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Introduction

“For over 40 years I have been working in agricultural research. Working within the Applied Research Fund with its emphasis on co-creation, such as with food chain stakeholders, has changed my life in research. Working together with farmers and processors in formulation and execution of research has surely increased our chances for achieving impact on Beninese food and nutrition security through research.”

Joseph Hounhouigan, Université d’Abomey-Calavi, Benin (During the ARF Benin workshop, November 2019)

The Food & Business Research programme addresses persistent food and nutrition security challenges as well as Private Sector Development in Low and Middle Income Countries (LMICs). It focuses on the urgent and growing need for adequate knowledge and solutions for regional and local issues in food and nutrition security. Food & Business Research consists of two funding instruments: the Food & Business Applied Research Fund (ARF) and the Food & Business Global Challenges Programme (GCP). 45 ARF-projects and 30 GCP-projects were funded in which multi-stakeholder interdisciplinary research is conducted in processes of knowledge co-creation. The fourth GCP call for proposals saw a pioneering collaboration with the CGIAR Research Program on Climate Change, Agriculture and Food Security. Through Food & Business Research a contribution has also been made to LEAP Agri – a long-term EU-Africa research and innovation Partnership on food and nutrition security and sustainable Agriculture.

In collaboration with the Food & Business Knowledge Platform

In 2012, the Ministry of Foreign Affairs established the Food & Business Knowledge Platform (F&BKP) for formulating research needs and exchange and use of knowledge on food and nutrition security. The focus areas of the Food & Business Research calls for proposals were defined by the F&BKP through consultation processes with their networks. And the F&BKP ensures that knowledge that is produced through ARF and CP feeds back to those networks.

A wealth of knowledge

This annual report presents the results of Food & Business Research in 2019. A wealth of new knowledge and practices is accumulated by multi-stakeholder consortia conducting research in North-South collaborations. ARF and GCP research tackles issues from the level of production to challenges at institutional level. Thereby working towards necessary transformations in food systems. In ARF projects a local practitioner’s organisation is in the lead, ensuring ownership as well as demand-driven knowledge and innovations. Knowledge co-creation through involvement of end-users right from the onset – also essential in GCP – facilitates local uptake of the newly created knowledge and practices.

From outputs to outcomes

This annual report highlights how the knowledge created in projects that completed in 2019 has led to outcomes – changes in behaviour, activities or partnerships - at local or regional level in order to enhance inclusive business, smallholder production and circular agriculture. All outcomes contribute to the overall impact envisioned by Food & Business Research. For example, in Benin soybean – a highly nutritious legume and, with ample possibilities for processing, a cash crop – is included in high level strategic plans and policies, which contributes to increased sustainable production of quality food, increased income for farmers and increased nutritional value.
The F&B 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 in LMICs. While the The Applied Research Fund (ARF) supports relatively short research in 10 of the 15 partner countries of Dutch development cooperation (2014), the Global Challenges Programme (GCP) supports more in-depth research on emerging global topics and challenges in food and nutrition security.
Food & Business Applied Research Fund

The Applied Research Fund promotes research-supported innovations

The Applied Research Fund aims to promote research-supported innovations that contribute to food security and related business needs in Dutch partner countries within the framework of the Multi-Annual Strategic Plans (MASPs) of the Dutch embassies. Projects granted within ARF contribute to improving sustainable access to sufficient and healthy food for the most vulnerable people, by showing the applicability of newly developed or adjusted knowledge, insights, technologies, tools, products or services or by analysing bottlenecks and identifying solutions at system level. The objectives of the ARF are to contribute to development and innovation. Rooting innovation in local and regional problems, socio-economic conditions and capabilities, is a prerequisite for meaningful impact. ARF provided grants only for high-quality applied research projects that are practitioner driven and evolve in a process of co-creation with different knowledge partners.

Figure 1: Graphical representation of the three calls of the Applied Research Fund and their foci.

Food & Business Global Challenges Programme

The Global Challenges Programme supports enhanced understanding

The GCP research and innovation programme aims at responding to the urgent and growing need for new knowledge, contributing to new insights, policies and practices to meet food and nutrition security challenges. GCP aims to generate research-based advanced understanding of 1) emerging key issues in food security and their impact on regional and local food security, and 2) the role of private sector development. It aspires to create new knowledge and to synthesize and deepen existing but fragmented knowledge through robust scientific research. GCP seeks to contribute to the development of new products, practices and policies that improve food security in Low and Middle Income Countries. A food system approach is central to all four GCP call for proposals.

Figure 2: Graphical representation of the four calls of the Global Challenges Programme and their foci. The 4th call is in collaboration with the CGIAR programme CCAFS.
Geographic spread ARF and GCP research

Through ARF and GCP research has been funded that focused on Food and Nutrition Security and Private Sector Development in the Global South. Projects funded through ARF could focus on the 15 partner countries of Dutch Development Cooperation 2014 – 2017: Afghanistan, Bangladesh, Benin, Burundi, Ethiopia, Ghana, Indonesia, Kenya, Mali, Mozambique, Palestinian Territories, Rwanda, South Sudan, Uganda, Yemen. In GCP research may focus on all Low and Middle Income Countries. Research focuses on at least a country that is part of these categories and if deemed of added value on additional countries.

Figure 3: Project countries of ARF and GCP.

Figure 4: Number of projects per country for ARF (left) and GCP (right). Please note that several projects are active in more than one focus country.
Budget

Food & Business Research is funded jointly by the Ministry of Foreign Affairs of The Netherlands and the Dutch Research Council (NWO). At project level at least 20% co-funding was provided by private partners (for profit and non-profit). The fourth call for proposals of GCP was launched in collaboration with, and co-funded by, CCAFS.

Figure 5: Funding structure of Food & Business Research.

€ 26.000.000
Ministry of Foreign Affairs

€ 8.425.000
Co-funding

€ 4.000.000
Dutch Research Council (NWO)

€ 39.425.000
Total budget

Leverage of ARF and GCP research

Co-funding is considered to demonstrate ownership and commitment of institutes and organisations to achieving the objectives of research projects. In ARF and GCP a minimum of 20% co-financing by private partners (for profit and non-profit) in the consortia is mandatory at project level. Co-funding can be provided on the basis of in-kind (personnel or material deployment) or in-cash (financial) contributions. In the fourth GCP call (GCP4), the co-financing was made available by CCAFS and not by private partners. One GCP4 project, however, is additionally co-financed by a for-profit private partner. Beyond the mandatory co-financing researchers, consortium partners and other stakeholders make additional contributions, demonstrating strong commitment.

Figure 6: On top of the mandatory 20% co-funding, projects provided almost the same amount as additional co-funding.

€ 4.950.000
Mandatory Co-funding

€ 4.475.000
Additional Co-funding

€ 9.425.000
Total Co-funding

LEAP-Agri

LEAP-agri (A Long term EU-Africa research and innovation Partnership on food and nutrition security and sustainable Agriculture) is a joint Europe Africa Research and Innovation (R&I) initiative related to Food and Nutrition Security and Sustainable Agriculture (FNSSA). 30 partners, including 24 Ministries and Funding Agencies (Group of Funders) from 18 European and African countries decided to join their forces and funding to build an ERA-Net Cofund project with financial support of the European Commission. From the Netherlands NWO-WOTRO is participating in this partnership together with the Ministry of Agriculture, Nature and Food Quality. LEAP-Agri has two main pillars, (i) co-financing of collaborative projects addressing EU AU & R on FNSSA, and (ii) conducting strategic thinking to strengthen the long-term EU-AU R&I Partnership on FNSSA. A total of 27 projects were funded in a call for proposals that was launched in 2017. A total budget of about 23 million € has been dedicated to the funding of these projects. The 27 projects involve 250 African and European teams from 20 countries. Dutch teams are participating in 14 of the funded projects.

Governance and Partnerships

NWO-WOTRO is governed by an autonomous Steering Committee, mandated by the NWO Executive Board. The Steering Committee is responsible for NWO-WOTROs strategy and policy. Its members are appointed by NWO’s Executive Board. The NWO-WOTRO office is responsible for the day-to day management of NWO-WOTROs activities, as well as for the Merian Fund.

Food & Business Programme Committee

The Food & Business Programme Committee has been installed by the NWO-WOTRO Steering Committee as the decisive body for the Food & Business Research instruments – the Food & Business Global Challenges Programme (GCP) and the Food & Business Applied Research Fund (ARF) and LeapAGRI. The Programme Committee ensures that funded activities are in line with the relevant funding instrument, its mission and objectives, and with the general administrative and financial framework of the instrument. The Programme Committee consisted in 2019 of the following members, representing:

- Dr G. (Guido) Gryseels – Royal Museum for Central Africa – Independent Chair
- Dr B. (Bruce) Campbell – representing CGIAR Research Program on Climate Change, Agriculture and Food Security
- Dr H. (Huub) Löffler – Wageningen University & Research-center – representing Food & Business Knowledge Platform – observer – discharged per 1-12-2019 due to discharge of the F&BKP Steering Committee
- Dhr Robert-Jan Scheer – representing Dutch Ministry of Foreign Affairs, Department Inclusive Green Growth – discharged per 1-12-2019 due to change in position
- Professor Dr M.J. (Marja) Spierenburg – Leiden University – representing NWO-WOTRO Science for Global Development
- Dr ir J. V.M. (José) Vogelezang – Wageningen University & Research-center – representing Topsector Tuinbouw & Uitgangsmaterialen

The Programme Committee is also the decisive body for the instruments that are part of the NL-CGIAR programme – the Seed Systems Development call, the Senior Expert Programme and the Public-Private Partnership expert. Reporting on this programme is conducted through a separate report.
Synthesis article: Indigenous foods

African indigenous foods
Opportunities for improved food and nutrition security

This executive summary presents key insights and results from the full paper ‘Pathways to improved food and nutrition security for the poor: the promise of African indigenous foods and technologies’ that is published in a series of articles based on a synthesis study of the Food & Business Research programme. The study is led by Ellen Lammers and Daniëlle de Winter.

The promise of African indigenous foods and technologies

Local and indigenous foods have a great potential to contribute to improved food and nutrition security, as well as economic empowerment, of poor and marginalised farmers and consumers in Sub Saharan Africa. For this potential to be realised, better knowledge is needed on the production, processing and marketing opportunities of valuable indigenous crops and foods. In addition, policymakers need to come on board. They play an important role in promoting value chains that are inclusive of poor, rural and female farmers and producers who aspire to bring these nutritious indigenous foods to a wider market.

After decades of decline, hunger is slowly on the rise again. In Africa, one in every five people is undernourished. The fight for food and nutrition security features prominently on the 2030 Agenda for Sustainable Development. Interventions by donors, governments and businesses focus on innovations in crop varieties, agricultural inputs and technologies. A group of research projects funded under the Food & Business Research Programme explored a completely different approach: to promote local and indigenous foods and crops, building on the traditional knowledge and technologies, and the ‘local food plate’ of local farmers and communities.

Seven transdisciplinary projects set in Sub Saharan Africa researched the production, processing and marketing challenges and opportunities of indigenous vegetables (such as African nightshade and spider plant) and other plants (such as Moringa oleifera, popularly called the Miracle tree), fermented dairy foods, and infant formulae made from local plant and animal resources.

Based on a synthesis study of this research, this executive summary presents key insights on the potential of indigenous foods to contribute to food and nutrition security of the poor and marginalised, as well as to food system diversification.

Social benefits & challenges

Promoting indigenous foods has two major social benefits: these healthy and nutritious foods are affordable for the poor, and they can empower the producers and processors, who often are women.

Local and indigenous foods have a great potential to contribute to improved food and nutrition security, as well as economic empowerment, of poor and marginalised farmers and consumers in Sub Saharan Africa. For this potential to be realised, better knowledge is needed on the production, processing and marketing opportunities of valuable indigenous crops and foods. In addition, policymakers need to come on board. They play an important role in promoting value chains that are inclusive of poor, rural and female farmers and producers who aspire to bring these nutritious indigenous foods to a wider market.

The Food & Business Research programme aims at addressing persistent food security challenges in low and middle income countries. It focuses on the urgent and growing need for adequate knowledge and solutions for regional and local problems related to food security. Food & Business Research consists of two funding instruments: the Food & Business Global Challenges Programme (GCP) and the Food & Business Applied Research Fund (ARF). Both are part of the Food & Business Knowledge Agenda of the Netherlands Ministry of Foreign Affairs.

• The objective of GCP is to promote research-based advanced understanding of emerging key issues in global and regional food security and their impact on local food security and the role of private sector development.
• The objective of ARF is to promote research-supported innovations that contribute to food security and private sector development in the partner countries of Dutch development cooperation.

The projects are all run by a consortium of academic, private sector and NGO partners to promote research uptake by relevant local, national and international stakeholders.

Food & Business Research is funded jointly by the Netherlands Ministry of Foreign Affairs and NWO-WOTRO Science for Global Development and is managed by NWO-WOTRO.
Environmental benefits & challenges

Indigenous foods have the potential to improve environmental sustainability by contributing to agrobiodiversity, strengthening climate resilience (for instance because of the genetic diversity within the farmer varieties of indigenous crops), and because of often lower natural resource requirements compared to more commercial and intensively farmed crops. Because indigenous foods can be harvested more times per year compared to many other crops, they manoeuvre support the resilience of farmers who, due to climate change impacts, are more often faced with failed harvests.

Although these environmental benefits were no primary research objectives, several projects gained relevant insights into the use of organic fertilisers and pest management tools, water-saving techniques, or the conservation of local forest resources. The potential ecological benefits of indigenous crops deserve more research investments, even more so because local farmers’ know-how on growing and preserving these crops is also on the decline.

A way forward

The potential of local and indigenous foods for food and nutrition security has long been ignored, yet interest is growing globally. An All-Africa Summit on the topic will take place in 2020, sponsored by international donors and the World Vegetable Centre. The research moreover showed that urban consumers in African cities are progressively buying indigenous and traditional food products, especially if these have proven health benefits. This important finding questions the usual assumption that promoting indigenous foods is tricky because of their low status among young, urban consumers. The growing worldwide market for organic and health foods also suggests attractive business opportunities.

To capitalise on all these opportunities, however, indigenous foods need to become part of policymaking. Local and national policymakers in the project countries showed interest especially when there were positive market prospects. Yet because ‘money talks’, the project results stress that in talking with policymakers, critical questions must be raised about who will benefit from the promotion of indigenous foods (smallholders or commercial producers? Women or men? Rural or urban consumers?), and how this can best be achieved (formal versus informal value chains? Production for the rural or urban market? For domestic consumption or export?). Openly and critically discussing the political and market dynamics and trade-offs is vital to ensuring that the promotion of indigenous foods will first and foremost benefit the food and nutrition security of the poor and marginalised.

Because of the traditional knowledge attached to indigenous foods, their promotion may also enhance respect for people’s cultural identities.

The major challenge to realising these social benefits is the lack of scientific knowledge on the nutritional value of many indigenous foods, as well as on effective processing and preserving technologies. This is where the Food & Business research projects made important contributions. In Zambia, Kenya and Benin, the nutritional value (macrominerals and microelements, vitamins, minerals, sugars and acids) of traditionally consumed fermented foods and over 300 edible plants, vegetables, cereals, tubers and animal resources (such as snails, insects, fish) were tested and documented. Based on the research insights, a hospital in Zambia experimented with using mabisi, a traditional fermented milk product, to treat babies that were severely malnourished. In Kenya, new preservation techniques developed for indigenous vegetables increased not only shelf-life but also their nutritional value.

Economic benefits & challenges

Promoting local and indigenous foods has the potential to significantly improve the livelihoods of small-scale farmers and entrepreneurs that grow, process and market these foods. Women in Kenya and Benin gained a higher and more regular income by growing and processing indigenous foods. There are moreover many opportunities for collaboration for improved value chain governance, for instance with farmer cooperatives, women’s organisations, youth groups, community seed banks, or consumer organisations.

However, there are considerable challenges too, which the projects addressed. One bottleneck for small farmers who aspire to upscale their production beyond the household and informal market, is a lack of approved and reliable production and processing technologies (required for quality consistency). The research insights contributed to better processing techniques of parboiled rice in Benin and vegetable drying in Kenya. Another bottleneck is the lack of certification of most indigenous crops and foods. Two projects reached important milestones by working closely with government agencies: in Benin, a newly developed infant formula was certified and is now on sale in supermarkets; in Uganda, indigenous vegetable seeds were granted improved legal recognition. In Zambia, collaboration is ongoing to determine the optimum processing parameters—combining indigenous knowledge and scientific lab test—as well as for the certification of fermented dairy foods. The project proved the high marketing potential, also in urban areas, of these traditional dairy foods.

High marketing potential, however, also implies a risk. The opportunities for small farmers and entrepreneurs to upscale their indigenous foods businesses may well be hijacked by more powerful commercial companies. In this case, economic benefits are captured by the stronger value chain actors. The formalisation of value chains can cause another trade-off that needs to be addressed upfront: product prices of indigenous foods may increase, which makes these nutritious foods less affordable for the poor.

Weblinks

- Full paper ‘Pathways to improved food and nutrition security of the poor: The promise of African Indigenous foods and technologies’
- Food & Business Research programme
- Food & Business Global Challenges Programme project overview
- Food & Business Applied Research Fund project overview
- Food & Business Knowledge-Platform

Authors

Dr Francesco Rampa, Dr Ellen Lammers, Dr Anita Linnemann, Dr Sijmen Schoustra and Daniëlle de Winter

NWO-WOTRO Science for Global Development, a division of the Dutch Research Council (NWO), programmes, funds and monitors innovative research on global issues, with a focus on sustainable development and poverty reduction. NWO-WOTROs research projects are realised by interdisciplinary teams of researchers from the North and South and in close collaboration with non-academic stakeholders. These partnerships yield solutions for development challenges and strengthen the bridge between research, policy and practice.

www.nwo.nl/wotro
Research funded through GCP is expected to contribute to the understanding and improvement of food systems by applying a food systems approach. The food system perspective considers food and nutrition to be the outcomes of interactions between different elements of a system. GCP is interested in understanding the drivers (from the global to the local level) that shape the transitions in the food system that are necessary to improve food and nutrition availability, access, utilization and stability. The policy environment, with its related institutions, at international, regional, national and local level, is a relevant aspect of the food system. In addition, the production and sharing of knowledge and information can influence the system, through skills, science & technology of various sources including farmer/consumer organizations, or the involvement of media and civil society organisations.

To improve food and nutrition security, research results inform government and the corporate sector on the operational, policy and institutional changes needed to ensure system change – at local and national level. Improved food and nutrition security also includes economically and ecologically resilient food systems and sustainable use of natural resources. System drivers are not only the quantity and quality of food, but also employment, income, health and ecological sustainability. Projects therefore cover technological, organisational, policy and social innovations as well as their relevance, efficiency and sustainability. Investments in the enabling policy and business environment, and consequently in the transformation and governance of key institutions, is a necessity to improve food and nutrition security.

Figure 7 represents the food system as used in the GCP. To illustrate how different projects take their place in the food system, four stories of change are directly linked to elements of the food system.

**ARF — Innovations for Sustainable and Profitable Intensification of Smallholder Dairy in Kenya (ISPID)**

Teresia Njoroge, a mother of 49 years who for a long time farmed maize and dairy under semi-arid conditions, has transformed her farm since joining ISPID project three years ago. Teresia had challenges feeding her dairy cows during the droughts, because she had limited feeds and a small feed store that could not support the herd during dry seasons. But she gained practical knowledge and skills in growing fodder, making silage and hay, animal housing and dairy goat management. Armed with the practical knowledge and skills, she effected significant changes in the farm. Teresia established 1 acre of yellow maize, another acre of sorghum, half acre of Napier grass and 3 acres of boma rhodes. From these, she is producing hay and preserving silage in 3 pits, storing hay in a large store sufficient to last for six months for her cows and still a surplus to sell. As a result she has been able to triple milk production to 90 litres per day, which is delivering to their Cooperative Society at better price, KSh 35 per liter, up from Ksh. 25 per litre. She sells a portion of the milk to neighbors, essentially to keep the local social networks. She now observes instructions on antibiotic withdrawal period to assure quality and safety of her increased milk production for processors. She processes some milk into yoghurt and mala (fermented milk), though for home consumption and these skills she learnt in the project training on value addition.

Teresia is playing role of a lead farmer to her neighbors who did not join the project. They frequently seek her technical advice and to further offer them advisory services, she has mobilized them into dairy farmer group. ‘I use the knowledge and skills I have gotten from ISPID to empower my neighbors,’ Teresia says.
She summarizes the benefits of the project to the community as employment to local milk transporters and more trade in hay and milk and fodder seeds.

**Marrenguele community** is a small farming community of 50 subsistence farming families in Massingir district. Since the 2000s, they have been challenged by large-scale investment in sugarcane production around their territory. The sugar company had obtained a large tract of land from the community while the community did not gain anything in return, apart from vague promises of future employment and support with food productions. The traditional community leader was accused of not consulting the community members when this transaction happened. The traditional community leader acted almost on his own with his close relatives, instead of involving all community members. The initial participatory diagnosis resulted in a common understanding that the community needed to organise itself better to support the leadership and negotiate collectively with external investors coming to them as well as to channel their concerns to the local government.

Another community called **Cubo** in Massingir District had been equally under pressure from a Mozambican/South African ecotourism company. Cubo had successfully negotiated with the company to improve their community infrastructures, such as a school, the maternity clinic and the community meeting facility in exchange for land. Cubo had a young community leader not being perceived as a traditional leader. This young leader made sure that the negotiations with the company took place in the presence of representatives from the entire community.

The project facilitated an exchange visit between Marrenguele and Cubo communities involving the respective leaders and community members. The Marrenguele delegation was impressed by the level of organisation of Cubo community. The project facilitated follow-up capacity building activities. In Marrenguele, the community demonstrated that they had organised four neighbourhoods and elected their representatives to shape a community committee. The project further supported the community with the training and offered basic record-keeping materials such as folders and notebooks. The project also supported the Marrenguele community to create and legalize a Natural Resources Management Organisation of Cubo community. The project facilitated follow-up capacity building activities in a local government.

