of your shell, and this certainly pertains to the research organisations as well. Perhaps it's easier and safer to only work with one partner, but the ARF approach makes sure that you're not only focusing on achieving the food security objectives, but you're also taking into consideration the process and its complexities. This generates better outcomes in terms of support, ownership and sustainability."

Project highlight

Improving irrigation in Bangladesh with a smartphone app

In the southern delta region of Bangladesh, large tracts of land are left fallow or are cultivated with low-input crops during the dry winter months. By developing a smartphone application that advises farmers on irrigation, this ARF project aims to contribute to more efficient water management (less waste) and smarter farming practices. This will help to increase food production and hence to improve food security for poor and vulnerable women, children and men in this impoverished part of Bangladesh. BIID has been working closely with the famers to make sure the app is tailored to both their needs and capacities. This is especially important because most of the farmers targeted by the project are illiterate.

The technology works as follows:



The farmer consultations led to two important adjustments. First, based on a clear need from the illiterate farmers, the software developers were challenged to write an app that only uses icons and no technical language or messages. Second, it was decided that the app would send the irrigation advice not only to the farmers but also simultaneously to the Irrigation Service Providers (ISP), who operate the irrigation pumps that the farmers lease for a fee per hour. The ISPs can act as a backup and will contact the farmers in case they fail to act on the irrigation advice they receive. This second adjustment illustrates that only focusing on the technical aspects of an innovation is rarely sufficient. Social aspects are often equally challenging. The project team realises that the success of the innovation will ultimately depend on the willingness of the farmers to swap age-old practices for the wisdom of a smartphone application. If this succeeds, the new technology could potentially have an impact on the business environment on a wider scale by offering an integrated service for farmers, input suppliers and buyers.

Project: *'Ground cover app to drive an irrigation scheduling service in the delta region of Bangladesh'*
Project lead: *Shahid Uddin Akbar (Bangladesh Institute of ICT in Development).*
Consortium: *University of Twente, International Maize and Wheat Improvement Center (CIMMYT)*

Research uptake: Using research evidence in policy and practice

Part of the core business of the ARF is to make sure that the research outcomes not only look ingenious on paper, but can also be translated into practical use. They should have a tangible, positive impact on people's food and nutrition security, or, at a systemic level, improve the policy and business environment for sustainable and equitable food systems. NWO-WOTRO and F&BKP's approach to achieve this aim is to promote and support *research uptake*, that is, all activities that contribute to the use of research evidence by policymakers, practitioners and beneficiaries.

An important lesson from earlier NWO-WOTRO programmes is that research uptake is not a mere add-on. To be successful, it needs to be treated as part and parcel of the project approach and activities from day one onward. Therefore, all ARF consortia are asked to formulate a research uptake strategy that builds on their impact pathway (see page 24). Because this is not easily done, NWO-WOTRO and the F&BKP offer a range of tools and activities to support the consortia in their effort to design and implement their research uptake strategies. Central to this support are the international and country workshops (see pages 25-26). During the lifespan of a project, moreover, the F&BKP supports the research teams by linking them thematically with other networks, research programmes and events, and boosts their communication by offering an online platform and social media tools to share project results and outputs.

When a project ends, the teams are required to organise a workshop where they actively engage all relevant stakeholders to reflect on the project's results and how to take these forward. In their final report, moreover, the consortia reflect on their successes and lessons learned in terms of research uptake. Most importantly, this concerns the issue of how they engaged the wide spectrum of stakeholders, not least policymakers, as well as the ultimate

How to build a research uptake strategy?

Based on earlier work by DFID ('Research Uptake. A guide for DFID-funded research programmes', 2016), NWO-WOTRO and the F&BKP developed a framework for knowledge sharing and research uptake, which includes the following:

Context analysis and stakeholder engagement early engagement and investing in building relationships with relevant stakeholders, including the beneficiaries;

Knowledge sharing and communication enhancing the availability, relevance and accessibility of research and its uptake;

Assessing and strengthening research uptake capacities both internal capacities (consortium/team) as well as the capacities of stakeholders and beneficiaries;

Monitoring, learning & evaluation integrating and revising research uptake objectives and expected results as outcomes and outputs in the impact pathways (and theory of change).

beneficiaries , during the different stage of the project to maximise the relevance of the findings and the chances of research uptake. A selection of thoughts from different ARF partners on these topics is presented below.