The community, which initially only expressed complaints and resignation, now started to show determination that they would fight against land grabs. They were determined to proactively negotiate with investors for improved infrastructures, and support for their livelihoods and food security.
GCP – Cocoa crop improvement, farms and markets: a science-based approach to sustainably improving farmer food security in West Africa (CoCIFAM)

Our project findings show that despite numerous efforts and high investments the adoption of better management practices is very low. We attribute this to the attitude of companies and governments to continue "sending" information to farmers mainly through trainings instead of listening to farmers needs or appreciating farmers' knowledge and skills. In case of pruning it has become clear that pruning contractors often "impose" best pruning practices as a standard whereas farmers prefer contextual pruning and are not devoid of pruning skills. Our project also contributes to the current debate on living income. It aims to raise the voice and standard of living of a large part of the cocoa farmers while acknowledging and raising awareness that not every cocoa farmer can be assisted to achieve a living income. Some need to be assisted to find more remunerative occupations outside agriculture while others may have to rely on safety nets.

CococSoils partnership includes Centre National de Recherche Agricole (CNRA), Cocoa Research Institute in Ghana (CRIG), Nigeria (CRIN) and Cameroon (IRAD), multiple companies amongst which Mondelez, CGIAR institutes amongst which International Institute for Tropical Agriculture (IITA) and Wageningen University and Research. Within this partnership resources are pooled to jointly conduct research and data are being shared. This is quite unique in the highly competitive cocoa landscape where companies often prefer keeping their research confidential aiming to protect and guarantee their supply from a specific resource base. In light of the multinational partnerships development we have good hope that findings from our project will reach and benefit the entire cocoa sector and spark more partnerships. An example of a new alliance is the announcement of a minimum selling price by Ghana and Ivory Coast, which is highly relevant as together they produce about 70% of all cocoa worldwide.

The text in bold indicates how and where the story of change following this diagram links to the food system.
GCP – Sustaining food supplies and improving health: Integration of small farmers into modern value chains with food safety standards in Kenya

We tested the impact of providing consumers information on which maize flour brands are most likely to meet Kenya’s regulations on aflatoxin. For some consumers this was accompanied by a free test of the maize flour they were consuming. We found that providing consumers with test results (regardless of the outcome of the test) led them to be significantly more likely to consume one of the tested brands over two months later. However, simply providing consumers with information about the safer brands did not affect their maize purchase behavior. This result indicates that creating changing consumer demand for safer food is feasible, but not easy. Currently, the strategy for scaling up Aflasafe use among smallholder farmers is mostly focused on getting the product to input dealers. However, our study found that many farmers who purchased Aflasafe after a brief training on how to use the product applied it too late in the maize growing cycle to realize its full benefit.

Theories of Change and Impact Pathways

Both ARF and GCP have an impact pathway at programme level which provides an overview of, and captures learning about, the contribution that the programmes are making towards the Food Security policy objectives of the Dutch Ministry of Foreign Affairs. The impact pathways have been organised in outputs, outcomes and impact. The outputs are the insight and knowledge created in the programme, the outcomes the changes in behaviour resulting from new insights and the impact the positive changes to food & nutrition security in the project countries. The impact pathways have been revised at the midterm stage of the programme and will be revised again at the end of the programme to capture learning about (the assumptions that are underlying): i. the food security issues addressed in the calls for proposals; ii. the research framework applied in GCP and ARF; and iii. the Food Security policy. It is important to note that the impact pathways are meant as learning frameworks and not so much as accountability mechanisms.

All projects failing under the ARF and GCP programmes have also developed their own impact pathways, which all contribute to the larger impact pathway at programme level. Projects have received documentation and guidance in using theories of Change and Impact Pathways.
Knowledge co-creation

Knowledge co-creation is a form of cooperation in research where different parties (researchers and stakeholders) in the knowledge process (demand and supply) interact and engage in joint learning to define problems, formulate possible solutions, design the research, conduct the research, assess the results and to translate these into new practices and products. Target groups, for example, are involved in an early stage in the design of the research projects, thereby also contributing to co-creation. Figure 8 shows how this works in one of the projects. The process of designing the innovation, the EASI-Pay mechanism, was conducted between all stakeholders, especially involving the end users. This process did not stop after the design – end users provided continuous feedback, thereby improving the mechanism step by step.

Figure 8: Co-creation approach as developed and used in the project ‘Enabling Access to Sustainable Irrigation with EASI-Pay for Baraha pumps in Indonesia’.

Transdisciplinary consortia

Both ARF and GCP projects are characterised by multi-stakeholder consortia from different disciplines. Although working in such multi-stakeholder consortia can be challenging due to differing interests and views, the project consortia themselves are very positive about this approach. Also in terms of impact, the requirement of multi-stakeholder consortia and the co-creation approach between Northern and Southern consortium members has proved its value. The external evaluation of the ARF programme, for example, found that this approach has not only been key in accessing target groups and influencing policy change, but also in ensuring technological and institutional sustainability.

The involvement of end-users in the process right from project formulation to project implementation ensured that their real needs are considered, which facilitates behavioural change in favour of new practices and arrangement.

Towards an efficient soybean food chain in Benin (ProSeSS)

Figure 10: Multi-disciplinary, multi-stakeholder consortia – the average composition in ARF.
The emphasis of a private sector actor as the lead applicant was also another good arrangement. The advantage here is that research questions arise from a need in the sector or by the private sector actor, are picked and addressed by research component of the Project, leading to a demand-driven research where research findings are adopted as soon as they are realized. It also allows for adaptation of results as they emerge to increase chances of their adoption under auspices of demand driven research.

African Indigenous Vegetable systems for better livelihoods in Kenya

Research Uptake

Research Uptake is a continuous process, starting with the design of the research project. As one project frames it: The ARF as a funding instrument is very unique regarding the user-led approach; it promotes close collaboration between practitioners, researchers and end users which ensures a good uptake of research outputs. The approach is innovative, as it allows researchers to interact with practitioners to alleviate producers and processors constraints. With this, researchers are no longer confined in laboratories, uptake is likely to be enhanced. (Towards an efficient soybean food chain in Benin (ProSeSS))

Figure 10 shows that research uptake continues after the knowledge has been created; it turns new knowledge (outputs) into actual changes in behaviour, the environment or social systems (outcomes) and into impacts. NWO-WOTRO and F&BKP each have a role in further enhancing the potential for outcomes and impact of the research projects funded through ARF and GCP. From the side of NWO-WOTRO this implies the development of capacities of researchers to conduct research within this approach and organising events, such as country-specific (ARF) and midterm and final meetings (GCP), in which knowledge sharing between and beyond research consortia is central. The F&BKP plays a key role in the enhancement of the potential of ARF and GCP research achieving outcomes by facilitating engagement of ARF and GCP research with wider networks of actors in policy and practice, beyond the stakeholders and networks that research consortia have themselves identified and engage with, as well as by contributing to the visibility of findings, including communication.
In order for research results to contribute to outcomes their exchange, synthesis and wider availability is paramount. Also in 2019 substantial effort has been put into facilitation of such processes within Food & Business Research. Through the initiation of an elaborate synthesis study on ARF and GCP results, as well as by coordinating a range of knowledge sharing and learning events. Synthesis enables bringing project-level insights and innovations to a higher level through aggregation and the identification of patterns across, and by that providing a result that is more than the sum of the individual parts. Knowledge sharing workshops allow for learning across research consortia and with wider groups of partners and stakeholders, involving representatives from private sector, government, extension services, NGOs and other practitioners working on food and nutrition security.
Synthesis Study

Before and during 2019 a large number of ARF and GCP projects have finalised. With final results from projects available it is time for NWO-WOTRO, in collaboration with F&BKP, to take stock of the achievements. Therefore, a synthesis study of the programme was commissioned, providing insights into research results and outcomes on policy and practice. The purpose of the studies is to capture the key findings and lessons emerging from ARF and GCP research projects (see Annex I for the specific objectives of the synthesis study).

Synthesis of findings and outcomes is foreseen around selected themes to produce an aggregated body of knowledge that is relevant for both policy and academic stakeholders. The synthesis study will deliver the following written output, that will be communicated through media and outreach events:

- Four thematic articles, synthesising research insights on four selected themes: Circular Agriculture, Indigenous foods, Inclusive Business and Smallholder Production;
- Three outcomes studies, presenting changes in policies and practices as a result of the use of ARF and GCP research insights that resulted from knowledge co-creation. The articles focus on outcomes around specific user groups: private sector, small-scale farmers and policy and practice;
- An article presenting generic pathways to impact: synthesising varying approaches that ARF and GCP consortia have taken towards achieving outcomes;
- An article reflecting on the Research for Impact approach that was applied in ARF and GCP, based on lessons learned from research consortia.

“Can we expect smallholders to make similar investments in time and knowledge as larger commercial farmers? The findings emphasise that context-specific results cannot be expected to apply to the realities of farmers across the board. Circular practices should not be promoted blindly, as they can lead to unmanageable increases in workload, especially when the food system does not yet support the new approaches.”

Food & Business Synthesis paper on Circular Agriculture

Result: article on Circular Agriculture

The first result of the synthesis study was a thematic article on Circular Agriculture, that presents opportunities and barriers of debates as well as policies and practices on Circular Agriculture. The paper discusses new Research for Development insights and innovations regarding three key principles of circular agriculture: 1) preserving and enhancing natural resources, 2) efficient use of resources, and 3) multi-purpose use and recovering value from waste. This thematic synthesis builds on the insights gained and innovations developed by twelve Food & Business Research projects funded by NWO-WOTRO Science for Global Development, which have all addressed aspects of circular agriculture and its application in low and middle income countries. The identified socio-economic drivers and barriers to scaling of circular approaches are put forward, as well as some concluding critical reflections on circular agriculture.

See the summary of the article on page 52 in this annual report, the full article is available online.

Knowledge sharing workshops

Research conducted within Food & Business Research leads to enhanced understanding on the matters in relation to food and nutrition security that the projects are focusing on, as well as on the approaches taken in terms of the Research for Impact approach. In order to maximise the potential for learning across research consortia, as well as with wider stakeholders, knowledge sharing workshops are regularly organised within ARF and GCP. NWO-WOTRO (in collaboration with the Food & Business Knowledge Platform) organises these workshops that bring together ARF and GCP research consortia and relevant stakeholders to enhance the potential of research uptake, of which learning is a central element. These workshops are held at various stages during research execution, to allow for continuous knowledge exchange. In 2019 ARF consortia met in Uganda and Benin to enhance uptake of findings at country level. GCP3 and GCP4 consortia met for assessment of progress and learning in midterm workshops. And with all projects of GCP1 and GCP2 (nearly) finalised in 2019 a final conference was organised to enhance the potential for uptake if final results.

Result: article on African Indigenous Foods

The second thematic article that resulted from the synthesis study focuses on African Indigenous Foods. Local and indigenous foods have a great potential to contribute to improved food and nutrition security, as well as economic empowerment, of poor and marginalised farmers and consumers in Sub Saharan Africa. This paper presents key insights and results on Pathways to improved food and nutrition security for the poor: the promise of African indigenous foods and technologies. See the summary of the article on page 14 in this annual report, the full article is available online.
Knowledge sharing for better understanding of scaling

‘Often, at the end of research interventions, outcomes are not scaled up and impact becomes limited. It’s not just about producing evidence of what works, but also ensuring that successful projects are scaled up.’ This statement, formulated during the ARF country workshop in Benin (20-22 November 2019, 11 projects) was part of the deliberations on processes of scaling. Two country workshops were organised, in Uganda and Benin, that brought together all ARF consortia in the respective countries. The central topic of the country workshop was the issue of scaling, that is hot topic for all consortia that are aiming to contribute to change with their research efforts. Scaling, as was observed during the ARF country workshop in Uganda (18–20 June, 8 projects), is not simply about reaching more people with an innovation but providing an enabling policy environment and ensuring there is effective change for and among people. Scaling the innovations of agricultural research requires the concerted efforts of numerous and diverse stakeholders. In the Benin workshops, the public sector, the private sector and intermediaries to bridge the key actors were identified as the three main drivers for scaling, although the local research and innovation systems make limited use of them. Overall it was concluded that approaches for scaling need to be part and parcel of research efforts from its onset and that by considering scaling efforts only at the end of projects is surely too late. Both workshops were characterised by a broad attendance of professionals from research, the private sector, NGOs and governmental agencies. The Benin workshop was unexpectedly attended by the Minister of Agriculture whom delivered a speech in which the research consortia were applauded for their efforts. Scaling was also discussed extensively during the midterm meeting of the GCP4 projects in Ethiopia. In 2020 synthesis will be conducted on findings on scaling across ARF and GCP.

Midterm meetings for joint learning

“The many components of food systems may create trade-offs in the short and the long term, such as affordability of food versus nutritional value.” This was one of the conclusions about working through a Food System Perspective in research for food and nutrition security. Eight consortia of projects funded in the third call of the Food & Business Global Challenges Programme (GCP3) gathered in Accra, Ghana, for a midterm meeting with the twofold purpose of learning and assessing progress. In a session on the Food Systems Perspective the participants shared their approaches on this perspective, in response to an input paper formulated by the consortium of the HortEco project (based on an Open Access published article of the consortium). Some conclusions of this session were:

- Normativity and political orientation/preference towards certain food systems must be made explicit in research and the (policy) systems they connect to
- However, it was considered better to think about creating synergies between different food systems
- Indicator-based systems can be useful to stimulate discussion, but should not be seen as a panacea
- The many components of food systems may create trade-offs (e.g. food access versus nutritional value) in short and long term

These findings were also shared with a wider Ghanaian audience in the public event that was organised at the afternoon at the last day of the event, organised by the Food & Business Knowledge Platform (F&BKP). More information and the report of the workshop can be found at the related webpage. More about the public event, as well as a video of how it was included in the Ghanaian news, can be found at the website of the F&BKP.

In June 2019, the projects from the fourth call of the Food & Business Global Challenges Programme gathered for joint learning and exchanges. The participants reflected on progress and research findings, including bottlenecks and challenges in their projects. In-depth discussions took place on the concept and application of scaling. Additionally, a Public Dialogue on ‘Scaling Climate-Smart Agriculture in East Africa’ was organised at the International Livestock Research Institute in Addis Ababa, Ethiopia. The concept of scaling was discussed in detail, during the internal meeting as well as the public session. A number of central issues were addressed that are relevant for the process of understanding and implementing scaling. This includes incorporating diverse actors, such as smart engineers, web weavers, system builders, and institutional workers; finding relevance between scaling and business realities; aligning CSA with country priorities; exploring opportunities for sharing and prototyping; identifying a process of prioritisation; creating space for feedback at multiple levels; delivering research that deliberately inserts local priorities into national contexts; promoting inclusivity and evaluating which voices are present in the design of CSA scaling processes. More information and the report of the workshop can be found at the related webpage.

The difficulties as well as potential of developing inclusive business models

Representatives of fourteen finalised Food & Business Global Challenges Programme projects and external participants from the private sector and from policy gathered to communicate, discuss and synthesise project research results, insights and lessons learned, aiming to inspire practices and policies in the field of inclusive agribusiness and to scale promising solutions. WOTRO Science for Global Development and the Food & Business Knowledge Platform organised the GCP1&2 final exchange days in The Hague on 14 and 15 November 2019.

A central message from the conference was the complexity of achieving business models that are indeed inclusive. An example recommendation was that distinctive business approaches should be supported in order to achieve inclusiveness as well as business development. To improve the livelihood of both BoP consumers and BoP entrepreneurs, one business model should target small-scale initiatives (to help them overcome entry-barriers and thresholds). To develop and scale innovations, the other business model should target large-scale companies. Such practical recommendations coming from research findings also serve as take away messages for attending policymakers and private partners. The main insights and recommendations resulting from the conference, as well as lessons learned of GCP1 and GCP2 research consortia on working in co-creating and towards impact can be found on the webpage.

Result: Special Issue on Inclusive Business

From the Food & Business GCP projects, a special issue is published in the ‘Current Opinion in Environmental Sustainability’. It presents a timely set of papers that question the key assumptions of inclusive business, its paradigmatic status in steering the agri-food sector towards social, environmental sustainability. The Special Issue can be accessed online.
5 Working towards impact on food & nutrition security

Outputs – Outcomes – Impact

On the following pages we present the contributions of all ARF and GCP projects that have been finalised in 2019 to the envisioned impacts of the Food & Business research programme. There is a focus on inclusive business, smallholder production, indigenous foods and techniques and circular agriculture. We present the contributions from the projects as simplified output – (intermediary) outcome sequences. Table 1 on this page reflects the projects’ output in numbers of publications, carrying the knowledge and insights they created. Figure 14 shows the sustainability of the projects. The vast majority of projects continue integrating the new knowledge in activities after the project has ended, either on a voluntary basis, as in-kind contributions from existing institutes and organisations, or through new funding. Half of the projects that were completed in 2019 have secured new funding.

Impact of the ARF — the numbers

40,458 Farmers apply new knowledge for enhanced production of quality food
63% of whom are women

8,330 Target group members were reached in 6 case study projects, working towards Pillar 1: Increase in Sustainable Food Production

406 Extension agencies now promote demand-driven production

51 Value chain organisations integrated new knowledge on food safety into their practice

Table 1: Number of publications from the GCP and ARF programmes as indicator for programme output. (Note that not all projects have uploaded all their publications)

<table>
<thead>
<tr>
<th>Publication type</th>
<th>GCP</th>
<th>ARF</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publications for a wider audience</td>
<td>46</td>
<td>48</td>
<td>94</td>
</tr>
<tr>
<td>Professional publications</td>
<td>21</td>
<td>12</td>
<td>33</td>
</tr>
<tr>
<td>Scientific publications</td>
<td>56</td>
<td>31</td>
<td>87</td>
</tr>
<tr>
<td>Conference papers</td>
<td>9</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Other</td>
<td>94</td>
<td>159</td>
<td>253</td>
</tr>
<tr>
<td>Theses</td>
<td>1</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>Books</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Chapters in books</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 14: Sustainability of GCP and ARF projects completed in 2019. Sustainability is expressed as the extent to which activities on the same research topic with at least one of the consortia partners or stakeholders is continued.

Overall, ARF projects report to have reached over 40 thousand farmers (63% of which are women) and that these are now applying new knowledge for enhanced production of quality food. To promote this change, over 400 extension agencies now promote demand-driven production and value change organisations integrated new knowledge on food safety in their practice.
Inclusive business

“An inclusive business is a sustainable business that benefits low-income communities. It is a business initiative that, keeping its for-profit nature, contributes to poverty reduction through the inclusion of low-income communities in its value chain. In simple words, inclusive business is all about including the poor in the business process be it as producers, entrepreneurs or consumers.” (The World Business Council for Sustainable Development, 2019). The GCP and ARF projects have adopted different approaches to inclusive business, varying from a focus on production to a focus on optimising advisory services. One of the main impacts that these projects contribute to, is an improved integration of farmers and production in local, regional or global markets, including contributions to an enabling environment to do so.

<table>
<thead>
<tr>
<th>Project Topic</th>
<th>Main outputs</th>
<th>Main outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inclusive business models &amp; the role of brokering</td>
<td>The understanding that the interaction and fit between a business model and the ‘business ecosystem’ of B2B markets seems crucial &amp; insights on the potential roles of brokers and intermediaries &amp; development of Inclusive Innovation Contact Assessment tool.</td>
<td>80 practitioners have a better understanding on business model for inclusive innovation, their roles and responsibility and the interaction of intermediaries with businesses and their ecosystem &amp; 30 key stakeholders in the Netherlands, Kenya and Nigeria are more aware of the role of intermediaries in developing PFPs for food and nutrition security and the relevance of BIS and context assessment tools to map inclusive innovation and create the appropriate conditions for its initiation, implementation and scaling.</td>
</tr>
<tr>
<td>Inclusive value chain collaboration and Learning platforms</td>
<td>Identification of the need for a farmer-centric approach with an eye for farmer- and gender-diversity &amp; learning platforms to create a safe space for knowledge sharing among smallholders, institutional and private actors, and researchers &amp; insight that Ghanaian tree-crop farmers show limited concern for unsustainable practices.</td>
<td>Increasing acknowledgement of farmer diversity. Public entities and companies embraced the learning platform approach. Innovations from below shared and adopted by others. Positive VCC effects were documented for Ghana, but only under positive profit prospects. Awareness of landscape dynamics increased following the participatory spatial backcasting workshops.</td>
</tr>
<tr>
<td>Ethical conduct along the value chain of food crops</td>
<td>Insights on quality management methods of food crops (production and further along the value chain) observing ethical codes (e.g. using high quality seed and agro-inputs), insights on the causes of unethical conduct among smallholders (e.g. competing self-interest, low degree of collaboration and monitoring etc.).</td>
<td>Knowledge informed policy level dialogue, positive mind-set change toward the importance of addressing unethical and quality standard issues at various levels. The effects on a farmer and consumer level were not monitored.</td>
</tr>
<tr>
<td>Soybean production &amp; processing</td>
<td>Insights that producers value a soybean variety’s productivity and processors value its grain density. Half of the seed samples from markets were found to be a mixture of varieties – 5 high yielding varieties identified and 2–3 matched to quality of derived product (milk, oil, tofu and Affin, a taste enhancer).</td>
<td>Processors show demand and can produce the end products, new policies on inclusion of soybean in the Strategic plan for the development of agricultural sector 2017 – 2025 and the national agricultural investment, food and nutritional security plan 2017 – 2021, an updated national seed policy.</td>
</tr>
<tr>
<td>Dairy input &amp; advisory services</td>
<td>Input &amp; advisory service configurations appropriate to market orientation levels and institutional context &amp; Curricula for post-graduate short courses for dairy professional reviewed and introduced.</td>
<td>Private service providers received feedback on how to make their service models appropriate and affordable &amp; 30 staff and 250 farmers completed a dairy course.</td>
</tr>
<tr>
<td>Optimising pineapple production for processing into juice</td>
<td>Optimal planting density and fertilizer management for pineapples with longer shelf-life (10 days), higher average yields (16–84 t/ha) and good juice characteristics – insights that with 80–85 °C pasteurization the juice has a shelf life of 10 months with maintenance of vitamin C. Training of 43 producers and 10 processors.</td>
<td>Producers are enthusiastic about using better agronomic practices &amp; processors are more confident that producers can meet their quality expectations.</td>
</tr>
<tr>
<td>Allotment gardens in peri-urban areas</td>
<td>Integrated framework for the development of allotment gardens in peri-urban areas and development of decision support tool to allocate optimal sites.</td>
<td>The gardens have improved the livelihoods of the 40 participants, they harvest and sell for 50 euro/month, consume a higher number of food groups and ate more meals per day compared to a control group. No concrete outcomes related to the site selection tool.</td>
</tr>
</tbody>
</table>

Inclusiveness is not a state of being, but mainly a process. A farmer-centred approach that recognizes smallholders’ differentiated and gendered realities, as well as their knowledge, innovation capacity and agency, is key to making VCC more inclusive.