Several project partners have emphasised the importance of more strategic thinking by NWO-WOTRO, the F&BKP and the project teams on how the co-creation and research uptake processes can be kept going after a project comes to a close, to make sure that innovations are put on the market, commercialised, and upscaled. The mid-term evaluation confirms that to use the full potential of projects, mechanisms are needed to facilitate research uptake after the projects have been finalised.

Engaging beneficiaries to ensure relevance and capacity development

Target groups and beneficiaries must be involved from the very start of a project, when research questions are formulated and technologies proposed. This is a condition for developing not only relevant innovations for food and nutrition security, but also solutions that can be used by and have a direct positive impact on the women, men and children who are the intended beneficiaries. The ARF projects use different methods for involving and consulting farmers, consumers and other users of the new technologies.

Shahid Akbar – BIID, Bangladesh "I see our project as a collective learning exercise. Every stakeholder's voice is considered, most importantly the farmers'. We have been consulting them about very practical issues from the very start, such as which smartphones they find most user-friendly. We may think highly of our technological innovation, but if it's too complicated for them to use, then our mission has clearly failed. We learned that it's not easy to get the farmers on board. We're developing this technology for them, but they have major reservations. They have used the same irrigation techniques for

centuries, so it's hard to convince them that a smartphone app will teach them more efficient water management methods. Winning the trust of your beneficiaries is sometimes the hardest nut to crack in the whole process of putting a new technology on the market."

Pierre Nahayo – CAPAD, Burundi "Our field staff have been working directly with farmers and farmer's organisations in the provinces surrounding Bujumbura for many years. The farmers tell us their problems, such as a lack of quality seeds to increase their yields, and together we discuss possible solutions. This is how the Farmer Field Schools came about. It is a strategy developed by the farmers and supported by the researchers on our project team. They provided the scientific knowledge and expertise on potato seed production and helped to develop on-farm trials. The trials were used to test and demonstrate six technologies to improve the quality of potato seed. One of these used small plot techniques. Since their active participation in the trails, many of the farmers have become producers of quality potato seeds. The project has supported the farmers in marketing their improved seeds and has linked them to seed buyers. We also developed a training of trainers for cooperatives, extension workers and local government officers. It is important to reinforce the capacities of all these actors in the value chain, because potato is not only fast becoming a major source of income for farmers, but also a major source of calories and nutrients for the Burundian population."

Anita Linnemann – Wageningen University & Research, the Netherlands "Our local partner who leads the project in Benin has been very proactive in engaging the various stakeholders in the pineapple value chain, who are our target groups. To improve the quality of fresh pineapple, experimental sites were set up to test different agronomic practices together with pineapple producers. Farmers are invited to observe and reflect on the results of the scientific trials at various crop development stages. The food scientists who are experimenting with processing technologies for a tastier pasteurised pineapple juice that meets the demands of local and international markets have involved juice processors in Benin to learn from and contribute to the research. Several of the persons leading the projects in Benin received their PhD education at Wageningen University. This has most certainly helped to persuade them of the importance of using participatory methods that engage the intended users of the project outcomes."

Ensuring the buy-in of policymakers and other stakeholders

At the start of the project, consortia conduct a stakeholder mapping to have a clear idea of all of the actors who might be interested in or relevant to the research outcomes, or who can help in the process of achieving results. It is critical to invest in communicating with these stakeholders from the moment when research questions are being formulated, and to keep them involved throughout the project's lifespan. Research uptake depends on building continuous relationships, which is especially critical in the case of policymakers and decision-makers. If they get to know the research team as a trustworthy partner and a robust source of new information, they are more likely to facilitate enabling changes in the policy or business environment, or to directly support the implementation or upscaling of the innovation.