(GCP – Inclusive value chain collaboration in Ghana and South Africa)

Envisioned impacts on inclusive business in ARF and GCP project countries

- Increased sustainable production of quality food at local levels (ARF & GCP) that meets changing local, national or global demands (GCP).
- Decreased food losses along local or national food chains from production to consumption (ARF).
- Improved integration of (local small-scale) farmers and entrepreneurs in local or national (ARF & GCP) or global (GCP) functional markets, including contributions to an enabling institutional environment for enhancing knowledge and governance of local, regional or global food security (GCP).
- Increasing food safety and nutritional value (ARF).
- Increasing income of farmers at local levels (ARF).
- Enhanced inclusive access to quality food that aligns with dietary needs in GCP countries (GCP).
- Contribution to local institutionalisation of learning and local research infrastructures (ARF & GCP).


Inclusive value chain collaboration through a farmer-centred approach

This project developed a farmer-centred approach to value chain collaboration (VCC) that is inclusive of different smallholder profiles, their knowledge and innovation capacity, and the environment. It centred on knowledge sharing, co-creation and joint learning in learning platforms, with a focus on ‘innovations from below’ and peer-to-peer learning via change makers. These learning platforms offer a safe space for farmers to voice their concerns, interact with institutional actors, and learn from the latest research findings. Research offered insights into different farmer profiles and associated differences in opportunities, constraints and aspirations; the effects of expanding tree crop production – cocoa and oil palm (Ghana) and avocado and macadamia nuts (South Africa) – on food production and the broader landscape; and gaps in extension services. This project innovatively combined ethnographic research and cluster analysis to study farmer diversity; action research to develop a farmer-centred approach towards learning and innovations; and a combination of remote sensing and participatory spatial methods to analyse the effects of expanding tree-crop farming on the landscape and unravel farmers’ and institutional actors’ views of their landscapes. The aim was to find out how VCCs can be made more inclusive and enhance food sovereignty and landscape sustainability.

(FCP – Inclusive value chain collaboration in Ghana and South Africa)

Felix from the Udder Agribusiness:

“Apart from the dairy training, the ADIAS project has widened my network with key dairy stakeholders in the country through sponsorships to key dairy events. This personal growth in the field of dairy is not only for me but for the overall contribution to development of the Kenyan dairy sector as I pass my knowledge to other citizens.”

(GCP – Assessing and supporting Dairy Input & Advisory service Systems (ADIAS) in Ethiopia and Kenya)
Smallholder Production

Many projects in GCP and ARF focus on smallholder production. The projects concentrate on a range of different crops and commodities, from shrimp farming to non-timber forest products such as honey and black pepper, and from cassava to dairy. Also, the projects differ in approach. Whereas one project focuses on fertiliser management and good agricultural practices on a field level, another project develops a pay-per-harvest system to enable farmers to use a new irrigation technique. Despite the differences in research topics, the envisioned impacts of all projects all contribute to increasing sustainable food production, thereby also increasing farmers' income and improving their market positions. Alongside, the projects also contribute to local institutionalisation of learning and local research infrastructures.

<table>
<thead>
<tr>
<th>Project topic</th>
<th>Main outputs</th>
<th>Main outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable intensification of dairy smallholder farming</td>
<td>Community action plan for inclusive sustainable dairy intensification, training on good dairy management (clean milk production, cow signals and dairy herd management), feed (feed composition &amp; preservation &amp; fodder trees and crops for resilience to shocks), re-using waste (biogas and composting) and processing of milk.</td>
<td>120 members registered with cooperative society strategic plan. Milk cooler obtained. 15.7% increase in compliance with antibiotic withdrawal, milk sale volumes increased by 49.5–102.8% (parity w/ dry season); Ksh 3.40 increase in milk price in dry season.</td>
</tr>
<tr>
<td>Irrigation through pay-per-harvest mechanism</td>
<td>Development of pay-per-harvest mechanism (EASi pay) to install Baraka pumps for irrigation with renewable energy – 10 pumps used by 210 farmers.</td>
<td>(Women) farmers increased the number of cropping cycles diversified their crops; income has increased with 20–40%.</td>
</tr>
<tr>
<td>Agroforestry with non-timber forest products</td>
<td>Intercropping non-timber forest products (NTFPs – grains of paradise, black pepper &amp; honey) increases timber yields, reduces wildfires &amp; provides market opportunities for some farmers.</td>
<td>Shade-tolerant NTFPs in timber production is now a key element of Ghana’s Forest Plantation Strategy 2016 – 2040; production groups in 3 communities; emergence of 4 new initiatives on tree/NTFPs.</td>
</tr>
<tr>
<td>Fertilizer management &amp; good agricultural practices for rice</td>
<td>NPK and micronutrient application increase rice yields, but without good agricultural practices (GAPs) by farmers there is no yield benefit.</td>
<td>35% of farmers in the project area have increased awareness of the benefits of fertiliser &amp; GAPs – many farmers adopted these practices &amp; when used together; 53% reported an average yield increase of 41% &amp; functional rice innovation platform established.</td>
</tr>
<tr>
<td>Cassava production &amp; value addition by smallholders</td>
<td>Available cassava varieties increased from 2 to 7, 902 farmers (332 female &amp; 418 male) trained on cassava disease management, 357 trained on processing using chippers, successful seed multiplication.</td>
<td>59% of beneficiary farmers have planted new varieties on a total of 288 ha and have produced 925.6 metric tons of cassava &amp; over a million cuttings for planting, 3 new cassava products (cakes, cookies &amp; high quality flour).</td>
</tr>
<tr>
<td>Integration of multi-purpose trees in farming systems</td>
<td>Insights that Acacia saligna can be integrated in existing farming systems (tested by 115 farmers) with benefits as rehabilitation of land, fuelwood, fodder, wood for construction &amp; possibly used meal for chicken – no policy documents as focus was on scientific articles.</td>
<td>395 farmers planted 59,000 seedlings in 2 communities. Through workshops, policy makers have made commitments to scaling up the use of Acacia saligna &amp; the private sector now sees the tree as a commodity.</td>
</tr>
<tr>
<td>Integrated multi-trophic aquaculture (IMTA)</td>
<td>Integrated multi-trophic aquaculture (IMTA) showed improvements on water quality, shrimp disease rates &amp; survival rates &amp; insight that in 12 to 16 weeks juvenile blue swimming crabs (BSC) (bycatch) can grow to about 100 gr, fetching € 6/Kg (instead of less than 10 cents for juveniles).</td>
<td>Increased pond harvest for farmers and increased income by 50–100% larger batches of good sized shrimps can be sold directly on urban markets &amp; additional income of 12 euros/2 hours of selling grown out BSCs € 6/Kg.</td>
</tr>
</tbody>
</table>

“...I was able to double my rice yield when I transplanted rice in lines,” says a farmer. “When I transplanted in lines, I found it very easy to weed, and this enabled me to get more bags from this farm.” another farmer reported. On average, a 14% yield gain has been recorded by farmers who used line transplanting, compared to random transplanting.

Envisioned impacts on smallholder production in ARF and GCP project countries

- Increased sustainable production of quality food at local levels (ARF & GCP) that meets changing local, national or global demands (GCP).
- Improved integration of (local small-scale) farmers and entrepreneurs in local or national (ARF & GCP) or global (GCP) functional markets, including contributions to an enabling institutional environment for enhancing knowledge and governance of local, regional or global food security (GCP).
- Increasing income of farmers at local levels (ARF).
- Contribution to local institutionalisation of learning and local research infrastructures (ARF & GCP).
A women farmers’ group pays for a hydro-pump through EASI – Pay

Corlina Konda Ngguna, a sumbanese woman of 42, is a head of a female farmers group with 21 female farmers within its network. With agriculture being their major source of income, they spend almost seven to ten hours per day in the field. However, none of the women in this group has a land of her own. So, what they generally do is, they borrow the land from landowners who do not use the land in dry season and give it back to them when the rainy season starts. Because they use the land only in dry season, they have to make hundreds of trips from the river to the field and back, carrying buckets full of water.

When the women heard about this pump that doesn’t require any fuel or electricity to be operated, that just runs from the energy of the flowing water, a pump that fits their exact requirement, they were excited and curious at the same time. Farmers generally rely on government’s donation to get such technologies to their field but this group of women, they got ready to pay for the pump on their own, through EASI – Pay Project, an initiative of aQysta, where farmers can get the pump now and pay for it only after they have harvested their crops and made an income from it.

Instead of seven to ten hours, they now spend five hours per day in the field. The rest of the time they spend on weaving clothes, which is their secondary source of income. With the workload getting tremendously lessened as Barsha pump completely replaced the manual work of irrigation; they even increased the land area for cultivation. They used to work in 0.2 hectares of land, whereas they now work in 0.3 hectares of land. They have switched into high-value crops and with KRMW Foundation helping them choose the seeds wisely and Barsha pump helping them irrigate timely, their harvest was 3 times higher than the previous year and of improved quality.

The EASI Pay project received ‘MoMo’ award by the Embassy of the Kingdom of the Netherlands to Indonesia in 2018. The award money helped expand EASI Pay concept to Flores and Sulawesi island.

The priest who changed his mind on Acacia saligna

“I was afraid of what might happen if I planted this tree,” said the priest of Mariam-Agamat village during the Agroforestry Innovation project’s Closing Workshop. “When I first received some seedlings, I planted them far away, as far away from my house as I could.” He told the group that he was fearful of any bad effects on his animals or crops that might happened from growing the trees. “But over time, my mind changed, and I brought it nearer and nearer to my house.” The priest, at first simply a member of the Farmer Research and Extension Group (FREG), became the FREG leader so he could help others in his community better understand how the tree might assist them. Through his leadership, the entire community mobilised together in 2017-2018 to plant around 40,000 trees in terraces throughout the steep watershed, to reduce erosion and provide a basis for fodder and fuelwood products in the future. The priest told the workshop, “Now I am convinced that this Acacia saligna is a good tree and a useful tree for farmers in our area.”

(AF – Farmer-led Agroforestry Innovation in Ethiopia: Improving livelihoods and food security by utilising Acacia saligna)
Circular Agriculture & Indigenous foods and techniques

Circular Agriculture

Circular Agriculture aims at closing the loop between livestock and crop production systems at several levels. Several GCP and ARF projects contribute by minimising losses, recycling nutrients or by introducing alternative sources of nutrients. The ARF and GCP project on this page focus on sustainable aquaculture and composting. Both projects aim to improve agricultural efficiency without damaging the environment, combining technological, ecological, social and economic principles.

Indigenous foods and techniques

Local and indigenous foods and techniques have a great potential to contribute to improved food and nutrition security, as well as economic empowerment, of poor and marginalised farmers and consumers. The two projects on this page focus on techniques – irrigation and rainwater harvesting – and production of indigenous grasses, creating awareness and/or promoting its use.

Circular Agriculture

<table>
<thead>
<tr>
<th>Project Topic</th>
<th>Main outputs</th>
<th>Main outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composting &amp; alternative fish and livestock feed</td>
<td>Bio-slurry can be used as compost and lemna (duckweed) as fish &amp; livestock feed &amp; 1858 (39% women) trained on the techniques.</td>
<td>By the end of the project period, at least 13 bio-slurry and lemna businesses have been established independently by the beneficiaries.</td>
</tr>
<tr>
<td>Sustainable shrimp farming</td>
<td>Good Shrimp Farming board game allowing farmers to explore risks &amp; benefits of different shrimp farming systems &amp; reflect on their decision making &amp; Agent-Based computer Model (ABM) showing vulnerabilities &amp; future bankruptcies in shrimp farming under the present policies with focus on intensive monoculture.</td>
<td>The game gave farmers insights that sustainable shrimp farming can be economically profitable, made them aware of the risks of intensive shrimp monoculture &amp; stimulated social learning: farmers consulted each other more often than before &amp; asked less advice from the salesmen of veterinary products. Involved policy makers have shifted opinion: &gt;75% now favours interventions on maintaining mangrove and &amp; making shrimp production more sustainable. They recommend both the game and the ABM to be widely used.</td>
</tr>
</tbody>
</table>

Indigenous foods and techniques

<table>
<thead>
<tr>
<th>Project Topic</th>
<th>Main outputs</th>
<th>Main outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous pasture production and rainwater harvesting</td>
<td>Knowledge created and shared with almost 2000 farmers on indigenous pasture production, forage quality of indigenous grasses, the pasture value chain &amp; rainwater harvesting from the road</td>
<td>Beneficiary farmers view indigenous pasture farming as a getaway to healthier animals, mitigation against soil degradation &amp; a viable source of income &amp; they apply the acquired knowledge and skills in their farms. Kitui County Government puts more emphasis on pasture production in farming policy.</td>
</tr>
<tr>
<td>Farmer-led Irrigation</td>
<td>Insights that farmer-led irrigation is ‘big’ and farmers are active in expanding and improving irrigation. Based on the current irrigation &amp; available water, irrigated area could be increased. The scale &amp; potential of farmer-led irrigation remains invisible for policy makers &amp; agricultural professionals.</td>
<td>Awareness creation among donors &amp; policy makers to support farmer-led irrigation development in Mozambique.</td>
</tr>
</tbody>
</table>

Envisioned impacts on circular agriculture and indigenous foods and techniques in ARF and GCP project countries

- Increased sustainable production of quality food at local levels (ARF & GCP) that meets changing local, national or global demands (GCP)
- Decreased food losses along local or national food chains from production to consumption (ARF)
- Improved integration of (local small-scale) farmers and entrepreneurs in local or national (ARF & GCP) or global (GCP) functional markets, including contributions to an enabling institutional environment for enhancing knowledge and governance of local, regional or global food security (GCP)
- Increasing income of farmers at local levels (ARF)
- Contribution to local institutionalisation of learning and local research infrastructures (ARF & GCP)

“If I divert runoff water from the road passing next to my farm, I can direct it into dug trenches. This has led to my farm being ‘evergreen’ during both the dry and rainy season. Really, water harvesting can change our farms.”

(ARF – Rainwater harvesting from roads for indigenous pasture production & improved rural livelihoods in Kenya (ROFIP)
During the baseline study Mr. Vo Van Thao thought integrated shrimp systems (ISM) provided low benefits and the income from a hybrid IMS-Intensive was less stable than that from his own system. He thought that the mangroves and IMS were not important for income safety and shrimp disease prevention. After playing the game twice, he appreciated more the roles of mangroves, and gave higher ratings to IMS than before. From playing, he learned the benefit-cost of every system, and how to invest.

(GCP – Serious games for sustainable shrimp farming in Viet Nam (ALEGAMS))

Women use bio slurry for vermicomposting business

Eti Rohaeti (37) is one of the women using bio slurry since 2014. Training from the PROFARM/GADING project provided her with knowledge and skills on how to use bio-slurry for composting, how to breed and use earthworms to improve composting and how to grow Lemna. At the beginning, she used the vermicompost she made only to fulfill the needs of agriculture activities owned by her family. But the trainings were followed by technical assistance and provision of infrastructure to ensure that Eti and the other beneficiaries could apply and benefit from the knowledge gained for their households and community. After joining a number of the project’s trainings, Eti applied the knowledge and decided to start a vermicomposting business. Along with the visible result, her neighbour became interested to use the fertilizer. “Formerly, there were no people wanting to buy or even use vermicompost. I used it for my own farming. But after my neighbours saw that my plants grew better, people started to know the benefit of vermicompost,” Eti remembered. Now, Eti runs the businesses together with other women in the area. Their business runs well and has provided economic benefit for their families. As the business developed, Eti and her friends also contributed in campaigning the sustainable agriculture practice by utilizing bio-slurry for vermicomposting.

(ARF – Greening farms in Indonesia (PROFARM))

Lemna (duckweed) proved valuable fish and livestock feed.

Farmers involved in the ROFIP project now view indigenous pasture farming as a getaway to healthier animals, mitigation against soil degradation and viable source of income (agriculture for business) through sales of grass seeds (€ 9 per kilo) and bales of hay (€ 3 per 15 kilo bale) in the local markets and are applying this acquired knowledge and skills in their individual farms. Kitui County Government has changed their approach in farming, putting much more emphasis on pasture production in line with their cattle breeding program. These priorities have been developed during the collaboration within the ROFIP consortium and is a big game-changer in agricultural policy and strategy.

(ARF – Rainwater harvesting from roads for indigenous pasture production & improved rural livelihoods in Kenya (ROFIP))

Harvesting runoff from road structures.
LEAP-Agri Impact Pathway

<table>
<thead>
<tr>
<th>Policy goals</th>
<th>Focus 1: Sustainable intensification</th>
<th>Focus 2: Agriculture and food systems for nutrition</th>
<th>Focus 3: Expansion and improvement of agricultural markets and trade</th>
<th>Cross-cutting: improved science-based policy and practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>LEAP-Agri contributes to improved Food and Nutrition Security &amp; health for long term sustainability and resilient livelihoods.</td>
<td>LEAP-Agri contributes to improved food and nutrition security in target countries.</td>
<td>Improved integration of local small-scale farmers and entrepreneurs in value chains in LEAP-Agri target countries enhances resilient livelihoods.</td>
<td>LEAP-Agri contributes to new and improved African and European food policy and practices.</td>
</tr>
<tr>
<td>Outcome</td>
<td>Innovative, technical, infrastructural &amp; institutional improvements for sustainable agricultural intensification are implemented by stakeholders in target countries.</td>
<td>Wider communities (research, practitioners, policy makers) integrates new knowledge and innovations which lead to:</td>
<td>Local small-scale farmers have access to improved infrastructure and value chains.</td>
<td>Relevant partners within and outside LEAP-Agri take up LEAP-Agri insights and innovation to improve policy and practice on food and nutrition security.</td>
</tr>
<tr>
<td></td>
<td>Stakeholders mitigate impact of disease on nutrition, production, food security and health for long term sustainability (one health).</td>
<td>• sustainable innovative agricultural and food systems;</td>
<td>Stakeholders use LEAP-Agri results to realise improvements of market/trade options/regulations.</td>
<td>Communities of thinking and practice among EU/AU institutes are established.</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Innovative, technical, infrastructural and institutional improvements for sustainable agricultural intensification are improved.</td>
<td>• improved productivity and sustainability of food systems;</td>
<td>Value chain stakeholders and policy makers show interest in new knowledge and innovations for enhancing inclusive value chain access.</td>
<td>Policy interest and engagement with LEAP-Agri projects.</td>
</tr>
<tr>
<td>Outcome</td>
<td>Stakeholders have improved access to and awareness of new insights and innovations regarding safe and nutritious food.</td>
<td>• improved food quality (nutrition, food safety and health).</td>
<td></td>
<td>Local and international participation in capacity building.</td>
</tr>
<tr>
<td>Activities</td>
<td>• Innovative scenarios for managing sustainable intensification identified using a food system approach;</td>
<td></td>
<td></td>
<td>Lessons learned for policy &amp; practice from integrated research approach with co-creation and stakeholder engagement in projects.</td>
</tr>
<tr>
<td>of the 27</td>
<td>• ICT and innovation platforms are operational;</td>
<td></td>
<td></td>
<td>LEAP-Agri meetings &amp; community building (e.g. conferences, project collaborations) - Cross project knowledge exchange.</td>
</tr>
<tr>
<td>projects</td>
<td>• Pest and disease problems are identified and institutions &amp; innovations for pest and disease management are created.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

On 12 March 2019 a kick-off meeting for all Dutch teams in LEAP-Agri was held inviting researchers, stakeholders and policy makers to the Ministry of Agriculture. The aim of this meeting was to create synergies between the funded projects. A report from the meeting, including the outcomes and policy recommendations for further execution of the projects can be found here.

From the beginning of the projects’ implementation there were issues with some of the funding partners who did not (fully) finance their research teams. These issues persisted in 2019 and complicate the cooperation in the LEAP-Agri projects. However, the main problem, which was caused by internal reorganisation of funding bodies on government level in Uganda, is improving and the necessary contracts have in the been signed in late 2019. This should un-block the co-funding funds from the EC in early 2020.
Rethinking agricultural food production: critical questions when thinking circular

Global agriculture is facing a major challenge: feeding a growing world population while keeping its footprint within planetary boundaries.

Those seeking solutions to restructure our food system are looking for answers to some challenging questions:
- How can we combine technological innovation while maintaining or even enhancing our ecological values?
- How can we improve agricultural efficiency to feed a growing population without damaging the environment or raising production costs? And, are there ways to combat or mitigate the climate change impacts that affect the reliability of our harvests?

Circular agriculture can provide answers to some of these questions. Yet, there is no blueprint to adopting such an approach. A collective pursuit by farmers, citizens, businesses, researchers and policymakers is needed to find the right combination of technological, ecological, social and economic principles. In this two-pager, based on a synthesis study of the projects under the Food & Business Research programme, three questions are put forward to contribute in seeking solutions to restructure our food system:

Key Question 1: How can we preserve and enhance our natural resources?
To manage our natural resources in a sustainable way, it is becoming increasingly important to capitalise on natural processes and services that are innate to the ecosystem so that we can reduce non-renewable or hazardous inputs. These processes and services include the inherent capacity of ecosystems to deal with pests, diseases and weeds, to maintain soil functions, and to improve resilience against unfavourable weather conditions.

The synthesis study showed that a variety of circular approaches can achieve such a robust ecosystem, while providing promising results in terms of productivity and nutritional value. Innovations were introduced and tested with (new) crops or plants that tolerate particular harsh weather conditions or that have the natural capability of giving life back to formerly depleted soils (Acacia saligna in Ethiopia). Other research focused on treating crop pests and soil-borne diseases without using chemicals and succeeded in producing higher yields and thus higher income for smallholder farmers (tomato production in Kenya). Finally, systems were introduced that focused on the regenerative capabilities of nature by carefully exploring how different components of the system interact. A system was developed that tested how fish feed and fish waste interacted with aquatic life in fish ponds in order to reduce disease outbreaks and lower the need for inputs (shrimp farms in Viet Nam).

Each of these circular approaches comes with its own set of challenges, such as a lack of capacity, risk-averse attitudes of farmers, and a lack of trust in the unfamiliar. A common challenge for smallholders across the projects is limited access to knowledge of tried and tested circular approaches.

Key Question 2: How can we manage our food systems in a sustainable way?

To maintain food systems in a sustainable way, it is becoming increasingly important to capitalise on natural processes and services that are innate to the ecosystems so that we can reduce non-renewable or hazardous inputs. These processes and services include the inherent capacity of ecosystems to deal with pests, diseases and weeds, to maintain soil functions, and to improve the reliability of our harvests.

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Key Question 3: How can we ensure that our food systems are inclusive and equitable?

To ensure that our food systems are inclusive and equitable, it is becoming increasingly important to capitalise on natural processes and services that are innate to the ecosystems so that we can reduce non-renewable or hazardous inputs. These processes and services include the inherent capacity of ecosystems to deal with pests, diseases and weeds, to maintain soil functions, and to improve resilience against unfavourable weather conditions.

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Key Question 1: Is it possible to use resources more efficiently?

An ecosystem is most efficient when it nurtures a dynamic cycle of nutrients, energy and matter. The circular hypothesis is that the more self-reliant and efficiently the natural system can function, the higher its potential to produce stable yields at lower costs in a more environmentally sustainable way.

WOTRO-funded research projects have tested this premise for both livestock and crops. In Brazil, ongoing research shows that context-specific breeding programmes can potentially improve productivity at a lower cost. Another approach involved the introduction of species that have higher resource use efficiency. For example, the Black Soldier Fly proves to be a promising alternative in animal and fish feed, as it has shown to enhance the growth rate of fish in less time and at lower costs compared to standard feed. Projects have also shown how ‘closing the nutrient loop’ can work effectively, as in the case of aquaponics approaches in Ethiopia. There, a symbiosis is created between fish rearing, soil fertility and crop growth in a closed system that shows potential for application in urban areas and drought-prone regions. However, scaling the technical know-how of such technologies and processes beyond the field test farms and their direct beneficiaries comes at a cost. Government support is indispensable if wide-scale adoption is the goal.

Weblinks
- Paper ‘Opportunities and barriers for Circular Agriculture’.  
- Food & Business Research programme  
- Food & Business Global Challenges Programme project overview  
- Food & Business Applied Research Fund project overview  
- Food & Business Knowledge Platform

Key Question 2: How can we add value to waste?

Waste is the new gold. At least, that is a growing belief among supporters of a circular economy and a circular food system. In a world faced with growing food shortages, it does not make economic sense to accept the high losses that mainstream food systems suffer at practically all stages of the value chain, from harvesting, to processing and consumption. Circular agriculture principles move away from the ‘take-produce-consume-discard’ model and seek to create a system that recycles on the 3Rs: reuse, recycle and reduce of existing or used materials and products.

The synthesis study showed how waste streams can be turned into valuable resources in LMICs, when appropriately managed and if commercial and public institutions provide the necessary logistical support and investments. A Ghanaian research team pioneered the possibilities of valorising organic waste collected at local markets by turning it into compost (school waste collection and composting in Ghana). Interestingly, another project has shown that organic waste can even be upgraded to a higher protein content. By feeding organic waste to Black Soldier Flies, smallholders can create a more efficient and affordable fishmeal or animal feed for their livestock (BSF in Kenya). Even human waste has seen repurposing in Bangladesh, where urine is collected and converted into valuable and perhaps more importantly, affordable, organic fertilisers (as a nitrogen fertilizer component in Bangladesh). For waste to become financially valuable, further streamlining of technologies needs to happen, together with efficient organisation of the separation and collection of waste streams, greater market demand and cultural acceptance of seeing waste as a valuable product. However, there is also a potential downside to the increasing economic value of waste, as this might limit the opportunities for smallholders and poor and marginalised groups who traditionally often make good use of waste streams as a cheap resource for their agri-businesses.

How can we make it all happen?

The research shows that there are trade-offs to be accounted for when applying circular approaches to agricultural practices. The key question is why will benefits from these circular processes? Can we expect smallholders to make similar investments in time and knowledge as larger commercial farmers? The findings emphasise that context-specific results cannot be expected to apply to the realities of farmers across the board. Circular practices should not be promoted blindly, as they can lead to unmanageable increases in workload, especially when the food system does not yet support the new approaches. Such support might entail the need for product quality guarantees through certification and guaranteed commercial offset and market demand. Supportive government regulations and by-laws are also required to enable necessary logistical or infrastructural changes that allow new circular approaches to be introduced at scale.

Above all, in LMICs the new technologies, markets and products that circularity introduces need to be accessible, affordable, and culturally acceptable to the smallholders and marginalised consumers it seeks to serve.
Working towards impact on food & nutrition security

The theories of change developed for the Applied Research Fund and the Global Challenges Programme both have underlying assumptions on food security issues, food security policy, and the research framework applied. Several years into the Food & Business Research programme, several of these assumptions have been validated, but others have been found invalid, or valid only under certain circumstances. The following pages provide insights from the projects on the validity of the assumptions, as well as the findings of an external review of the ARF.

Food security

In general, ARF projects did not struggle with the assumptions on food security issues, indicating that those have been laid out well in the call for proposals. Also the Syspons evaluation was positive that business models and value chains can be developed in inclusive ways. At the same time, however, Syspons became aware of a trade-off between the programme objective of fostering private sector development and supporting food insecure target groups. ARF projects that aim to establish a business model do not consistently focus their efforts on vulnerable target groups that suffer under food insecurity in the partner countries, but on those who can contribute to the business effort (which mostly are farmers with sufficient income and education). Also in the GCP programme, projects only partly confirmed the assumptions that business models can be inclusive of poor farmers. Marketing the surplus from allotment gardens for example provided extra income. Another project, however, mentioned that inclusiveness is often constrained by profit prospects.

The assumption that increased income of farmers and other producers leads to better food and nutrition security did not hold in all projects. One project even argued that increasing cash crop production (and thus income) reduces household food and nutrition security, because the land area under food crops decreased. Another project commented that higher income can lead to better food and nutrition security, but only when accompanied by nutrition education. Also the Syspons evaluation specifically mentioned that, while the projects contribute to an increase in income of the ultimate target group, this does not necessarily lead to an increase in spending on food or savings and therefore higher food security. The Syspons case studies showed that farmers did not see themselves as being food insecure and thus spend the additional money on transportation or education for their children. The assumption that increased income leads to increased food and nutrition security could therefore not be validated.

Food security policy

Not all assumptions on the food security policy were found to be valid in all cases. Two ARF and one GCP project for example mentioned that a focus on the Dutch policy goals in agriculture does not always align with the goals of the project country. According to one of the projects, ‘running a consortium with different partners is already difficult in itself – a process of knowledge co-creation is not easy’ – and by adding a Dutch policy interests to it, it makes even more complex’. Another project noted that the strong focus of Dutch policy on market solutions can in fact have adverse effects on food and nutrition security, because the own production and availability of food crops decreases.

Key assumptions

On the food security issues addressed in the calls for proposals

1) Business models and value chains can be developed on inclusive ways (ARF)
2) Business models can be inclusive of poor producers and consumers (ICP)
3) Nutrition is in the minds of all engaged actors (ARF)
4) Increased income of farmers and other producers leads to increased (local) food and nutrition security (ARP & ICP)
5) Gender-sensitive farming practices improves income for women, which leads to more food and nutrition security (ARP)
6) Starting from consumer demands enhances the potential for small-scale farmers to be linked to value chains (ARP)
7) Food systems have a ‘purpose’ and factor for economic and social development (ARP)
8) Knowledge and technology are limiting factors in enhancing food security (ICP)
9) A food system approach is adequate for studying complex and interrelated FSN challenges (ICP)

On the food security policy guiding ARF & GCP

1) Local demand is in accordance with the MASPs in the respective countries (ARP)
2) Private sector development will lead to enhanced integration of small-scale farmers in markets (ARP & ICP)
3) Private sector supports dissemination of knowledge (ARP & ICP)
4) Increased income leads to increased (local) food and nutrition security (ARP & GCP)
5) Small-scale farmers and other producers need to scale up practices to enhance local food and nutrition security (ARP & ICP)
6) Actors in local, national and international food systems are in accordance with the objectives set out in the Dutch policy for Food Security (GCP)
7) Dutch policy addresses crucial global FSN challenges (ICP)
8) The for-profit private sector is important for achieving FSN (ICP)

On the research framework applied in ARP & GCP

1) A contribution to food security and private sector development is achieved ... through GCP projects creating knowledge that can be further developed and applied by the target groups (e.g. the food insecure) ... through the implementation of various modes of knowledge and innovation diffusion (e.g. through involvement of final beneficiaries, through the involvement of the main stakeholders along specific value chains) ... through cooperation and involvement of (public) governance and outreach stakeholders that can diffuse knowledge and innovation (ARP & GCP)
2) Actors from policy and practice are willing and able to be informed by knowledge; new and pertinent knowledge is used in decision-making (ARP & GCP)
3) More knowledge leads to application (ARP & GCP)
4) Collaboration between various partners leads to synergies >> interests and world views of partners align (ARP & GCP)
5) Interests of consortium partners and stakeholders are aligned (ARP & GCP)
6) Stakeholders can be considered as homogeneous, aligned; are well organized and part of well-functioning institutions (ICP)
7) Engagement of stakeholders leads to research uptake >> stakeholders are homogeneous and have similar interests (ARP)
8) Stakeholders are in a position to influence policy, practice and partnerships (ICP)
9) Stakeholders are well organized and part of well-functioning institutions (ARP)
10) By putting the lead of the consortium in the hands of a practitioner’s organisation research will be demand-driven and this will lead to ownership and uptake of results (ARP)

Nor was it always the case that the private sector supports dissemination of knowledge nor that development of the private sector always leads to enhanced integration of small scale farmers in markets. Regarding the first, the private sector requires input from other key stakeholders to affirm the validity of the knowledge. In addition, one project mentioned that the private sector ‘unnecessarily guard knowledge as business secrets’. Regarding the latter, one project found that partnerships between companies, smallholders and other public and private partners indeed results in market integration of smallholders, but also that exclusion and ‘adverse inclusion’ for those with limited benefits is a large flipside of it.

Finally, the assumption that small-scale farmers and other producers need to scale up practices to enhance local food and nutrition security was counteracted by some projects. One project for example specifically mentioned that diminishing the risk of failing harvest does much more for local food and nutrition security than actual upsaling of production.

Lessons learned

6 Lessons learned
The research framework

The projects provided much feedback on the assumptions underlying the research framework applied in ARF and GCP. For ARF, putting the lead of the consortium in the hands of a practitioners’ organisation has indeed made the research demand-driven and led to better ownership and uptake of the results. Many projects also positively commented that engagement of stakeholders and the co-creation process leads to better uptake of research results. However, the assumption that stakeholders are homogeneous and have similar interests and the assumption that stakeholders are well organised and part of well-functioning institutions, were not or only partially validated. Power differences and conflicting interests exist among stakeholders. In addition, farmers sometimes receive contradictory messages from ‘boundary partners’. Nevertheless, projects reported that the co-creation approach definitively brought the different partners closer together, resulting in new or strengthened existing partnerships. One project commented that although the co-creation approach has been very important in the project, it was not enough to have the envisioned big impact, because of weaknesses in the organisational, institutional and financial environment.

The assumption that stakeholders are in a position to influence policy, practice and partnerships, was validated only to a limited extent. Although governmental and non-governmental actors acknowledge the importance of farmers’ knowledge, achieving more structural changes is limited (integrating Learning Platforms into work-plans of government agencies can be a solution). Another project found that farmers, farmer organisations and small and medium enterprises do not have the power to influence, nor have the avenues to advocate for their interests.

Finally, more knowledge can lead to more application, but not automatically. It requires deliberate efforts to engage in transdisciplinary teams and platforms. As formulated by one project: ‘Especially peer-to-peer learning between farmers, facilitated by the project approach of collecting ‘innovations from below’ and sharing them in LPs resulted in knowledge being applied. The application of knowledge was facilitated because innovations were relatively simple and low-cost, while farmers were able to see the practices in the field and to approach their peers.’

Early in the project, the Technical Working Group realised that policy influence and scaling-up would only occur if the project engaged more closely with decision-makers from the regional government and private sector. A collaborative approach would help take them on the journey of mindset change and to see the benefits of growing and utilising Acacia saligna.

(Farmer-led Agroforestry Innovation in Ethiopia: Improving livelihoods and food security by utilising Acacia saligna)

A major strength that Syspons found, is that the ARF programme is largely effective, meaning that most outcomes are reached across the programme.
Introducing programme indicators

With the revision of the programme impact pathways in 2018, programme indicators at output and outcome level have been formulated for both GCP and ARF. Projects from both programmes now report on a self-chosen set of those indicators in their final reports. Although the goal of a clean database at programme level could not be met – projects report on different indicators and they report in different ways on the same indicator – the overview of project reporting on programme indicators is still valuable because it allows us to concentrate project progress in one place, which makes it easier to reflect on the progress on programme level. Project reporting on indicators might improve when the indicators are built in their M&E framework from the onset of the projects, which was not the case in GCP and ARF.
The Food & Business research programme implements the research agenda of the Food & Business Knowledge Platform, set up by the Ministry of Foreign Affairs of the Netherlands.

The Food & Business Global Challenges Programme (GCP) is a transdisciplinary research programme on food security. It supports the development of new products, practices and policies that improve food security in Low and Middle Income Countries (LMICs). Examples of projects include sustainable horticulture in Chile, improvement of the cocoa sector in Ghana, empowering women food entrepreneurs in Kenya, and efficient fishery chains in Indian cities. The programme aims to generate understanding of emerging key issues in food security and the role of the private sector. It is funded by the Ministry of Foreign Affairs of the Netherlands with co-funding from NWO, the Dutch Research Council.

NWO-WOTRO Science for Global Development of the Dutch Research Council (NWO) manages the research programme and developed the calls for proposals.

This book showcases the results and findings of the fourteen projects funded in the first and second call of the Global Challenges Programme.

NWO-WOTRO Science for Global Development

The Dutch Research Council (NWO) funds top researchers, steers the course of Dutch science by means of research programmes and by managing the national knowledge infrastructure. NWO plays different roles: financing, programming, bringing together, supporting and influencing.

WOTRO Science for Global Development, a division of NWO, funds and monitors innovative research on global issues, with a focus on sustainable development and poverty reduction. NWO-WOTRO’s research projects are realised by interdisciplinary teams of researchers from the North and South and in close collaboration with non-academic stakeholders. These partnerships yield solutions for development challenges and strengthen the bridge between research, policy and practice.

Food & Business Knowledge Platform

The main objective of the Food & Business Knowledge Platform (KP) is to increase the impact of Dutch research projects, programmes, policies, investments and business on SDG2 by knowledge brokering across professional divides. The KP will facilitate the creation, exchange and use of knowledge by the collection, connecting and combining of knowledge for Dutch actors and their partners working in LMICs on Food System Transformation.

As such, the new Knowledge Programme is the response to a changing context and inspired by five years’ experience of the F&BKP and its consortium partners. The KP will be one of the building blocks of the envisioned Netherlands Food Partnership (NFP) and will become the space for Dutch knowledge brokering in the field of Food System Transformation aiming at Food and Nutrition Security (FNS). This is relevant, since the complex and multifaceted character of FNS calls for an integrated approach, creating synergies and countering fragmentation of relevant knowledge and expertise.
Food security challenges

Food security is high on the international agenda. More than 800 million people suffer from chronic hunger, and 2 billion people face malnutrition. Population growth, dietary shifts and climate change further aggravate the problem. The situation calls for appropriate policy responses, but also offers challenges and opportunities for private enterprises. New knowledge, contributing to new insights, can help policy makers, the private sector and civil society to meet food and nutrition security challenges.

Project partners

GCP is a response to this need. The research is executed by consortia of research institutes and project partners in the Netherlands and LMICs. The project partners—example industry, ministries, local governments, farmer cooperatives and NGOs—are involved from the research proposal stage onwards. Capacity building and knowledge sharing with the project partners and other stakeholders form a crucial element of the projects.

System approach

The researchers, coming from different disciplines, focus on a system approach. This approach considers food and nutrition to be the outcomes of interactions between different elements of a system. The teams analyse the drivers (from the global to the local level) that can improve the situation for the most vulnerable consumers. This requires insight into the roles of participants within the food system, such as women and men, smallholders and commercial farmers, traders and consumers, policymakers and industry.

Research projects

GCP is financed by the Dutch Ministry of Foreign Affairs and NWO-WOTRO Science for Global Development. The Food and Business Knowledge Platform supports the programme by articulating knowledge demands, developing joint knowledge and sharing results. Thirty projects were started between 2014 and 2017. Some have a duration up to five years (maximum of 600,000 euro per project), others of two to three years (maximum of 250,000 euro per project). All projects of the first and second call were focusing on issues around Inclusive (Agri)Business.

Food & Business Global Challenges Programme

Projects first & second call

Projects first call 2014

9- Zambian traditional fermented foods
11- Nutritious System Pond Farming in Vietnam
15- Adapting pork production to local conditions in Brazil
17- Helping poor farmers grow money in Sierra Leone
19- Inclusive value chain collaboration in Ghana and South Africa
21- Intermediaries in inclusive business networks for scaling food security

Fast Track projects, second call 2014

25- ALEGAMS: Assessing Learning Effects of Serious Games on Attitude of Stakeholders on Sustainable Shrimp Farming in the Mekong Delta
27- Promoting healthy diets and agri-business development through Aquaponics farming
29- Information transparency system as a low-cost scalable solution to farmers access to credit and services

Integrated Projects, second call 2014

31- Follow the Food: Dutch agribusiness and local food security in Africa
33- ILIP: Improving livelihood by increasing livestock production in Africa
35- Licap: Local and International business collaboration for productivity and quality improvement in Dairy chains in Thailand, Indonesia, Tanzania and Kenya
37- SUPERSEAS: Supermarket supported area-based management and certification of aquaculture in Southeast Asia
39- WFE: Women Food Entrepreneurs

Overview by Nicky Pouw

8 - Evidence from the first and second call of the Global Challenges Programme
14 - The key findings and good practices from GCP 1 & 2 projects
23- Recommendations to policy and practice
The Food & Business Global Challenges Programme | First call project
Zambian traditional fermented foods

Fermented food products have significant added value compared to unfermented food products, such as: enhanced digestibility and associated higher nutritional value; enhanced food safety by protection from proliferation of pathogenic microbes; and a prolonged shelf life. Fermented products have been produced and consumed around the world for centuries as a means of preserving food and increasing the nutritional value of raw material. In many African countries, local fermented products exist with interesting properties, which offers a great potential to enhance nutritional status and livelihood of local people. In Zambia, commonly found traditional fermented foods include Mabisi, based on milk, and Munkoyo, based on cereals.

The project aimed to improve the food chains between consumption and production of these two Zambian traditional fermented products by aligning needs and preferences of rural and urban consumers with practices of local producers, mainly women in rural areas. We assessed the variations that exist in processing practices of the two products and the microbiology of fermentation that is key to the processing of these foods. We evaluated the preferences of consumers and producers regarding food safety aspects of the products.

Needs and preferences of rural and urban consumers and production processes need to be aligned for a product to have impact in promoting food and nutrition security. Our project has provided scientific insight to allow to align these needs. Moreover, the nutritional and food safety aspects of products in relation to the currently used processing practices – including mixtures of microorganisms used for product fermentation – need to be optimised to expand production and processing. We are now in contact with larger companies. The project’s next steps are to optimise current processing practices to SME level. We are now able to define starter cultures for the products and their different variations. Starter cultures are defined mixtures of bacteria to ensure more consistent product quality. We assessed food safety properties of the products by studying the ability of relevant pathogenic bacteria to grow and survive in the products during processing and in the final product, using protocols of the European Union. We found that all bacteria tested are inhibited for growth and survival. We are now in contact with the Standards Bureau in Zambia to formalise Mabisi processing protocols to allow sales at the formal market through formal market channels.

Messages to:

- Actors from private sector
  Local cooperatives can develop into organisations that can be equal partners to larger companies.

- Civil society and practitioners organisations
  NGOs who work on local rural capacity building are instrumental to the success of improving traditionally fermented food chains by bringing together local farmers and producers.

- Policy makers
  There is a need for legislation to allow specific products on formal food chains.

Nicky Pouw

Nicky Pouw is Associate Professor in Economics of Wellbeing at the Governance and Inclusive Development Research Programme (GID) at the University of Amsterdam and one of the project leaders of the GCP project leaders and involved in the synthesis study of the Food & Business Research programme.

Final Research Findings
The research consortium started by characterizing the current variations in production processes among producers. It was found that for both products, variations exist that give rise to regional variations of the product. The products are almost exclusively produced at the household level. In fermentations, a first characterisation of the present types of microbes has been made, and the nutritional content of the products has been quantified. The current diet of people in rural areas was additionally surveyed. It was found that especially Mabisi can contribute to optimizing the local diet. Local farmer cooperatives have been formed in the last few years that have also started to process primary produce such as raw milk. The project’s next steps are to optimise current processing practices to SME level. We are now able to define starter cultures for the products and their different variations. Starter cultures are defined mixtures of bacteria to ensure more consistent product quality. We assessed food safety properties of the products by studying the ability of relevant pathogenic bacteria to grow and survive in the products during processing and in the final product, using protocols of the European Union. We found that all bacteria tested are inhibited for growth and survival. We are now in contact with the Standards Bureau in Zambia to formalise Mabisi processing protocols to allow sales at the formal market through formal market channels.

Also read from Nicky Pouw
- The key findings and good practices from GCP 1 & 2 projects P22
- Recommendations to policy and practice P21
the market. Currently, Makola is based on raw milk and Mabisi is produced using plant roots and these are not allowed on the market. The results of our project can be used to initiate approval for sales through formal market channels.

Knowledge networks

Knowledge sharing with the Food & Business Knowledge Platform and Agrifood Business Platform has been very beneficial to the project and other related projects. They further held three dissemination workshops in Zambia, aimed at local producers as well as institutional stakeholders, that were attended by over 400 people.

Co-creation

The project originated from fundamental science and the study of fermentation with a focus on the ecology and evolution of microbes. In this research, there are more questions than this project group has time and resources for. The contribution of various local stakeholders and their organisations has greatly helped to prioritise the research by putting it into the local context. By asking local producers about their practices, needs and queries regarding the products they produce, as well as engaging consumers by asking them about their preferences, this is a very rewarding way to narrow down what questions to ask. Stakeholder engagement is also key to generate logistical support for project activities.

Interestingly, the questions that are viewed as most pressing by rural communities are the same questions that are most exciting from a fundamental science perspective. These questions focus on what factors stabilise (microbial) ecosystems. For local practices, answering these questions should point to best practices on how to get a safe, tasty ecosystem. For local practices, answering this question are most exciting from a fundamental science perspective. Interestingly, the questions that are viewed as most pressing by rural communities are the same questions that are most exciting from a fundamental science perspective.