Donald Houessou – ACED, Benin "Ordinarily projects hold two major workshops to present their project plan and to disseminate their findings. While this approach is conducive to reaching many stakeholders, it also has its drawbacks. By the time the second workshop takes place, usually 18 to 30 months after the inception workshop, many

stakeholders have forgotten all about the project. Moreover, information sharing is too much of a one-way exercise. This is a missed opportunity to let stakeholders contribute significantly to the findings. We therefore agreed with our Dutch project partner that we needed a more continuous form of stakeholder engagement. To allow us to share preliminary findings, test ideas, ask for advice, receive quick feedback and to make sure that we keep focusing on the relevant issues. At the inception workshop of our project in Cotonou, we set up a 'Stakeholders Committee', which serves as an advisory body throughout the project period. The committee has seven members, coming from the national Ministry of Agriculture, the relevant local government agency tasked with fishery issues, the national association of fishermen, the national women's organisation for fisheries, the national water partnership working on integrated water management, the inter-communal council that represents the municipalities, and ACED as the consortium representative.

Our project team has been meeting physically with the Stakeholders Committee every six months – and for urgent issues its members can be reached by phone or email. This setup has been extremely helpful for two reasons. First, the committee members act as liaisons to their own constituencies and keep them abreast of any developments in our project and vice versa. Second, it has also supported our initial data collection on the distribution of fishermen

across the four municipalities. In the absence of such support and ground-level knowledge, it would have been difficult to conduct a rigorous and comprehensive sampling for the main survey of the project. Furthermore, the local government representative asked his colleagues to introduce us to the fishers. This was critical for our access to these marginalised communities, where people are sceptical about researchers coming in, demanding their time, but giving little in return.

The strong engagement of the local authorities increased the fishers' confidence about the relevance of the research and the likelihood that its results will be translated into practical actions that will ultimately increase their resilience. After presenting our preliminary research data, which confirm the extent of water pollution and over-fishing that are threatening the inland fishery sector, the committee members suggested that our project should provide input to the Application Decree, which will be developed to support the new Fisheries Act passed in 2014. This is an unexpected yet powerful outcome that should help our research to have a tangible impact."

Momo Kochen – MDPI, Indonesia "Our project has been organising what we call data management committees, a form of co-management, where some 30 representatives from government, academia, NGOs and industry, including fishermen, come together to talk about fisheries issues. This has really helped to create more stakeholder ownership on the issue of traceability. We made sure to engage both provincial and national government agencies in all meetings. Initially we had to push hard for their participation, but their interest increased as they realised that the data collected through the new traceability technologies can be used to support national fisheries management, for instance for stock assessments or production estimates. The Indonesian government, due to the sheer size of the country and the widely dispersed small-scale fisheries sector, has lacked adequate information, which is requested by management bodies such as regional fisheries management organizations, as well as the international market. The traceability technologies present a new and collaborative way for them to acquire the necessary data in a relatively quick and cheap way."

Worlali Senyo – Farmerline, Ghana "We have installed over fifty automatic weather stations since the start of our project, which is wonderful, but our ambition is to have at least one in each of Ghana's 216 districts. The ministry can create the enabling environment for this to happen, by making budget allocations or providing opportunities for businesses involved. Changes in government, however, have complicated this process. After the elections, key positions in the ministry were changed and we had to begin our engagement all over again. The traditional mindset of most civil servants is also a challenge. It took a great deal of effort to get the Ghana Meteorological Agency on board. However, these efforts paid off and ever since they committed themselves they have been a trustworthy partner. In fact, the government's involvement is now helping to pave the way for the sustainability of our project and innovation."

Project highlight:

Solar-powered mango drying in Ghana

Each year, on farms and plantations across Ghana, mounds of mangoes go to waste. Because the harvesting season is so short and because mangoes are as perishable as they are delicious, farmers have a window of only six weeks to find buyers for their fruits. Due to a lack of markets or appropriate storing facilities, up to 40 per cent of the mango harvest goes to waste. Not only do the Ghanaian farmers lose income as a result, but poor families are also missing out on an important high-vitamin, high-fibre source of nutrition. One solution is to process the mangoes: dried fruit or juice can be stored, while local processing multiplies the value of raw fruits. This ARF project successfully designed, developed and built a new affordable, drying technology.

A shipping container is insulated with polyurethane foam. Solar panels mounted on top generate hot water that circulates through the casing and heats up the container to 70 degrees Celsius. The heated air absorbs the moisture of the mango fruit drying on stainless steel sheets. On a cloudy day, or when the early morning sun is still weak, the installation temporarily switches to LPG to ensure a continuous drying process. In eight hours' time, two tons of fresh mango fruit can be dried. This innovative technology was built entirely by locally trained artisans and with local materials. The Ghanaian-Dutch consortium compared mango-drying machines from Burkina Faso (cheap, but not efficient), South Africa and India (good quality, but too expensive) to design this low-cost, high-quality prototype installation.