Future research and activities

Based on the past project, we have obtained funding to continue our work and to further expand. The follow-up project will have 10 PhD/postdoc projects aimed at research into upscaling of Makola processing and connection to consumers, optimisation of nutritional composition and impact in diets of consumers and the interaction with soil quality and soil biology in relation to product properties. Further, we will have a project aimed at assessing the opportunities for entrepreneurship of local female processors. We will not only study Makola in Zambia, but will now also include parallel projects on Mabisi in Zimbabwe and Aïkan in Benin. For this new project, we built partnerships based on the network on the past project and engaged new partners in Zimbabwe and Benin.

10, 11

Siyam Schouten, Wageningen University/University of Zambia

Consortium partners: Tropical Diseases Centre (Zambia); Interbroker International - Zambia Office, CIV Food Engineering (NL), Yobe-for-Life Foundation (NL).

The Food & Business Global Challenges Programme | First call project

Nutritious-System Pond Farming in Vietnam

Aquaculture is the farming of fish and shellfish production in freshwater, marine and coastal environments. These production systems play a central role in global nutrition security and contribute to livelihoods of millions of people around the globe. With wild fish stock declining and aquaculture production increasing at almost 8 per cent per annum in the last decades, aquaculture has become more important than fishery as food provision. This growth is enabled by an expansion of fish and shellfish farming areas and an intensification of the production systems that provide currently roughly half of the fish and shellfish consumed worldwide.

An essential component for this intensification of aquaculture is feed, which uses significant quantities of aquatic (e.g. fish meal and terpenes) and terrestrial (e.g. cereals and pulses) resources. At present, the aquaculture feeding systems target the animal (e.g. fish or shrimp), of which the requirements in terms of nutrients and energy have been studied, but not the contribution of the pond ecosystem and its food web to the animal’s diet. The food web (e.g. the food chain within the pond from phytoplankton, microbes, and other organisms until the shrimp or fish in the pond) is stimulated by non-eaten and non-digested feed, which acts as a fertiliser to the pond.

The objective of this GCP project is to design a “nutritious system” pond concept that exploits the potential of the pond ecosystem to mineralise wastes and produce natural foods. The pond aims to increase the contribution of natural food produced in ponds to total pond production, and to make aquaculture less reliant on fish meal and fish food. The “nutritious system” concept aims to stimulate the microbes activity that mineralises (or “processes”) wastes in the pond and the production of high-quality natural foods. Actually, Nutritous-Pond search to optimise mineralisation and nutrient fluxes through the food-web. As such, the aim is to make pond farming more sustainable and predictable to farmers. This five-year project integrates three components: firstly, fundamental research; secondly, applied research with on-farm trials; and lastly, interactive design platforms to adapt the new feed system to the local technological, social and institutional context.

The Nutritious-Ponds project develops this concept using shrimp aquaculture in Vietnam as a model, and an innovation platform to design the technology in order to enable its uptake by the sector. This innovative feed-the-system concept will be developed in cooperation between industry (Nutreco - The Netherlands, Skretting- Vietnam, and Yike UC - Vietnam), universities and research organisations (Wageningen University - the Netherlands, Can Tho University - Vietnam, and WorldFish) and Vietnamese farmers. The platform fosters the dialogue between stakeholders in the sector, shares results from fundamental research and on-farm trials, and supports the inclusion of different farming types in the innovation process.

Final Research Findings

• Removing fishmeal and oil from shrimp feed did not reduce shrimp growth significantly. The same happened when replacing expensive organic nitrogen with cheap inorganic nitrogen while not changing the carbon input.

• In a controlled environment, reducing the feed load with 40% while doubling the Carbon:Nitrogen ratio did not significantly reduce shrimp production.

“Moving towards sustainable intensification of shrimp culture will requires changes of the regulatory framework”

• Participatory analysis of the shrimp system showed that the uptake of the technology will be easier if the nutritive system ponds becomes more robust. The latter includes (i) making the nutritive feed concept less sensitive to climate change and disease than existing farming systems; (ii) relying on novel – presently underutilised – novel crop waste products, and (iii) managing diseases at the landscape level.

• Innovation system analysis of the shrimp sector demonstrated that moving towards sustainable intensification of shrimp culture will requires changes of the regulatory framework (i) to allow efficient control of input quality and wastewater management, and (ii) to stimulate better coordination between
Working towards impact on food & nutrition security

- Research on scaling the innovation demonstrated that farmer clusters are key to (i) get access to new technologies and (ii) build trust between farmer and (novel) knowledge providers.
- An innovation platform composed of farmers, extension services, the private sector, researchers and NGOs defined experimental trials and their monitoring. The preliminary results showed that in semi-intensive and improved extensive systems, replacing about 25% of high priced ingredients with less expensive carbohydrate sources can reduce the cost of production up to 30% while reaching similar productivity than in a conventional system. Similar results were observed during the three successive years of on-farm experiments. On-farm experiments showed that using Nutritious Pond Feed makes the pond less vulnerable to disease outbreaks and reduces the cost of production, hence raising farm income.
- In intensive culture, corn starch results in higher production than mahasee application as carbohydrate source.
- A nutritious pond system contributes to the highly unsaturated fatty and dietary requirements of cultured shrimps, allowing to reduce the inclusion of this expensive resource in the diet.
- Feeding 50% less protein, while substituting the associated reduction in dietary nitrogen application with inorganic nitrogen, and the reduction in dietary carbon by carbohydrate application, did not affect shrimp production and increased farm income.

**Policy makers**
- To be sustainable, intensification of aquaculture production for smallholders should be based on ecological processes and should aim to reduce production costs and environmental impact.
- Reducing risk of disease and production cost while increasing yield and return for smallholder farmers is possible by feeding both the shrimp and the pond.

**Knowledge networks**
- The project initiated the Nutritious Pond Innovation Platform that includes farmers (extensive and intensive), private companies, feed producers, aquaculture certification bodies, research institutes, universities, and extension services.
- The project used WorldFish, Skretting and Wageningen University network to scale the concept and experiments in other research funded project in Bangladesh, Zambia. The informal Nutritious Pond network now include researchers in Bangladesh, private and public sector in Zambia and a research Center in Egypt.

**Messages to:**

**Actors from private sector**
- Co-designing a new feed system with farmers, extension services and local authorities helped to adapt the new feed system to local context and facilitated its future uptake by farmers.
- Communicating innovation and novelty through farmer clusters helped in building trust towards the private sector and facilitated adoption.

**Civil society and practitioners organizations**
- Yield and profit from semi-intensive systems can be improved by reducing the feed amount and feeding both the shrimp and the pond. This improves the within pond nutrient cycling and returns the contribution of natural food to the total pond production.

**Knowledge generated by experiments in a controlled environment are and will be published in peer review articles. Research findings were also be presented in conferences to reach the scientific community. At the local level, research findings were presented during a Master Class in Can Tho University, while recommendations to deploy the new feeding system were presented to farmers and extension services in Hoa De Cooperative, Soc Trang province.**

**Research will continue with additional PhD projects looking at energy evaluation of pond diets based on locally available plant-based novel feed ingredients and nutritious feed utilisation efficiency in Tilapia & carp polyculture systems in south east Asia.**

**Future research and activities**
- The Knowledge generated by experiments in a controlled environment are and will be published in peer review articles. Research findings were also be presented in conferences to reach the scientific community. At the local level, research findings were presented during a Master Class in Can Tho University, while recommendations to deploy the new feeding system were presented to farmers and extension services in Hoa De Cooperative, Soc Trang province. Research will continue with additional PhD projects looking at energy evaluation of pond diets based on locally available plant-based novel feed ingredients and nutritious feed utilisation efficiency in Tilapia & carp polyculture systems in south east Asia. In addition, the technology will be piloted and scaled in Zambia, Bangladesh and Egypt for tilapia culture. Design of new feeds will continue with Skretting, Alien Aqua and de Heus as feed company partners to commercialise “nutritious pond diets”, stakeholder groups in Vietnam, the latter usually not facilitating dialogue between small scale farmers and companies. The platform was also used to support the Rapid Appraisal of Aquaculture Systems where different stakeholders groups have identified constraints and opportunities for sustainable intensification of the shrimp aquaculture sector. It has supported lively debates between different stakeholder groups to identify future solutions for shrimp aquaculture development.
Nicky Pouw | Key findings and good practices from GCP 1 & 2 projects

- How can inclusive Business models contribute to more inclusive and sustainable food systems in low and middle income countries (LMICs)?
- BoPConsumers, producers, workers and entrepreneurs operate at the interface between the informal and formal economy. BoPs also many “hidden costs” that limit their income earning opportunities and render their “businesses” unprofitable. These include economic, social and political ‘costs’, leading to exclusion.
- Formal business and policy actors and institutions tend to overlook the contributions of BoPs to local food systems, as well as their priorities and needs. As a result, food quantities, qualities and flows produced and marketed by and sold to the BoP go unrecorded in official statistics.
- Gender and other social categorisations based on ethnicity and age, influence BoP participation and outcomes in the food value chain. Capacity building fosters empowerment, but social upgrading is a societal broader process that requires involvement and commitment by multiple actors and institutions.
- Bottom-up innovations prove effective to address day-to-day agri-business challenges. These innovations are often times invented by the BoP themselves, but are neither shared with nor valued by other stakeholders. Simple innovative technologies can be professionalised and up-scaled when validated by broader groups of stakeholders.
- The BoP lack critical connections to businesses and government actors and institutions. This limits their potential interaction with other food value chain actors and institutions, and limits their access and use of supportive services (e.g. finance, ICT, capacity building, extension services).
- Social learning between BoPs and other business and government stakeholders helps to identify feasible strategies for mitigating difficult trade-offs between economic viability, social and environmental interests and values in business processes.
- Scientific innovations benefit the BoP when these are affordable, accessible and adaptable (AAA). Their added value within a resource constrained context requires the validation by BoP users. Mutual validation – both scientific research and the ‘real reality’ of the BoP – is thus important for any type of innovation to pay off.
- Financial and business products and services that are climate-smart and attuned to the capabilities and needs of the BoP reduce vulnerability and risks, by improving consumption smoothing, savings and the agri-business planning cycle. This enables BoPs to become more reliable supply and demand partners in the local food system.
- ICTs that are used to create ‘hype-transparency’ in local food systems, currently are both an opportunity and a threat to the BoP. Digitalisation can enhance inclusive agri-business by creating better access to farm-level information, markets, financial services (e.g. mobile money, mobile financial services) and assurance models. However, it can also create new inequalities due to lack of ICT literacy, access to digital networks and platforms, and ethical infringement.
- Circular economy strategies (e.g. waste reduction cycles, closed animal nutrient loops) provide a stable business opportunity to the BoP, when these facilitate a reduction of agri-business input costs, and/or increase output yields.
- Urban governments are attracted to the idea of ‘Mini-Farming’ by BoP food producers and processors, and food corridors into peri-urban areas, and see a space for this in the modern urban landscapes.

The Food & Business Global Challenges Programme | First call project
Adapting pork production to local conditions in Brazil

To increase availability of low costs and locally produced pork as a high quality protein food, the LocalPork project aims to improve the efficiency of pig growth in Brazil by focusing on pig feed and pig genetics. Pigs can eat almost anything but are fed alternative ingredients. Genetic analysis showed that selecting purebred pigs is not 100% effective for improving performance of typical growing pigs that are crossbred. Therefore, including crossbred information such as performance and genotypes is important in genetic analyses as well as accounting for the different genetics of purebreds and crossbreds and different growing conditions. A methodology called BOA was developed to enhance the genetic improvement for feed efficiency in crossbred pigs. The method allows breeding programs for crossbreds to use data recorded on crossbred pigs. BOA was shown to be effective but not computationally efficient which hampers its routine use. Another methodology called Metafounders (MF) is equally effective as BOA but in a more efficient way. The economic cost and environmental impact of pork production can be reduced when breeders give more emphasis to improving production traits, relative to reproduction traits. Also, diets with alternative ingredients were shown to have potential benefits, especially to avoid land use competition with cropland for human consumption. Different by-product ingredients were included in this analysis, including macacuba cake.

“Breeders can reduce the environmental impacts of pig farming by focusing on traits that increase farm productivity”

Research Findings

The project has shown multiple findings. Firstly, the use of commercial crossbred information will improve genetic progress made for feed efficiency in pig production. Secondly, by-products like macacuba cake can be included in pigs diets without affecting their performance, and it is recommended as they can improve the economic and environmental sustainability of pig production. Thirdly, the selection of purebred pigs based on a diet different from the diet used for commercial crossbred pigs does not jeopardise genetic progress. Lastly, breeders can reduce the environmental impacts of pig farming by focusing on traits that increase farm productivity. In summary, additional improvements in efficiency of pork production in Brazil that can be made through breeding are similar to those in other countries, while opportunities to improve efficiency by feeding different diets are greater than, for instance, in the Netherlands. Those involved in pig breeding and production in Brazil are aware of the technological improvements that can be made in pig breeding, while there seems to be a reluctance to consider feeding by-products to pigs. By products are considered inferior and are expected to lead to reduced pig growth, but our results show this is not the case. Currently, an experiment is ongoing in Brazil to validate the generated results in local Brazilian circumstances, to obtain, in this way, acceptance of the innovations and achieve the anticipated impact from all parts of the project.

Messages to:
- Actors from private sector
  - Breeders for local crossbred performance can benefit from directly targeting crossbred information (performance and genotypes). The MF model may be useful here.
  - Breeders need to give more emphasis to improving production traits than reproduction traits for raising, at the same time, the economic and environmental sustainability of pig farming.
  - The use of by-products in the diets of pigs creates market opportunities for producers and processors (e.g. macacuba processors).
- Civil society and practitioners organisations
  - Organisations working to improve environmental sustainability of pork production might promote the...
use of by-products.

• Local farmer involvement, e.g. collaboration with academia research by recording phenotypes from crossbred pigs, is needed to show the value of alternative ingredients in practice.

Policy makers

• Policy makers may stimulate a consumption shift from pork that is produced using food crops to plant feed sources for better food security.
• Policy makers may encourage the use of by-products in the diets of pigs to reduce deforestation for growing corn and soybeans and thereby reduce environmental impacts associated with land use change.
• Validation of research findings under Brazilian circumstances is very important for acceptance of innovations by the industry.

Knowledge networks

Breed4Food is a consortium established by Wageningen University and Research, and four international animal breeding companies with the ambition to be the world leading center for research and innovation on livestock genetics. State University of São Paulo (UNESP), Faculty of Agricultural and Veterinary Sciences – Jaboticabal Campus.

Co-creation

This project investigates opportunities to improve efficiency of pork production by combining animal genetics, animal nutrition, and business economics. During the development of the project, the collaboration between Animal Sciences and Business Economics was very important to value the contribution of breeding and nutrition to improving the dynamics of local pork production in Brazil. Industrial data was provided by Topigs Norsvin for testing models and approaches by PHOS and TFD3, to ensure results are relevant for breeding organizations. The project team observed reluctance of the pork industry in Brazil to consider using co-products. Thus, a focus on the importance of crossbred pigs, is needed to show the value of alternative ingredients in practice.

Alternative ingredients in practice.
new and smart ways to incorporate these institutions, otherwise success will remain limited.

Messages to:

- **Actors from private sector**
  - Land investments in Sierra Leone are complicated. Finding suitable land and arranging contracts is challenging and potential investors should take appropriate time and invest in learning for this process to be successful.

- **Civil society and practitioners’ organisations**
  - Incorporating local institutions is essential for development programming and success of all kinds of interventions, changing gender relations of production require especial attention.

- **Policy makers**
  - Labour is a core constraint in Sierra Leone local economies because there is very limited understanding of how local land-holding institutions actually work. The biggest gap in knowledge concerns women’s embedded rights in land, and how to motivate support from women’s rights holders, or how properly to compensate for loss of rights.

Knowledge networks

- Cocoa working group in Sierra Leone.

Co-creation

- The interactive regular workshops with programme stakeholders were useful in generating buy-in, adapting research design and enhance research uptake. Working together closely with Theobroma and AMS BV allowed us to have a firsthand look at how business operates in difficult environments such as in Sierra Leone. It also helped us formulate research questions and identify constraints. In the process we have engaged many other stakeholders who were not originally in the consortium. For example, we worked with a local NGOs, to evaluate how their programme aimed at conserving the Gola Rainforest National Park, influenced surrounding communities and conservation outcomes. This has deepened our understanding on the necessary conditions for interventions to be successful.

The interdisciplinary nature of our research was crucial for coming to these insights. Using a diagnostic approach, combining qualitative and quantitative methods was fruitful. Qualitative work is also enabling us to identify mechanisms and pathways, deepening the understanding of our findings from quantitative work.

Future research and activities

We aim to deepen our understanding of within-village processes that affect investments in land. Specifically, we assess gender and access to land. Furthermore, the project team will work with partners along the value to disseminate research findings.

Maarten Voors | Wageningen University Development Consortium Partners, Kyute University (Sierra Leone), Theobroma International BV (NL), Agroproduce Management Services Ltd. (AMS) (Sierra Leone)

Learning platforms offer a safe space for farmers to voice their concerns, interact with institutional actors, and learn from the latest research findings. Research offered insight into different farmer profiles and associated differences in opportunities, constraints and aspirations and the effects of expanding tree-crop production – cocoa, oil palm, avocado and macadamia nuts – on food production and the broader landscape. This project innovatively combined ethnographic research and cluster analysis to study farmer diversity; action research to develop a farmer-centred approach towards learning and innovations; and a combination of remote sensing and participatory spatial methods to analyze the effects of expanding tree-crop farming on the landscape and unmet farmers’ views of their landscapes. The aim was to find out how VCCs can be made more inclusive and enhance food sovereignty and landscape sustainability.

Research questions addressed were:

1. How do partnerships align with the livelihood profiles and innovation capacity of male and female smallholders involved?
2. How do you contribute to farmers’ food sovereignty (access to food, having a say over the way in which it is produced and marketed, and the sustainability of its production)?
3. How can “learning platforms” make the collaboration more effective, inclusive and innovative?
4. How can tree-crop contributions to sustainable landscapes?

Final Research Findings

1. Smallholder tree-crop farmers are generally food secure both in Ghana and South Africa. However, seasonal food insecurity exists and food production is becoming under pressure in Ghana. In South Africa experience-based indicators indicate food security, but nutrition-based indicators suggest deficient dietary diversity. New forms of food production (e.g. intercropping) emerge in South Africa.

2. Small-scale farmers are not all the same. They differ in being full- or part-time engaged in farming, off-farm income, access to land and assets, age and gender. This creates different conditions for engagement in value chains, and receptiveness and capacity for innovation.

3. Farmers engage in multiple value chains to reduce risk and dependency and retain autonomy. They use VCC to negotiate access to markets, credit, resources, and knowledge and innovations.

4. Change makers can be entry points for transformative change. They are “movers and shakers” and have a vision, a network, and drive to improve farmers’ lives for the better.

5. Innovations come as much “from below” as they come “from above”. “Endogenous” innovations are usually small and consent technologies used in the production process or forms of collective action in farmer associations or savings and credit groups. They form the starting point for peer-to-peer learning in learning platforms.

6. Learning platforms offer a space for joint learning and knowledge sharing if organised close to the farmers. Farmers and practitioners expressed high appreciation for the learning platforms, and knowledge sharing and joint learning have resulted in change of practices.

7. Expanding tree crops prejudice land for food crops and tree cover and leads to a landscape that mimics one of large-scale plantations. Farmers acknowledge adverse effects on food production and ecosystem services but prefer a segregated over a mosaic landscape for income and efficiency.

Messages to:

- **Actors from private sector**
  - Go beyond the “low-hanging fruit”. There may be potential amongst those excluded from the value chain collaboration.
  - Recognise diversity amongst farmers when providing

Inclusive value chain collaboration in Ghana and South Africa

This project developed a farmer-centred approach to value chain collaboration (VCC) that is inclusive of different groups of smallholders, their knowledge and innovation capacity, and the environment. It centred on knowledge sharing, co-creation and joint learning in learning platforms, with a focus on ‘innovations from below’ and peer-to-peer learning via change makers.

The Food & Business Global Challenges Programme | First call project
Working towards impact on food & nutrition security

Co-creation

Knowledge networks

Ghana Limited in Ghana (thanks to a subsidy of the Lindt countries, there has been a strong interaction with the collaboration with smallholder farmers. In both of academic knowledge in the practice of value chain transdisciplinary knowledge in academic products, and consortium partners. The complementary skills and platforms, but also through joint fieldwork by the learning occurred mainly in and after the learning beyond the project.

Knowledge co-creation with farmers and peer-to-peer learning to enhance innovation.

Remaining questions include how different types of agricultural support differ in empowerment outcomes, and what role peer-to-peer learning and local innovation networks play in the co-creation of knowledge. In Ghana several efforts are being undertaken to follow-up on the learning platforms and have them institutionalised. The Resource Management Support Centre of the Forestry Commission and the University of Energy and Natural Resources have already adopted and incorporated the learning platform concept in their activities. Also the Royal Tropical Institute (KIT) is using the concept in several projects with private cocoa and chocolate companies.

Future research and activities

• Play a role as bridging organisation by bringing together actors from different sectors and operational levels, and act as knowledge broker and facilitator of learning platforms.
• Perform a “watchdog” function in partnerships between actors of differential power.
• Knowledge exchange and support services should start from the farmers and their networks.

Policymakers:

Recognise different ways of knowledge exchange and the importance of combining cross-level with peer-to-peer learning to enhance innovation.

Learning platforms that bring farmers together with practitioners, private sector actors, researchers and practitioners, played a key role in this project. They are arenas of joint learning and knowledge exchange through sharing experiences, concerns, solutions, innovations and research findings, and peer-to-peer education. They strengthened the participants’ networks beyond the project.

Co-creation

Knowledge co-creation with farmers and peer-to-peer learning occurred mainly in and after the learning platforms, but also through joint fieldwork by the consortium partners. The complementary skills and different perspectives of practitioners and academics in the consortium allowed for the “translation” of transdisciplinary knowledge in academic products, and of academic knowledge in the practice of value chain collaboration with smallholder farmers. In both countries, there has been a strong interaction with the private sector through collaboration with Armogan Ghana Limited in Ghana (thanks to a subsidy of the Lindt Cocoa Foundation) and the South African Subtropical Growers Association (Subrop), an association of associations of avocado, lychee, macadamia and mango growers. Lessons about innovations “from below” and transformational change were learned from interactions with “change makers” in the public and private sector, rural people on the ground. Last but not least, there was a strong mutual learning between researchers and farmers in Ghana, who experienced to be partners in research rather than informants or respondents.

Final research findings

Inclusive business models aiming at improving food security of low income markets and consumers can be clustered in five business intervention strategies (IBS):

1. Farmer development services,
2. Secured sourcing schemes,
3. Rural retail hubs acting as intermediary between (smallholder) producers and consumers;
4. Food product adaptation: market expansion towards BOP consumers with existing healthy and nutritious food products;
5. Hybrid market creation: market creation towards BOP consumers with new healthy and nutritious food products.

The project revealed that:

1. IB models for improved food and nutrition security consist of: foundation-level components, alliance building strategy, upgrading strategies and IB “ecosystem” strengthening strategy.
2. Features identified in 15 analysed cases are: 1. distribution and marketing of new products and services to low income food producers and consumers, 2. added value of cross-border partnerships connecting companies to fringe stakeholders and development of break through inclusive business innovations; 3. the role of intermediary organisations.
3. A mapping of international intermediaries contributing to inclusive business revealed that they assume the convener, broker and/or co-creator role. The co-creator role is a more recent role being assumed, and seems to be stimulated by changing funding requirements and institutional voids encountered by companies when entering low income markets. These conditions stimulate intermediaries to assume a more proactive role of initiator and/or co-creator of the innovation.

4. However, most intermediaries are challenged by lack of funding in the development of these cross border partnerships. This often hampers their engagement in all 4 phases of partnership development, being design, initiation, implementation and evaluation/scaling. Often there is only funding to engage intermediaries in the ideation and engagement phase, but it is more difficult for them to stay involved during the implementation phase due to a lack of willingness of other parties in the partnership to finance the participation of the intermediary. This may limit the full implementation of recommendations defined in the design phase as other parties may underestimate the relevance of some of them as they are more focused on their own needs instead of the needs of the common which is more the agenda of the intermediary organization.

5. The innovation system in which the IB model will be developed has great impact on its initiation and development. IB innovation systems consists of market, institutional and cultural characteristics.

Achieved outcomes

The project developed an IB-market assessment tool that provides up front insights in the strengths and the weaknesses of markets for inclusive innovation on food and nutrition security. Presentation of this tool was welcomed by experts of intermediary organisations and representatives of the public and private sector. The tool

The Food & Business Global Challenges Programme | Second call Fast Track project

Intermediaries in inclusive business networks for scaling food security in East & West Africa

An increased number of cross-border public-private partnerships aim to realise inclusive business (IB) for business growth and development impact at scale, also in the field of food and nutrition security. These partnerships often face institutional and culturally distant environments, internally and in surrounding spheres, and therefore experience cooperation governance challenges. Dedicated internationally operating intermediaries have emerged that enhance these collaborations.

It was unknown how these intermediaries position themselves to obtain a credible position and how they become effective contributing to overcome the challenges. Therefore, this project studied how such intermediaries facilitate North-South partnerships on inclusive business for improved food security in East and West Africa.

Final research findings

Inclusive business models aiming at improving food security of low income markets and consumers can be clustered in five business intervention strategies (IBS):

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2. Secured sourcing schemes,
3. Rural retail hubs acting as intermediary between (smallholder) producers and consumers;
4. Food product adaptation: market expansion towards BOP consumers with existing healthy and nutritious food products;
5. Hybrid market creation: market creation towards BOP consumers with new healthy and nutritious food products.

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1. IB models for improved food and nutrition security consist of: foundation-level components, alliance building strategy, upgrading strategies and IB “ecosystem” strengthening strategy.
2. Features identified in 15 analysed cases are: 1. distribution and marketing of new products and services to low income food producers and consumers, 2. added value of cross-border partnerships connecting companies to fringe stakeholders and development of break through inclusive business innovations; 3. the role of intermediary organisations.
3. A mapping of international intermediaries contributing to inclusive business revealed that they assume the convener, broker and/or co-creator role. The co-creator role is a more recent role being assumed, and seems to be stimulated by changing funding requirements and institutional voids encountered by companies when entering low income markets. These conditions stimulate intermediaries to assume a more proactive role of initiator and/or co-creator of the innovation.

4. However, most intermediaries are challenged by lack of funding in the development of these cross border partnerships. This often hampers their engagement in all 4 phases of partnership development, being design, initiation, implementation and evaluation/scaling. Often there is only funding to engage intermediaries in the ideation and engagement phase, but it is more difficult for them to stay involved during the implementation phase due to a lack of willingness of other parties in the partnership to finance the participation of the intermediary. This may limit the full implementation of recommendations defined in the design phase as other parties may underestimate the relevance of some of them as they are more focused on their own needs instead of the needs of the common which is more the agenda of the intermediary organization.

5. The innovation system in which the IB model will be developed has great impact on its initiation and development. IB innovation systems consists of market, institutional and cultural characteristics.

Assessing these features prior to designing and introducing inclusive innovation is helpful to identify potential opportunities and constraints of the innovation context and to define measures for risk mitigation to reduce the eventual negative impact of constraints.

Achieved outcomes

The project developed an IB-market assessment tool that provides up front insights in the strengths and the weaknesses of markets for inclusive innovation on food and nutrition security. Presentation of this tool was welcomed by experts of intermediary organisations and representatives of the public and private sector. The tool
helps them to define upfront additional measures in the institutional environment to assure a more smooth introduction of the inclusive innovation, during the initial phase of the partnership development. Research findings have been used for practical trainings for representatives of intermediary organisations facilitating cross border partnerships in The Netherlands, Nigeria and Kenya. Besides, also technical advisors of research institutes, public entities and NGOs attended the trainings. They learned about inclusive business models that contribute to business intervention strategies on food and nutrition security, and also about tools and practices to act as a broker in multi-actor initiatives, and to better understand needs and constraints of parties they are involved with, and lastly how to assess an inclusive innovation system in a country.

Messages to:

**Intermediaries**
- Your added value to inclusive innovation development is significant.
- The innovation context in low income markets requires a more proactive creator role of the innovation due to the institutional and cultural gaps encountered in low income markets.

**Actors from private sector**
- Allow intermediaries to be part of all the phases of a partnership development process, and not only during the initial phase.
- Include budget for the involvement of an intermediary when you want to develop an inclusive innovation.

**Civil society and practitioners organisations**
- Be careful not to assume roles and responsibilities of companies and/or the public sector just because you want to move faster forward, as the investments in innovations need to be maintained by the private sector, and changes in the institutional environment often depend on decision by the public sector.
- The negotiations with public entities are most of the time led by the international companies involved in a cross border partnership. Their power position can help civil society to reach better and more sustainable changes in the system.
- Tendency to build heavy governance structures in an attempt to overcome the complexity of cross border and intercultural partnerships is not helpful for inclusive innovation.

Laurens Klerkx | Wageningen University & Research
Consortium Partners: BoP Innovation Center (NL), IFDC (Kenya and Ghana), ICFR (NL), AABS (Kenya)

Nicky Pouw | Recommendations to policy and practice

- There is a need to map out systematically who produces what, and for whom. Food quantities, qualities and flows need to be monitored to make the contributions of the BoP to local food systems visible, and to understand their priorities and needs.
- Greater government and business efforts should be directed at reducing the ‘hidden’ costs faced by the BoP, for accessing markets and services, resources (land, clean water, space), markets and services, testing and certifying produce, training and education, and establishing business connections. Support to resolve inefficiencies in unpaid household and care work also needs to be mobilised. This will enable the BoP to participate more effectively in the local economy.
- Building on existing groups and networks of local BoP food producers, consumers, workers and entrepreneurs can render Inclusive Business models more effective, since these groups have already developed voice and visibility in the local context. Moreover, they have overcome certain governance and sustainability challenges, and proven their ‘raison d’être’.
- Setting-up local issues-based networks with the involvement of home grown practitioner and research organisations to stimulate social learning on local food and nutrition security challenges and exclusion. These can also help to create deliberative and negotiation spaces, and to mobilise resources and commitment to achieve more inclusive and sustainable food systems.
- Investments in validating both bottom-up and scientific innovations according to AAA principles, offer much potential for enhancing Inclusive Business in LMICs.
- Through co-creation, viable business opportunities in the circular economy for the BoP can be effectively identified and tested. Governments and businesses should also strive to minimise the social and environmental harm inflicted upon the BoP by larger companies.
- Inclusive Business strategies and policies should address the terms and conditions of ‘inclusion’ from the point of view of the BoP. This requires ex-ante attention to ownership arrangements, voice, and (sharing of) risks and rewards.
- Urban development plans should be challenged to create sustainable spaces for ‘mini-farming’ in the city, and corridors to peri-urban farming.
Knowledge networks
Food & Business Knowledge Platform, ITOA, ANDE, European BoP Network

Co-creation
The collaboration with IFDC and BoP Inc has helped to gain trust by the case interviewees. Collaboration with ICRA has helped to convert research finding in training material that fits better to the needs of practitioners. In that way the research material becomes more accessible and increases the likeliness that the findings will be used and will influence practice. The periodic meetings with consortium members have contributed to a frequent review and update of the project Theory of Change. The data collection for the 4 case studies was done in close collaboration with the international intermediary organisations involved. This facilitated the trust building with the experts the project approached and made them willing to share information.

The project assessed whether:
1. Realistic board games (RBG) can change farmers knowledge, attitude on IMS.
2. Combining RBG and participatory agent based models (ABM) can modify policymakers' knowledge and opinion on IMS and sustainability of intensive shrimp farming.

The team developed a board gaming called "Good Shrimp Farming." Playing this game made farmers aware of the risks of intensive shrimp monoculture. Back home, the farmers consulted each other more often than before and asked less advice from biased salesmen of veterinary products.

"Playing this game made farmers aware of the risks of intensive shrimp monoculture"

An ABM simulating farmers decisions through time showed that, under present shrimp policies and technology, intensive farming will expand and, in particular in Ben Tre, threatens the mangrove cover. Moreover it showed, that the present intensive shrimp monoculture almost reached its maximum total yield and income. The focus on monoculture decreases the financial stability of the farms and increases the number of bankruptcies. The latter tendency increased when including climate change in the simulations. In simulations of an organic farming scenario, Integrated Mangrove Shrimp (IMS) hardly expanded as the intensification trend persists.

Final research findings
Overall, playing the game gave farmers an improved understanding of the (long term) impact of their decisions related to the risks and opportunities of various farming systems. The research team improved its understanding on when and how serious games can be used best as interventions, and on the effect of local conditions and farmers learning.

Achieved outcomes
The assessment of the Good Shrimp Farming board game showed that:
• The more often farmers played, the better they succeeded to avoid financial losses, but this resulted also in less players with exceptionally high gains.
• After playing, back home, the farmers consulted each other more often than before and asked less advice from the salesmen of veterinary products.
• Combining the RBG with ABM, changed decision-makers’ understanding of local dynamics, and farmers attitudes, goals and decisions.
Two stories demonstrated the change signalled above:

- Playing the game confirmed a farmer’s thoughts about the different risk levels. He finds “that intensive monoculture is only suitable for those having a lot of money.” The acuity to practice a “sustainable” hybrid model to improve his income and ease the environment.
- A farming extension agent found the game realistic and usable to compare the system’s stability and to recognize the importance of IMS. The game can be used to advocate technologies. He intends to apply a hybrid system of IMS with small intensive ponds.

Knowledge network
Games4Sustainability
Co-creation
The regular contacts, feedback and joint collaboration on the reporting of results creates a good platform for a fruitful process of co-creation of knowledge and strategies within the project group.

Outcomes achieved
1. The female entrepreneurs in Shewa Robit initiated a group to share insights and ideas on how to run their aquaponics, what crops to grow and where to sell them. Each woman stayed responsible for her own business. One woman has started as fish feed entrepreneur. The group regularly invited the local university expert for advice. At project completion the group took ownership through sending a letter to the University to negotiate continued advice and access to inputs in return for hosting students. All project ending some women expressed their intention to expanding their aquaponics gardens.
2. In Metehara unemployed youth were selected by the government to run a large-scale aquaponics farm as a cooperative. The farm technically functioned, but collective management proved to be a problem. As

The Food & Business Global Challenges Programme | Second call Fast Track project
Promoting healthy diets and agri-business development through Aquaponics farming

Aquaponics is an innovative food production method in which fish and vegetable farming are integrated. The nutrient rich water from the fish tanks is utilised by the vegetables that grow directly with their roots in the water thereby cleaning it. The circularity of the system saves water compared to rainfall and irrigated agriculture and can be implemented on non-fertile lands as it is a soil-less growing technique. It is therefore highly suitable for Ethiopia, with scarce land and water resources. Aquaponics production being independent of rainfall offers year-round availability of both fish and vegetables in local, malnourished, communities.

The project looked into the possibilities for the creation of a sustainable business model that enables local households to grow vegetables and fish, improving their diets, while selling a surplus to the community. The income from sales serves to support operational costs and pay back investments costs and additionally allows making a small profit. In cooperation with local administrations entrepreneurs in various regions have been selected. For each site a different approach was chosen to allow comparison of business models:

1. Shewa Robit: 8 female entrepreneurs with a system of 12 m² each;
2. Metehara: A system of 3000 m² managed by a cooperative of unemployed youth;
3. Hawassa: 8 poor family entrepreneurs with a system of 12 m² each.

The aquaponics facilities were offered to the households on credit to foster responsibility. They received training on technology and business skills and were advised to foster peer-group learning and creating bargaining power in accessing inputs and targeting clients for sales.

Research findings
1. The technical functioning of Aquaponics has been proven. Aquaponics is highly water, nutrient and energy efficient. The development of a value-chain proved to be essential for good functioning. At the start fingerlings and fish feed where not available thus value-chains to provide them have been set up. Besides aquaponics, hydroponics appeared to be attractive as management is less dependent on constant inputs, and it avoids the more costly fish production. In Awassa some participants switched to hydroponics.

2. In Metehara unemployed youth were selected by the government to run a large-scale aquaponics farm as a cooperative. The farm technically functioned, but collective management proved to be a problem. As
Working towards impact on food & nutrition security

the facilities were given for free, nobody felt responsible and distrust and individual side-selling prevented the group from making the farm profitable. A new start was made with a new business model in which each of the participating youth had to buy in (via government credit) to ensure their responsibility.

3. Aquaponics offers great potential in producing year-round crops, however the high investment costs still prove a challenge. In theory the investment could easily be earned back in the first 2 years. In the project case, technical and institutional challenges during the start-up phase have caused the entrepreneurs to take much longer. In further projects consortium partner TGS is experimenting with supplementing the plants with mineral nutrients to guarantee profitability and production from the start (hydroponics phase). As soon as the farm is running well the full component, with its supply chain, is added. In this way challenges are tackled one by one.

The developed websites are maintained to ensure knowledge dissemination after project completion and two centres of support have been established in Ethiopia. One project staff member has started his PhD on aquaponics in Ethiopia. In Ethiopia aquaponics has been included in the fisheries policy. TGS has expanded aquaponics services to many other countries.

Messages to:

- **Action from private sector**
  Investing in groups of small-scale entrepreneurs is an alternative to large farm investments and more inclusive especially when investments can be earned back quickly. The sales could create profit for local entrepreneurs, suppliers, traders and investors.

- **Civil society and practitioners organisations**
  - Introducing aquaponics could substantially increase household nutrition and add additional income for people that do not own enough land for conventional farming, or are located in areas with low rainfall, water scarcity and low soil fertility.
  - Aquaponics could be proposed to women that have no access to land and limited labour available as aquaponics is soil-less and labour extensive, and women may favour inclusion of the produce in household diets. Aquaponics could be proposed to refugee camps as the systems need little space and material.
  - Interested entrepreneurs should receive trainings in technology and business skills. Participants should not receive aquaponics as charity. They should only be selected as entrepreneur and buy-in to guarantee individual responsibility. Combined with peer group learning this seems most effective.

- **Policy makers**
  Policies should create incentives for companies with agricultural knowledge to share their knowledge and/or equipment with local entrepreneurs (small and medium enterprises).

Knowledge networks

To build knowledge internationally the project has launched a website (www.sustainable-aquaponics.com) that is currently being integrated with knowledge on aquaponics in Kenya and other parts of the world. TGS has been in touch with several NGOs (e.g. Mercy Corps) and private enterprises to discuss project results. Besides, commercial demo-farms have been started in Kenya, Kyrgyzstan, Palestine and Egypt based on findings from Ethiopia.

Co-creation

Co-creation has been at the core of the project as private sector (TGS), Universities (AAU, WUR and FAO) (W dort) have worked together. The involvement of TGS has guaranteed that outcomes are shared in projects worldwide, both through their operations and through maintaining the knowledge platform. Furthermore, staff of Addis Ababa University has indicated an interest to explore working with the private sector more often as this has been completely new to them. They see the relevance of the private sector to build the supply chain and to support economic development instead of charity and to avoid project knowledge from being lost after completion. Lastly, the aquaponics entrepreneurs have been co-creating the systems by co-deciding with AAU and TGS on the sizes of the systems, the choices of crops and their outlets.

Maja Slingerland | Wageningen University & Research Collaboration partner: UIA Business & Development Initiatives (BDI), Addis Ababa University (Ethiopia), Rise Development Programme (Ethiopia)

The Food & Business Global Challenges Programme | Second call Integrated Project

Information transparency system as a low-cost scalable solution to farmers’ access to credit and services

The project aims to investigate how to increase financial inclusion of cocoa farmers in Ghana. In first instance, we focused on the relevance of information transparency; how information about farmers and their farming practices can help them get access to credit. However, line with recent scientific evidence which suggests that access to savings products is much more important for long-term food security than access to credit, the project decided to increase focus on access and use of savings products by cocoa farmers.

We organised several interventions to increase the uptake of savings products, among others we developed a new long-term savings product (a pension product) for cocoa farmers. Our study suggests that cocoa farmers are very eager to open savings accounts. However, it turned out to be difficult for cocoa farmers to continue savings for old age at a regular basis, e.g. due to a lack of hope regarding the future. We therefore also organised an aspirations/hope enhancing intervention to induce cocoa farmers to take care of old age, among others by regularly saving for old age.

Final Research Findings

Related to the initial aim of the study regarding the relevance of information transparency, we conducted two studies. First, a study on “Digital technologies, hyper-transparency and smallholder farmer inclusion in global value chains.” The study characterises the rise of hyper-transparency in global value chains (GVCs), followed by the potential of ICT technology to enhance inclusion of smallholders in GVCs. The study concludes that transparency can strengthen the position of smallholders, other market players, states and civil society by holding the supply chain actors accountable for negative environmental and social externalities of their business practices. Second, a study on the relevance of FinTech in the context of agribusiness in developing countries. This study argues that new sources of data (green technologies), and analytical approaches in combination with mobile financial services can create a digital ecosystem in which tackling the transformation of agribusiness in developing countries is in line with the agenda for sustainable development seems more possible than ever. However, the study also uncovers serious limitations and risks such as underinvestment in infrastructure, including physical capital, constraining access and implementation; shortages of human capital that may lead to divergence across the agribusiness sectors in developing and industrialised nations. We also identified a “knowledge gap” in our current understanding of the cost, benefits and scalability of these technologies due to a lack of rigorous research.

From the projects’ savings studies, we found that cocoa farmers are very eager to open savings accounts. It also appears that farmers prefer flexibility: they prefer savings products with possibilities to withdraw savings before old age over savings products that do not enable them to withdraw money before pension. However, we also found that cocoa farmers find it very difficult to sustain savings for old age at a regular basis, among others due to a lack of hope regarding the future.

As uptake of improved inputs is very important for future food security, our project also examined why access to improved inputs is very low for many cocoa farmers. We find that e.g. social capital is a major reason for low access: network social capital has a significant impact on access to seedlings, but not fertiliser. Network social capital can even bypass government subsidy qualification criteria for access to seedlings. Getting access to fertilizer, on the other hand, depends primarily on farmers’ readiness to adopt inputs.

Intermediate achievements

As our study clearly suggests that cocoa farmers have difficulties in continuing to save for old age, among others probably due to a lack of hope about the future, we recently organised another intervention—a so-called aspirations enhancing intervention by means of a pension documentary, that aims to incentivise farmers to save on a regular basis for old age. While results of the latter intervention still need to be analysed, some initial
Working towards impact on food & nutrition security

**Messages to:**

**Actors from private sector**

An important message resulting from our study is that, while cocoa farmers are very eager to open savings accounts, the use of these accounts is limited. Hence, additional measures are needed to induce farmers to use these savings accounts, and to sustain a regular pattern of savings, especially long-term savings. Initial results of a pension documentary treatment suggests that especially interventions that increase hope/ aspirations of cocoa farmers, in combination with access to financial products, can be very successful.

**Civil society and practitioners organisations**

Public-private partnerships (PPPs) encouraged through some civil society organisations have been very useful in starting pre-competitive dialogue to raise issues related to cocoa farming. However, through direct co-funding of some of private sector initiatives, they have failed to defend farmers interests. A perfect example are fertiliser-, productive seeds- etc. initiatives where at first, it was good to provide support to solve some of the burning problems of poor productivity and quality of cocoa farmers around the world. But now, these organisations still support the same type of projects even though the productivity has gone up significantly, and as a result, the cocoa prices are hitting the rock bottom. It is always good to follow up on the industry developments, including especially crop prices, and not rely so heavily on experiences and demands of the private sector partners only.

**Policy makers**

The Dutch Ministry of Foreign Affairs, through IDH Sustainable Trade Initiative and Solidaridad, has been putting a lot of effort in improving productivity and quality of cocoa across West Africa. However, the two most important West African governments are now preventing these programs from penetrating the market in producing countries. This specifically applies to the Coffee-Cocoa Council in Ivory Coast and Cococod in Ghana, because the PVP efforts to improve cocoa productivity and quality had resulted in increased cocoa productivity and plummeting cocoa prices. They didn’t raise farmer incomes at all. The fact that almost 40% of Fairtrade certified farmers surveyed (see below) the UN defined poverty line (when looking at farm income only) goes to prove that.

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**Knowledge networks**

Project members are part of an extensive Wageningen/CRIG-initiated group of cocoa researchers. The group exchanges news over email and meets at cocoa conferences, such as the International Symposium on Cocoa Research, World Cocoa Conference and Choosa festival in Amsterdam.