The prototype mango installation dried 84.4 tons of fresh mangoes in 2016 and 2017. Laboratory tests conducted by consortium partner KNUST showed very good results both in terms of nutritional composition and the absence of contaminants of any form. The Dutch consortium partner Ujuizi Labs is currently fine-tuning the mobile phone application that will enable the farmers to control the drying process remotely through their smartphones.

In 2017, HPW Fresh & Dry, the major commercial fruit-processing company based in Ghana, approached the project to work together on decentralizing their mango-drying operations. They are interested in the new technology because it targets medium-scale farmers with mango plantations of around 50 acres or more, who will also be able to process the fruits of surrounding smallholders. This is an exciting opportunity for the consortium to accelerate its ambition of making on-farm mango processing a reality in Ghana, and possibly across West Africa. It also shows how an ARF project can positively influence the business environment in the country.

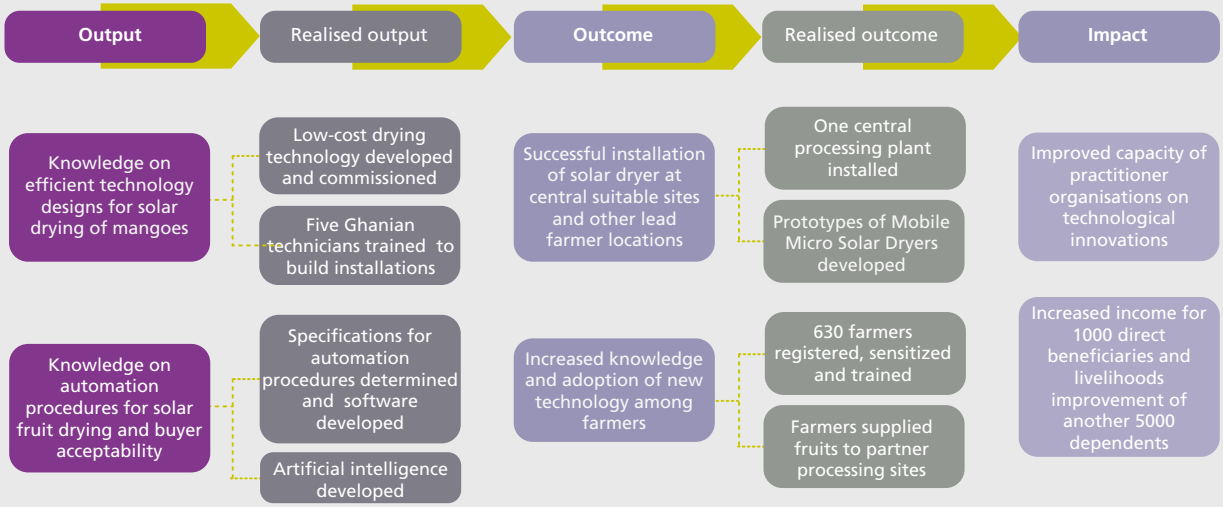
Project: *'Development of automated solar powered fruit drying technology for smallholder farmers in Ghana'*
Project leader: *Kwasi Etu-Bonde (Sustenance AgroVentures).*
Consortium partners: *Eucharia Farms Ltd, Kwame Nkrumah University of Science and Technology (KNUST, Ghana), Ujuizi Laboratories (spin-off company of University of Twente).*

Impact Pathways: Capturing the route to change

All ARF consortia sketched an Impact Pathway (IP) at the start of their projects. The pathway clarifies how project activities and the immediate results of these activities (output) relate to short-term or intermediate changes (outcomes) as well as to the long-term developmental changes in terms of food and nutrition security (impact). Indicators assigned to the output and outcome levels are monitored annually to help the consortia keep track of the project's progress and effectiveness. Where needed, activities and strategies are revisited based on the IP framework. The mandatory self-assessment workshop at the end of each project is seized as an opportunity to reflect on the achievements as captured in the IP together with stakeholders from outside the project team.