**Co-creation**

In spring 2018 the project held a 3-day workshop with all consortium partners in Accra, during which research interest, challenges and way forward were discussed. Together the project members have addressed the relevant research output that could come out of this project and defined who will collaborate on which papers.

Due to project activities, the project leader has been invited to provide a training at Ghana Statistical Services in October 2019. This training has been attended by project partners (i.e. from the University of Ghana, CRIG and People pension Trust). There are on-going discussions with Ghana Statistical Services to conduct a Ghana-wide survey of relevance of financial inclusion, e.g. for cocoa farmers.

The focus of the research is on the impact of companies on local food security, through production and employment, shifts in access to- and use of- natural resources, and changes in market conditions. How do these dynamics affect local development for those involved and others in their area of operations? Furthermore, which business models are best-equipped to make a sustainable contribution to local inclusive development and food security? Answers to these questions are used to offer advice for investors, smallholders and policy makers on how to engage in inclusive agribusiness and enhance local food security. The project is conducted in collaboration with Solidaridad, Fair & Sustainable Advisory Services, and St. Mary’s University in Addis Ababa, Ethiopia.

**Final Research Findings**

- Inclusion in many situations is confused with “sustainability”. When scrutinising the terms of engagement, in many cases the relation between business and farmers’/consumers' is one of unequal power; the company sets the terms of trade. The only option for farmers or consumers is to accept or to opt-out. Opting producers in a value chain is considered as “inclusion”, while in terms of risk, value and … farmers trekken aan het korste eind.
- Many of the inclusive business models are designed on a linear notion of “linking producers and consumers” > leads to improving income > leads to improved livelihoods. However, the effects of an inclusive business reaches beyond direct impact. A good understanding of the potential side effects - such as farmer dependency on the buyer, decreasing crop diversity, or reproducing gender relations is absent in most business interventions. These side effects influence food security in the longer term.
- Many business interventions focus on improving productivity or product quality and income, assuming a positive impact on food security. Academic research however shows that there is no correlation between the first and the latter.

**Final outcomes achieved**

In March 2017 the Follow the Food Consortium participated in the African Landscape Dialogue in Addis Ababa. Invited by Solidaridad the consortium organised a workshop on “The role of agribusiness in the landscape”. Five companies from the network of Solidaridad and Fair & Sustainable participated. The direct lessons learned from this workshop include the following:

- The workshop taught the consortium partners how each company is unique in the challenges it faces. The broader context - the physical and institutional environment - is of much importance in this. The insights gained during the conference influenced the research framework and helped to move from a value-chain approach to a focus on systems, taking account of the wider landscape and political economy dynamics.
- The workshop of the Follow the Food consortium was the only one in the conference that involved private sector parties. The consortium could therefore be instrumental in showing that prevailing perceptions of the private sector as ‘bad guy’ harming the environment and working against community and worker interests was one-sided. In the workshop it became clear that lack of governance and collaboration at the landscape level reduce the scope of agri-business to contribute to food security. The African Landscape Dialogue partners drafted the African Landscape Action Plan (ALAP) in which the consortium through Solidaridad is part of the active Business for Sustainable Landscapes work stream.
- In October 2019 Solidaridad together with CDI, Wageningen University, St. Mary’s University in Addis Ababa. Invited by Solidaridad the consortium organised a workshop on “The role of agribusiness in the landscape”. Five companies from the network of Solidaridad and Fair & Sustainable participated. The direct lessons learned from this workshop include the following:

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![Robert Lensink | Wageningen University – Developent Economics](image)

Partners that joined the project later: Cocoa Research Institute of Ghana (CRIG), University of Ghana, People Pension Trust.
Working towards impact on food & nutrition security

Knowledge networks
LANDac and Future Food Utrecht

Messages to:
Actors from private sector:
• Your impact reaches beyond the farmers and consumers involved.

Civil society and practitioners organisations
• Commercial agriculture is often directed towards markets outside the sourcing region, and therefore not contributing to, or even harming, local food availability.
• For competitiveness reasons, inclusive Business in general are not able to engage the poorest community members. Focus is on (semi-) commercial farmers, inclusive business models risk to reproduce or strengthen local inequality.

Policy makers:
• Increase in agricultural productivity and quality might contribute to improved farmer income but does not automatically translate to improved local food availability.
• Local food availability and accessibility are key for improving local food security, a profound focus on targeting farmers in food security interventions.
• Since its inception, project partners Solidaridad and Fair & Sustainable Consulting have been closely involved in PhD and MSc research. They facilitated the flagship case selection, logistic, supervision. The project PhD students regularly work from their offices in Nairobi and Addis Ababa.
• Solidaridad (Netherlands, East- and West Africa) and Solidaridad (Netherlands, East- and West Africa) collaborated to develop, pilot and launch the business tool.
• Fair & Sustainable consulting (both Netherlands and Ethiopia) and Solidaridad (Netherlands, East- and West Africa) collaborated to develop, pilot and launch the business tool.
• There is close cooperation with the AgriProFocus office Netherlands. Together we have written a policy brief on targeting farmers in food security interventions.
• Solidaridad West Africa collaborated with CDI, Wageningen University to facilitate a course on landscape approaches in Ghana for Solidaridad employees. The framework developed during this course has been presented at the Global Landscape Forum in Accra.
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Final Research Findings
In response to the lack of a clear and comprehensive legal framework at the international and national level to pave way for more investment in insect-based enterprise, the project jointly organised an “International conference on legislation and policy on the use of insects as food and feed in East Africa” held in Nairobi, Kenya with effective participation of 10% participants from 13 countries worldwide to formulate a common roadmap with policymakers. Results from the EU-Funded project research the need for alternative sources of high-quality insect-based protein feeds for poultry, pig and fish industries to improve livelihood and promote youth and women employment through capacity building on the use of insects as a source of protein in feeds for livestock production.

Inclusive business models involving insects as feed ingredients may contribute to solving socio-economic and environmental problems. With low initial capital investments, smallholder insect farmers have good opportunities to increase productivity, improve their livelihood and contribute to food security and a circular economy. Poultry, pig and fish farming are the fastest growing agribusiness activities in East Africa.

However, poor availability and high cost of feed protein ingredients (fshmeal, soy bean, seed cakes and several other grains), which represents 60 – 70% of total cost of production, greatly hampers profitable gains for small and medium-holder farmers in these sectors. In addition, it is becoming unsustainable to rely on fshmeal, soybean and cereals as protein sources in feed production, as these ingredients also complete with human nutrition. This project researches the need for alternative sources of low-cost protein in feed supplements. The potential of insects, mainly the black soldier fly (BSF, Hermetia illucens) in the commercial production of a low-cost, high-quality protein ingredient to substitute or replace the expensive fshmeal in the animal feed sector, becomes crucial due to their high crude proteins and fat content as well as rich amino acid proles. Through the consortium partners, the project promoted the establishment of community-led agro-enterprises for commercial production of safe and high-quality insect-based protein feeds for poultry, pig and fish industries to improve livelihood and promote youth and women employment through capacity building on the use of insects as a source of protein in feeds for livestock production.

ILIPA: Improving livelihood by increasing livestock production in Africa
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The Food & Business Global Challenges Programme | Second call Integrated Project
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Inclusive business models involving insects as feed ingredients may contribute to solving socio-economic and environmental problems. With low initial capital investments, smallholder insect farmers have good opportunities to increase productivity, improve their livelihood and contribute to food security and a circular economy. Poultry, pig and fish farming are the fastest growing agribusiness activities in East Africa.

However, poor availability and high cost of feed protein ingredients (fshmeal, soy bean, seed cakes and several other grains), which represents 60 – 70% of total cost of production, greatly hampers profitable gains for small and medium-holder farmers in these sectors. In addition, it is becoming unsustainable to rely on fshmeal, soybean and cereals as protein sources in feed production, as these ingredients also compete with human nutrition. This project researches the need for alternative sources of low-cost protein in feed supplements. The potential of insects, mainly the black soldier fly (BSF, Hermetia illucens) in the commercial production of a low-cost, high-quality protein ingredient to substitute or replace the expensive fshmeal in the animal feed sector, becomes crucial due to their high crude proteins and fat content as well as rich amino acid proles. Through the consortium partners, the project promoted the establishment of community-led agro-enterprises for commercial production of safe and high-quality insect-based protein feeds for poultry, pig and fish industries to improve livelihood and promote youth and women employment through capacity building on the use of insects as a source of protein in feeds for livestock production.

Final (outcomes) achieved
A total of 1 PhD and 4 MSc students were involved in this project. Mass-rearing protocols of BSF, nutrient value and safety quality on different substrates have been successfully established. Over 35 different feed formulations have been formulated and tested on-station on poultry, pig and fish (tilapia and catfish) production with excellent results compared to conventional fshmeal-based feeds. Bioetanol production-from BSF remains has shown excellent growth performance and yield on all three crop species investigated. These technologies are now available for promotion and upscaling to facilitate employment creation and income generation opportunities for farmers (mostly women and youths) thereby improving livelihoods and economic development in Kenya. Over 675 (54% men and 36% female) farmers, young entrepreneurs, policymakers, feed traders and processors have been trained on insect rearing for integration into animal feed.

Messages to:
Actors from private sector
• Private sectors, with ready organic waste streams are strongly encouraged to adopt insect-based protein technologies to convert their organic waste streams into high-quality nutrient biomass for animal feeds.
and biofertilisers for improved soil health and crop yield.
- An inclusive business environment is crucial to link up with local institutions and businesses as well as to share their knowledge with other stakeholders.

Collaborative networks and partnerships organizations
- Collaborative network with the public sector in instrumental in scaling out insect-based protein technologies in Kenya and beyond.
- Community-based demonstration sites for insect farming with women and youths in leadership roles would facilitate awareness creation of gender and identify joint opportunities and development of collective strategies, beneficial at individual, household and group level.

Policy makers
- Enforced policies that aimed at creating opportunities for small-scale exo-enterprises to scaled farmer groups on insect farming through collaboration with Kenyan microfinance companies and the vulnerable populations.
- Strengthen inclusive business development through gender sensitive lens - awareness policy measures and instruments.

Co-creation
- Consultative meetings, exchange visits and knowledge sharing has been encouraged among farmer groups, extension, and farmer associations, extension access and credit access, have enhanced farmer participation in insect-based protein value addition.
- Strengthen inclusive business development through gender sensitive lens - awareness policy measures and instruments.

Future research and activities
Given that insect-based protein technology is a very new initiative, there is need to develop the infrastructural requirements, build capacity, and transfer knowledge to scale and transform the insect-based feed industry into a viable business venture with the private sector. Future research will focus on: (i) supporting the development of markets and marketing channels for insect-based protein feed using different business models at community levels; (ii) developing an interactive mobile platform as a small marketplace where the actors along the value chain can sell their dried insect-based products and (iii) assessing the potential for employment generation and economic benefits of insect-based protein enterprises.

Marcel Dicke | Wageningen University & Research
Consortium partners: Sanergy Ltd (Kenya), Kenya Agriculture and Livestock Research Organisation (KALRO) (Kenya), International Centre of Insect Physiology and Ecology (Umpala) (Kenya), Collaborative East & Central Africa Expertise Centre (CEACEC).

The project LIQUID aims to provide a better understanding on how producer organisation collaborations and quality management systems contribute to two performance indicators: milk quality improvement and value chain inclusiveness. LIQUID involves research and capacity building.

Dairy value chains are important food chains in many developing countries, with the potential to contribute to food security, social change and poverty reduction. However, as the quality of raw milk and of processed dairy products is often low, producers miss income opportunities and consumers are exposed to health risks. The introduction of dairy development programs as collaborative efforts based at the producer organisations should help farmers get a better income and improve dairy quality at the same time. For women, important actors in dairy production, and the poorest smallholders, highly dependent on this income, the improvement of milk quality could make a major difference in their household economics. Dairy development programs, however, considering the continuing lack of good milk quality, seem not to function as expected. In dairy production and processing, women and other disadvantaged groups play essential roles as they supervise the home-based activities. Particularly when innovations for quality improvement are required, all actors need to be involved. By identifying barriers and constrains to inclusive milk quality improvement, LIQUID offers opportunities for dairy development practice.

Final Research Findings
It seems that the success of milk-quality improvement through inclusive producer organisations is a trade-off. On the one hand, milk-quality improvement requires a strong business-oriented organisation. On the other hand, inclusive producer organisations are usually not the most efficient in their business operations. Levels of inclusiveness and social inequalities can be related to informal institutions and the hidden effects of formal regulations, organisation structure and farmers’ organisation grade as well as urban-rural locations of farms. The more remote the farm location, with limited access to informal and formal markets, the more essential the producer organisation is to smallholder dairying. As the organisation grows, however, the more market focused and less inclusive it becomes. Insights into power balances in formal and informal dairy value chains as related to the inclusive development effects of milk quality improvement activities can be considered as the key results of our programme.

Final achievements
For how to best improve food security and hygiene in the Dairy Value Chain in Tanzania, Ledo finds that improvement strategies revolve around approaches that integrate poor smallholder farmers along the chain through support programs (training, technical assistance and infrastructure development) involving dairy companies, local businesses, governments and non-governmental organisations. As quality improvement is often not the primary goal of these programs, they are too general to bring about a significant upgrade in milk safety system performance. Ledo’s study with the farmers shows that, despite of the positive perception of the support of the non-commercial program, neither of the support programs achieves safety and hygiene control improvements. To improve on this, Ledo has developed a customised tool that does seem to help the smallholders. The customised assessment tool was able to differentiate accurately between the actual safety and hygiene control practices of dairy chain actors. The resulting actor performance profiles provided a starting point for the development of tailored training programs to farmers with similar performance levels.
Working towards impact on food & nutrition security

Co-creation

Messages to:

- Policy makers
- Civil society and practitioners organisations
- Actors from private sector
- Farmer groups, farmer respondents and other grass root stakeholders
- Existing structures and address existing needs.
- At the programme level, communication within the consortium, with stakeholders and with related projects has been used to allow for co-creation, feedback and reflection as well as changing agenda’s and focus according to urgency.

Future research and activities

The objective of SUPERSEAS is to improve the design of area-based management for aquaculture production in order to reduce the economic and environmental risks associated with smallholder aquaculture, and improve the terms under which smallholders are incorporated in domestic, regional and international retail value chains. The research is organised into three PhDs focusing on (1.) management principles and governance, (2.) finance and risk transfer, and (3.) value chain governance. Countries of study are Thailand, Vietnam and China.

Final Research Findings

1. There is a general trend of the promotion of area-management by international public actors. However, we also see efforts to integrate area-level approaches to management coming from the private sector. While there has been increased interest across these range of actors to address systemic risks in aquaculture production, there is little research on how area-based approaches are organised, how effective they are in Southeast Asia, or what benefits they can bring to farmers, value chain actors and consumers alike.

2. It is clear that many existing area-based approaches are based on top-down planning, most often associated with remote GIS-based techniques for defining zones or areas. Very little research has been producer-centered, taking into account environmental risks in- and outside of their farms. Defining these boundaries is a key target of research.

The final (outcomes) achieved

Area-based management is a transformative concept which first requires empirical research, so the project is no longer action research with an adaptive research cycle. The project has multiple levels of influence; through national and international policy, private standards and industry arrangements for groups or areas that incorporate smallholders currently excluded from Northern markets. As an inclusive business model, these areas can also ensure access to finance including smallholders.

"Very little research has been produced centered, taking into account environmental risks in- and outside of their farms"

Messages to:

- Actors from the private sector
  - Since supermarkets face risks in terms of matching demand for aquaculture products with supply, we assume it is in their interest to create inclusive arrangements for groups or areas that incorporate producers in their supply chains.
Co-creation

The PhD researcher interviewed project partners and external stakeholders at the start of the project to choose study sites. Partners were invited to a kick-off meeting in Malaysia, a European workshop in Utrecht and most recently a webinar meeting in Vietnam. The various meetings throughout the project have facilitated feedback to the researchers after their scoping trip and partners identified opportunities for taking up potential research results including: the FAO Committee on Fisheries process; feeding into the Aquaculture Stewardship Council group certification standard development, the IDH Landscape approach programme and aquaculture programme, input into the Sustainable Fisheries Partnership aquaculture programme. The researchers also had considerable engagement with various organisations in the field. For example, the Chinese NGO China Blue Sustainability Institute during fieldwork.

Knowledge networks

Simon Bush is on the technical advisory board of the Monterey Bay Aquarium Seafood Watch Programme and of the Dutch Sustainable Trade Initiative’s (IDH) Aquaculture Programme. There he has discussed the work of SUPERSEA and advocated the results to date where relevant. His work with the Seafood Watch Programme has also led to a sub-project under SUPERSEA to establish an aquaculture governance framework including area-based management.
The Food & Business Global Challenges Programme

All projects Global Challenges Programme

GCP-funded research projects aim to generate research-based advanced understanding of emerging key issues in food security and their impact on regional and local food security, and the role of private sector development.

GCP-projects, first call 2014

Enhanced nutrition security through traditional fermented foods in Zambia
Dr Simm Schussina - Wageningen UR, Laboratory of Genetics (NL)

Co-creation
In the process of knowledge sharing and laying the foundations of co-creation, local government and private sector stakeholders have become more attentive to WFEs diversified priorities and needs to access land and water resources, market space, enhance food commodity added-value, food security and income opportunities. On their sides, WFE groups have become more aware of the commonality of the obstacles and constraints that are shared across different groups in producing, processing and marketing food commodities in the urban and peri-urban slums. This has induced them to seek strength in the collective by identifying and establishing new linkages, with other WFE groups, private and public government stakeholders. Finally, it is fair to conclude that all stakeholders involved have developed new understanding about a range of sustainable social amendments that can be fairly assumed, either from organic manure that some WFEs self-produce, already or from local mines in the form of rock dust (that is now a waste product). The project is now in the process of testing these soil amendments, separately and in different combinations. Soil characterisation and rock dust analysis results have been shared with the WFE groups and local government and business stakeholders.

nitrogen- and phosphorus-efficient technologies, which can help reduce their environmental footprint and increase the sustainability of their food production system. One of the project's objectives is to develop and test a soil nutrient management system that can be adapted to local conditions and support the increased production of traditional fermented foods in rural and peri-urban areas. This could lead to improved food security and nutrition for vulnerable populations in rural areas.

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commercial-offer food waste recycling technologies.

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The collection of food wastes in market places can be translated into an inclusive business model. The food waste is turned into natural compost by the WFEs, packaged and sold after and testing and certification by the local laboratory and research institutes.

Women in the local and regional markets could benefit from better visited spots in local markets and lower market fees, resources, market space, enhance food commodity added-value, food security and income opportunities. On their sides, WFE groups have become more aware of the commonality of the obstacles and constraints that are shared across different groups in producing, processing and marketing food commodities in the urban and peri-urban slums. This has induced them to seek strength in the collective by identifying and establishing new linkages, with other WFE groups, private and public government stakeholders. Finally, it is fair to conclude that all stakeholders involved have developed new understanding about a range of sustainable social amendments that can be fairly assumed, either from organic manure that some WFEs self-produce, already or from local mines in the form of rock dust (that is now a waste product). The project is now in the process of testing these soil amendments, separately and in different combinations. Soil characterisation and rock dust analysis results have been shared with the WFE groups and local government and business stakeholders.

Knowledge networks

• EADI - INCLUDE - The Broker - AgriProFocus - NAFTC

Enhanced nutrition security through traditional fermented foods in Zambia
Dr Simm Schussina - Wageningen UR, Laboratory of Genetics (NL)
Consortium partners: University of Zambia, Tropical Diseases Research Centre (Zambia), Helio International (Zamb), CSK Food Enrichment (NL), Yoba-life Foundation (NL)

Local fermented foods are nutritious and safe and are part of Zambian and African culture. Their potential to promote development is currently neglected. This project will optimize the entire value chain of these products from local (female) producers to consumers, resulting in better health and nutrition as well as increased income for local people.

Helping Poor Farmers Grow Money: Sustainable Cocoa Productivity and Socio-Economic Impacts of International Investments in Sierra Leone
Dr Maarten Voors UR, Wageningen University & Research (NL)

In the process of knowledge sharing and laying the foundations of co-creation, local government and private sector stakeholders have become more attentive to WFEs diversified priorities and needs to access land and water resources, market space, enhance food commodity added-value, food security and income opportunities. On their sides, WFE groups have become more aware of the commonality of the obstacles and constraints that are shared across different groups in producing, processing and marketing food commodities in the urban and peri-urban slums. This has induced them to seek strength in the collective by identifying and establishing new linkages, with other WFE groups, private and public government stakeholders. Finally, it is fair to conclude that all stakeholders involved have developed new understanding about a range of sustainable social amendments that can be fairly assumed, either from organic manure that some WFEs self-produce, already or from local mines in the form of rock dust (that is now a waste product). The project is now in the process of testing these soil amendments, separately and in different combinations. Soil characterisation and rock dust analysis results have been shared with the WFE groups and local government and business stakeholders.

Consortium partners: Theodora BV (NL), Nikta University (Serra Leone), Agroproduction Management Services (Sierra Leone)

Commercially-driven investments in cash crop production aim to provide benefits in terms of both productivity and poverty alleviation, providing a win-win strategy for rural development. In this project, we examine the direct impacts in post-conflict Sierra Leone for farmers, their communities as well as the cocoa value chain.

Inclusive partnerships and innovation platforms for sustainable landscapes and greater food sovereignty
Dr Miriam Ross-Tonen - University of Amsterdam

In the process of knowledge sharing and laying the foundations of co-creation, local government and private sector stakeholders have become more attentive to WFEs diversified priorities and needs to access land and water resources, market space, enhance food commodity added-value, food security and income opportunities. On their sides, WFE groups have become more aware of the commonality of the obstacles and constraints that are shared across different groups in producing, processing and marketing food commodities in the urban and peri-urban slums. This has induced them to seek strength in the collective by identifying and establishing new linkages, with other WFE groups, private and public government stakeholders. Finally, it is fair to conclude that all stakeholders involved have developed new understanding about a range of sustainable social amendments that can be fairly assumed, either from organic manure that some WFEs self-produce, already or from local mines in the form of rock dust (that is now a waste product). The project is now in the process of testing these soil amendments, separately and in different combinations. Soil characterisation and rock dust analysis results have been shared with the WFE groups and local government and business stakeholders.
Integrated GCP projects, second call 2014

Improving livelihood by increasing livestock production in Africa: An agribusiness model to commercially produce high quality insect-based protein ingredients for chicken, fish and pig industries (IPUN)

Prof. Marcel Dicke, Laboratory of Entomology, Wageningen University. Consortium partners: International Centre for Insect Physiology and Ecology (Kenya), Kenyatta University, Technoserve (Kenya), Solidaridad (Kenya).