Outputs: First and most immediate results of a research project;
Outcomes: Changes in behaviour, relationships, actions and activities of stakeholders resulting from knowledge sharing and the uptake of a project's output;
Impact: The 'big picture' changes in economic, environmental and social conditions that a project aims to realise

Impact Pathway (with two examples per step) of the "Solar-powered mango drying in Ghana" project



International and country workshops: Interacting to boost impact

NWO-WOTRO and the F&BKP work together to support the ARF teams in strengthening their knowledge sharing and research uptake strategies and capacities. The international and country workshops that have been convened since the start of the ARF programme are a key instrument for this support.

Two international workshops that brought together the project teams of the first and second ARF call took place in Entebbe, Uganda (2015) and Cotonou, Benin (2016). The 15 consortia that were awarded funding through the third call are invited to a workshop that will take place in 2018 in Addis Ababa, Ethiopia. At these lively three-day events, the project teams partake in training sessions on key topics such as stakeholder analysis, monitoring impact pathways, outcome mapping, involving the private sector and policy influencing. Through various exercises, they are triggered to share and discuss challenges, experiences and insights.

In the three countries where most projects are taking place – Ghana (5 projects), Uganda (10 projects) and Benin (11 projects) – country workshops were organised to inspire knowledge sharing between projects, especially on strategies for local policy uptake together with local stakeholders and Dutch embassies in these countries.

Without exception, the participants are very enthusiastic about the regional and country workshops, both for the new knowledge and insights they bring and for being great networking opportunities.

Daniel Asare-Kyei – Eucharia Farms, Ghana
"The workshops in Entebbe and Accra opened our eyes to other projects working around similar challenges. It was so encouraging to hear their success stories. They convinced us that we needed to engage a wider circle of stakeholders if we really wanted to scale up our innovation. University laboratories and municipal authorities, for instance, have since come on board."

Wim Simonse – AWay4Africa, the Netherlands
"The digital F&BKP platform for sharing knowledge is great, but sharing only becomes truly dynamic once people meet face to face. I therefore think it is fantastic that WOTRO and the F&BKP invest in the workshops. The moderators were very clever at sparking open interaction between all of us about our successes and failures. During the discussions, you experienced first-hand what the ARF accomplishes as an instrument. Moreover, the workshops in Uganda and Benin generated all kinds of valuable new contacts for us."

A recurring discussion topic at all workshops is how to effectively communicate research results to different audiences, or in other words, how to acquire the skills of synthesising and repackaging research findings for a range of outreach channels, such as policy briefs, fact sheets, manuals, newspaper articles, videos, policy dialogues and conference presentations. Hands-on training to improve such communication skills is welcomed by most consortia.

Contributions by ARF project members

Wim Simonse – Away4Africa, the Netherlands
Introduction of cashew nut for income security for poor farmers in Northern Uganda
Wim Simonse is also involved in an ARF project in Benin.

Daniel Asare-Kyei – Eucharia Farms, Ghana
Development of automated solar powered fruit drying technology for smallholder farmers in Ghana

Shahid Akbar – Bangladesh Institute of ICT in Development (BIID), Bangladesh
Ground cover app to drive an irrigation scheduling service in the delta region of Bangladesh

Momo Kochen – Masyarakat dan Perikanan Indonesia (MDPI), Indonesia
Technology innovations towards sustainability in Indonesia's tuna supply chains

Worlali Senyo – Farmerline, Ghana
Water and Weather Monitoring Services in Ghana's Cocoa region: Innovative weather censoring and information services for local farmers

Anita Linnemann – Wageningen University & Research, the Netherlands
Designing appropriate agronomic and processing practices for pineapple supply chains in Benin
Anita Linnemann is also involved in three other ARF projects in Benin and one in Uganda.

Pierre Nahayo – Confédération des Associations des Producteurs Agricoles pour le Dévéloppement (CAPAD), Burundi
Development of potato seed quality based innovations for small scale farmers in the three provinces surrounding Bujambura town in Burundi

Donald Houessou – Actions pour l'Environnement et le Développement Durable (ACED), Benin
Improving the resilience of the inland fisher communities and aquatic systems to overfishing and water resource degradation in Benin

Descriptions of all ARF research projects, including various project outputs – such as reports, videos, policy briefs – can be found at the Food & Business Knowledge Platform **knowledge4food.net**. More information about Food & Business Research and the Applied Research Fund can be found on the NWO website **www.nwo.nl/foodandbusiness**.

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