Poultry, pig and fish farming are the fastest growing agribusiness activities in East Africa. However, the high costs of feed greatly hampers profitable gains for farmers. The research will explore the potential of insects to supplement feed. Furthermore, awareness and market opportunities for production of insect-based protein for the livestock industry will be created.

Follow the food: Dutch agribusiness and local food security in Africa

Dr. Guss van Westen - Utrecht University, Faculty of Geosciences. Consortium partners: St. Mary’s University, Addis Ababa (Ethiopia); Solidaridad, Arusha (Tanzania); Nairobi (Kenya); and Utrecht; Fair & Sustainable Advisory Services, Utrecht

There is considerable foreign investments in African food production for world markets. This may serve global food security, but can have negative consequences when external agribusiness displace food smallholders without alternative income sources. This study investigates which different business models manage to achieve inclusive growth in Ethiopia, Kenya and Ghana.

Information transparency as a low cost scalable solution to farmers? access to credit and services in Ghana

Prof. Robert Lensink – Wageningen University; Development Economics Group. Consortium partners: University of Ghana, Cocoa Research Institute of Ghana (CRIG) and AgriRace

This project examines whether the introduction of a farmer information platform improves cocoa farmers’ access to finance. By closing information asymmetry between financial institutions and farmers, the farmer is more likely to offer financial services to the latter. Technology is expected to reduce know-your-customer and transaction costs of reaching out to smallholders.

Women Food Entrepreneurs in Kenya and Burkina Faso: Building inclusive business models for food security in the city slums of Kisumu and Ouagadougou

Dr Nicky Pous - University of Amsterdam (the Netherlands) Consortium partners: Faculty of Natural Sciences, University of Amsterdam (the Netherlands), Solidaridad (Kenya), Technoserve (Kenya), Solidaridad (Kenya)

Improved collaboration among local and international businesses in value chains can lead to higher productivity and improved quality. This project provides insights and practical tools to strengthen inclusive dairy chains in SE Asia and East Africa, with the aim to improve product quality and farmer income.

Supermarket supported area-based management and certification of aquaculture in Southeast Asia (SUPERSEAS)

Dr Simon Bush - Environmental Policy Group, Wageningen University (The Netherlands) Consortium partners: WorldFish Centre (Malaysia/Bangladesh), Can Tho University (Vietnam), Prince of Songkla University (Thailand), Sustainable Fisheries Partnership (Thailand)

Coastal aquaculture in Southeast Asia affects resources and communities across coastal landscapes. But environmental management only focus on the farm level. This project will determine how aquaculture farmers can improve their environmental and social performance by scaling up management to beyond the farm and what market and financial support they can receive for doing so.

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Assuring the Learning Effects of Games on Attitude of Stakeholders towards Food and Nutrition Security in Ghana: Intervention and Impact Evaluation

Dr. Joachim Plummer – Wageningen University, Department of Development Studies (The Netherlands); Consortium partners: University of Ghana, KNUST (Ghana); REACH International (UK)

While education is the most reliable approach to changing food and nutrition behavior, games can be a useful tool to increase awareness and motivation. This project will evaluate the effectiveness of a game-based intervention that改变了 Attitude towards Food and Nutrition Security in Ghana.

Assuring and Supporting Input and Advisory Services for Resilient Evergreen Forest Management in Eastern Africa: A Poverty-Alleviation Approach

Dr. Opeke Olaotu – University of Ibadan, Nigeria; Consortium partners: IFAD, IFPRI, IFDC, IITA, CIRAD, IFPRI, CIAT, ICRISAT

This project will focus on improving input and advisory services for farmers in Eastern Africa, with the goal of increasing climate-resilient forest management practices.

Assuring and supporting input and advisory service systems for resilient market-oriented smallholder dairy systems in the Uganda and Kenya highlands

Dr. Lars J. Siebert – Wageningen University, Department of Development Studies (The Netherlands); Consortium partners: Makerere University (Uganda), Egerton University (Kenya), KARI (Kenya), IITA (IITA)

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This project will focus on improving input and advisory services for smallholder dairy farmers in Uganda and Kenya, with the goal of increasing climate-resilient dairy production.
Cocoa farmers in West Africa face poor productivity due to constraints at the crop, field, farm and sector level. To ensure future cocoa production yields need to increase sustainably. This research will investigate the effect of field level practices on cocoa productivity. The suitability of different (combination(s) of) practices for different smallholder farm systems will be explored. Effective delivery of the services supporting these practices will be co-developed with public and private partners.

Horticultural food systems based on ecologically intensive production and socio-economically sustainable value chains in the transition economies Chile and Uruguay (HortiCo)

Dr Walter Roos - Wageningen University, Farming Systems Research (FSR) (The Netherlands)

Consortium partners: University of the Republic (Uruguay), Pontificial Catholic University of Valparaiso (Chile), Administrative-Commission of the ‘Nebado Market’ (CAAMM) (Uruguay), National Commission for Rural Promotion (CNFR) (Uruguay), National Commission of Horticulture (DHN) (Chile), Horticulture Committee of Chile (HortsChile), Wageningen University, Management Studies; Knowledge, Technology and Innovation; Rural Sociology.

While consumption of vegetables in emerging economies falls well short of dietary recommendations, vegetables production contributes to environmental pollution and health risks. This project will engage with small farmers and organizations involved in low-on-cost vegetable production methods to develop new effective production, knowledge sharing methods and collaborative value chains.

Fast Track GEP projects, fourth call 2017

Inclusive and climate smart business models in Ethiopian and Kenyan dairy value chains

Dr Robert Baars – Van Hall Larenstein University of Applied Sciences

Consortium partners: Rik Dieden (Van Hall Larenstein University of Applied Sciences (VHLS)), Arne Bechert (Wageningen University & Research), Udo Wolfenbuttel (Wageningen University & Research).

This research aims to describe business models of chain actors and supporters to identify opportunities for scaling up good climate smart practices. It is linked to ‘Routinely Appropriate Mitigation Actions’ (NAMA) in Kenya to reduce GHG emissions from dairy production. Six dairy value chain case studies will be purposively selected, three in Kenya and three in Ethiopia, with varying degrees of market orientation. Three PhD students will be field investigators in each of two selected chains.

Understanding and scaling Organisational structures for Smallholder resilience (CAMEAR) in Malawi, Mozambique, Tanzania, Zambia and Zimbabwe

Dr Domenico Dentoni (Wageningen University (WU))

Consortium partners: Seru Gondwe (Longyear University of Agriculture and Natural Resources (LUNAR)), Nelson Mwape (Zambian-Super Seeds (ZSS)), Todd Rosenstock (World Agriculture Centre (WAC), Golden Mahove (GVMA), Sam Kambiri (GVMA), Jacques Thiemeier (Wageningen University), Valentina Matera (Wageningen University (WU)).

This project seeks to understand when and how the organisational new business models linking farmers to markets leads to resilience of smallholders, in particular youth and women. Resilience will be assessed in terms of development of farmers’ adaptive capacity and their engagement with other stakeholders in the system. During and after the investigation, personal and group trainings will be provided for smallholders, their representatives and stakeholders to exchange knowledge and respectively foster their capacities.

Upscaling CSA with small-scale food producers organised via VSAs: Financing for adoption, behavioural change and resilience in rural fringe regions, Tanzania

Prof. Rued Ruben (Wageningen University & Research (WUR))

Consortium partners: Joseph Hella (Sokoine University of Agriculture (SU)), Tadil Masoud (CARE International in Tanzania), Evam Gizert (CAT).

The small-scale agriculture sector and food systems in rural Tanzania are in a critical need of investment towards Climate-Smart Agriculture (CSA) that satisfy criteria of sustainability, profitability, equity and resilience (SuPER). This project will provide practical and conceptual insight into the appropriate combinations of business training (through Farmer Field & Business Schools - FFBs) and financial services (through Village Savings & Loans Associations – VSAs) that support community-based adoption (CBA) action plans.

Multiple pathways and inclusive low emission development: navigating towards leverage points in the East-African dairy sector

Dr Seatele Vellama (Wageningen University & Research)

Consortium partners: Todd Crane (International Livestock Research Institute (ILRI)), George Schonefeld (Center for International Forestry Research (CIFOR)), Joanne Abie (African Centre for Technology Studies (ACTS)), Robbert Mifsud (Ministry of Agriculture Kenya, Livestock and Fisheries (State Department of Livestock)), Polly Erickson (International Livestock Research Institute (ILRI)).

Reducing emissions intensity of livestock is high on the agenda in East Africa. This research analyses institutional conditions for scaling inclusive Low Emission Development (LE-D) interventions that account for the diversity of practices, development pathways and interests in the Kenyan and Tanzania dairy sectors. The project engages governments, leading dairy firms, service providers and male and female livestock keepers in research-driven dialogues to design a portfolio of cost-sensitive LED approaches reducing emissions intensity while enhancing socio-economic inclusivity.

Understanding and improving scaling readiness of climate smart, nutrient management decision support tools (DST) in different institutional environments: Ethiopia & Tanzania

Prof. Caes Lammers (WUR – Wageningen University & Research)

Consortium partners: Jens Anderson (International Maize & Wheat Improvement Center (CIMMYT)), Peter C. Craufurd (International Maize & Wheat Improvement Center (CIMMYT)), Getaneh Gumma Debele (Ethiopian Institute of Agricultural Research (EIAR), Arild Angels Mushsong (Agricultural Research Institute (ARI)-Uganda), Martin Van Ittersum (WUR – Wageningen University & Research).

This project aims to improve the delivery and uptake of nutrient management advisory tools that aim to increase African maize production while avoiding increases in greenhouse gas emissions. Working closely with different types of farmers and advisory services, the project examines the ‘user logics’ and institutional environments that affect the large-scale uptake of three climate-smart nutrient management advisory tools by smallholder farmers in Ethiopia and Tanzania.

Promoting climate resilient seed varieties: Smallholder barriers to adoption and willingness to pay for seed of drought tolerant varieties in Uganda and Ethiopia

Dr Peter Gildemacher (KIT)

Consortium partners: John Waswa Mulunia (National Agricultural Research organization, Plant Genetic Resources Centre), Josephine Akia (Participatory Ecological Land Use Management (PELUM)), Carlo Fadda (Bioversity International), Dejene Kassahun Mengistu (Mekelle University), Silvina Sarapura (KIT), Francine Krajiessen (KIT), Glenda Ottenbeek (Bioversity International).

Traditionally new varieties of crops are tested by agricultural scientists, with farmers, in controlled trials. In ‘citizen science’ samples of candidate varieties are sent to a large group of farmers. They test the candidate varieties and provide simple feedback on their performance. This project will bring ‘citizen science’ to use in variety testing and registration in Ethiopia and Uganda. Focus will be on selection of varieties with high nutritional value adapted to climate wise.

Using Climate-Smart Financial Diaries for Scaling in the Nyando Basin, Kenya

Prof. Romeo Osundey (Amsterdam Centre for World Food Studies, Urpi University)

Consortium partners: John Gathika (School of Economics, University of Nairobi), Anne-Andersson Djakeli (Agricultural Economics Eastern Africa), Marion Rudley (ECAFS East Africa/LBUR), Cor Wartel (ECAFS / Wageningen Economic Research).

Nyando Basin in western Kenya experiences agricultural stagnation, environmental degradation and deepening poverty, all aggravated by climate change. Previous ECAFS projects identified the combination drought-resistant breeds of goats/horticulture/agroforestry as a promising strategy that is climate-resilient and climate smart in closing nutrient cycles. This project will support upscaling this business model addressing three challenges: (1) designing a conducive financial environment, (2) identifying additional value chain partners, and (3) identifying constraints, opportunities and required policy interventions at landscape level.

The uptake of certified seed by smallholder farmers is presently low, despite the fact that this seed has much higher yield potential and is often more tolerant to drought than the varieties traditionally grown by farmers. This project investigates the main sources of risk for smallholder farmers, and whether offering appropriate insurance products together with seed will increase their willingness to pay for drought tolerant seed varieties.

Edison’s Science approach to climate smart and nutrition sensitive seed value chains for food and nutrition security in Uganda and Ethiopia

Dr Peter Gildemacher (KIT)

Consortium partners: John Waswa Mulunia (National Agricultural Research organization, Plant Genetic Resources Centre), Josephine Akia (Participatory Ecological Land Use Management (PELUM)), Carlo Fadda (Bioversity International), Dejene Kassahun Mengistu (Mekelle University), Silvina Sarapura (KIT), Francine Krajiessen (KIT), Glenda Ottenbeek (Bioversity International).
The Dutch Research Council (NWO) funds top researchers, steers the course of Dutch science by means of research programmes and by managing the national knowledge infrastructure. [www.nwo.nl/wotro](http://www.nwo.nl/wotro)

The Ministry of Foreign Affairs (BZ) makes our Kingdom safer and more prosperous and is committed to a fair and sustainable world. [www.govemment.nl/ministries/ministry-of-foreign-affairs](http://www.govemment.nl/ministries/ministry-of-foreign-affairs)

The aim of F&BKP is to increase the impact of Dutch research projects, programmes, policies, investments and business by knowledge brokering across professional divides. The KP facilitates the creation, exchange and use of knowledge of knowledge for Dutch actors and their partners working in LMICs. [knowledge4food.net](http://knowledge4food.net)

Read more: [www.nwo.nl/foodandbusiness](http://www.nwo.nl/foodandbusiness)
Three synthesis studies have been commissioned by NWO-WOTRO, in collaboration with the F&BKP, on the results of finalised ARF and GCP projects. The synthesis studies will be conducted in two phases – the first phase started in 2019 and focuses on the results of projects finalising before the end of 2019 (i.e. 35 ARF and 14 GCP projects), the second phase will start in April 2020 and builds on the first phase; it covers all ARF and GCP projects.

The purpose of the studies is to capture the key findings and lessons emerging from ARF and GCP research projects. Synthesis of findings and outcomes is foreseen around selected themes to produce an aggregated body of knowledge that is relevant for both policy and academic stakeholders. Within the first phase synthesis is conducted at three levels:

1. **Synthesis on key research insights** from ARF and GCP on four themes: i. Circular Agriculture, ii. Indigenous Food and Techniques, iii. Inclusive Business and FNS, iv. Smallholder Production
   - With as objectives: To synthesise research insights for the selected themes, from ARF and GCP projects, in order to:
     i. innovations to respective conceptual and thematic (in policy and practice) debates, and
     ii. facilitate and promote research use, i.e. to have an effective outreach strategy to relevant stakeholders and networks across the programmes at higher level than at individual project level;

2. **Synthesis on outcomes** on policy and practice achieved, organised per target group of outcomes: i. private sector, ii. policy/practice, and iii. smallholders
   - With as objectives: To capture and synthesise outcomes achieved in order to:
     i. define, share and communicate the (overall) contribution of ARF and GCP research to changes in local and (inter)national policy and practice, and
     ii. identify effective strategies for achieving outcomes in order to formulate various potential pathways for achieving outcomes on policy and practice following from research, in order to inform and inspire ongoing and future research consortia and programmes, policy and practices;

3. **Synthesis on best practices, challenges and lessons learned** with regard to the ARF and GCP integrated approach to enhancing impact
   - With as objective: To capture best practices, challenges and lessons learned on the ARF and GCP approach to enhancing impact, in order to inform ongoing and future research consortia and research programme development
List of Abbreviations

ARF - Food & Business Applied Research Fund
CGIAR - Consultative Group on International Agricultural Research
DDE - Department for Sustainable Economic Development, Dutch Ministry of Foreign Affairs
DGIS - Directorate-General for International Cooperation, Dutch Ministry of Foreign Affairs
F&BKA - Food and Business Knowledge Agenda
F&BKP - Food and Business Knowledge Platform
FTR - GCP Fast Track Research
GCP - Food & Business Global Challenges Programme
IAC - GCP International Advisory Committee
IP - GCP Integrated Projects
LMIC - Low and Middle-Income Country
MASP - Multi Annual Strategic Plan
MEA - Dutch Ministry of Economic Affairs
MFA - Dutch Ministry of Foreign Affairs
NWO - Netherlands Organisation for Scientific Research
ODA - Official Development Assistance
PIE - ARF Pool of International Experts
WOTRO - Science for Global Development, NWO division

NWO-WOTRO

Final Evaluation of the Food & Business Applied Research Fund (ARF)

Final Evaluation Report
June 2019

Syspons GmbH
Prinzenstraße 84, Aufgang 1
10969 Berlin, Germany
Matias Krämer
Manager
Telephone: 0151/26 460 485
E-Mail: matias.kraemer@syspons.com

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Executive Summary

Background
The global food system today is beset by serious challenges and risks. Major demographic shifts are increasing and changing the demand for food, with a rapidly growing population expected to reach 9.5 billion people by 2050 and drive global demand for food up by 60%. These shifts are driving new threats to populations, systems and environment. At the same time, some 795 million people go hungry every day, with 2 billion people lacking the nutrients to live a healthy life.

These challenges are systemic and interconnected, driven by the actions and interactions of many diverse actors across the food system. Such large-scale, complex challenges require scientific research and innovations to develop solutions that contribute to long-term access to affordable, safe and nutritious food for vulnerable and resource-poor populations. Moreover, these solutions have to be readily applicable and contribute to the enhancement of sustainable food security for these most vulnerable populations.

Against this background, the Ministry of Foreign Affairs developed a new knowledge and research policy in 2011 that should strengthen Dutch development policy and its implementation, as well as contribute to development and self-reliance in developing countries. To this end five knowledge platforms were established for the four thematic priority areas – food security being one among them – where learning can take place, as well as discussions on the knowledge agenda, a coherent research agenda and the utilisation of existing knowledge.

The main instruments to generate this new knowledge for the platform on food security are the Applied Research Fund (ARF) and the Global Food Challenges Programme (GCP). Both instruments aim at having an impact on food security in order to improve the situation of food insecure populations in developing countries and to generate research findings as well as innovative solutions that are relevant for development policy in the domain of food security and the challenges the global food system is facing today.

Purpose of the Final Evaluation of ARF
The ARF instrument possesses a monitoring and evaluation framework in which a baseline study, a midterm and final evaluations have been carried out. NWO-WOTRO commissioned Syspons GmbH to implement this framework. In this regard Syspons assessed the contribution of ARF to food security and private sector development in Dutch partner countries. The objective of this evaluation and monitoring framework is also to account for public expenditure and to contribute towards future policy development and implementation.

For this final evaluation of ARF, Syspons was asked to deliver insights into the aspects of effectiveness, impact, and sustainability concerning ARF. Furthermore, the final evaluation’s aim is to provide recommendations for the future implementation of ARF or the design of future research-based food security instruments. The final evaluation focused on finalised or almost finalised ARF projects. This final evaluation report therefore complements the mid-term evaluation report. As such, a synthesis report of both will be submitted in 2021 together with the synthesis report of GCP.

The final evaluation was undertaken from June 2018 to June 2019. Within the given timeframe the evaluation team conducted an in-depth analysis of all relevant documents and data (e.g. project reports), an online survey among all consortia members as well as three case studies in Ghana, Uganda and Benin in which nine ARF projects from the first and second ARF call for proposals were analysed.

Key Findings and Conclusions
One of the strengths of the ARF programme is that it is largely effective, meaning that most outcomes are reached or achieved by the programme. For example, the evaluation finds that farmers and other producers adopt and apply new knowledge and innovation. This outcome was observed in the three case study countries Benin, Ghana and Uganda. Furthermore, the evaluation finds that the programme is successful in raising awareness for the food security issues that are being researched. For example, a project in Benin demonstrated that communicating the research outputs in formats specifically adapted to the target groups can lead to high acceptance of research findings. Moreover, the evaluation finds that the ARF programme has been successful in fostering collaboration between Northern and Southern researchers. For this success, the ARF programme design, which requires teamwork and co-creation between Northern and Southern consortium members was key. In addition, the results show that it is possible to develop business models and value chains in inclusive ways, as assumed by NWO-WOTRO in calls of proposal.

Overall, the evaluation finds that the main design features of the Food and Business Applied Research Fund are a main source of success of the programme, as they are instrumental for ensuring its effectiveness. In this regard, the F&BKP was a useful feature, as projects used it to share their results and some projects used the opportunity to expand their networks and explore further cooperation, such as starting similar projects in other countries. Moreover, by funding multi-stakeholder consortia and encouraging co-creation, the ARF instrument ensures access to the target groups and other external stakeholders. Regarding co-creation, the evaluation finds that consortium members particularly engage in information seeking and advocating for their joint projects. Moreover, the case studies showed that co-creation involved using networks of consortium members to access political actors and therefore influence policy change. In addition to co-creation, research uptake strategies are important for achieving the project outcomes. In this vein, the evaluation finds that it is important to communicate the results appropriately to the target group to ensure their willingness to be informed by the research results.

In terms of the impact, the interim progress evaluation concluded that the step from outcome to impact was too far, as the transfer of a technology adopted by the ultimate target group to the application on a national level in a country was a bar set too high. In the revised impact pathway, the ARF seeks to contribute to changing food security at local and / or regional levels in ARF countries. Accordingly, the final evaluation identifies successful examples of projects contributing to changing food security at local or regional levels.

In addition, the evaluation finds that the ARF programme uses successful measures for ensuring its sustainability, particularly regarding the technological and institutional sustainability. In this sense, human resources, processes and procedures of the project have been incorporated into the structures of the consortium members (institutional sustainability), and newly developed methods and technologies can be used by the target groups without external assistance and maintenance support after the project (technological sustainability). For achieving institutional sustainability, the close collaboration between project stakeholders in their consortia, their connections to the research topic and a focus on complementary and/or non-redundant research as the result of the ARF programme can lead to high acceptance of research findings. Moreover, for ensuring the technological sustainability of the outcomes of the ARF projects integrated their research into existing value chains and managed to integrate efforts for technological and institutional sustainability. Furthermore, projects that develop technologies which can be turned into business ideas were particularly prone to secure the continued investment of the private partner.

Next to these strengths, the evaluation team also finds some challenges in the ARF programme, which can serve as starting point for the further development and improvement of the programme. In terms of reaching and sustaining the research outcomes, the evaluation finds that local authorities mostly lack the capacities to adopt and eventually sustain the project activities and to follow-up on learned topics to further implement and spread knowledge, e.g. to other parts of the intervention region.

Additionally, regarding co-creation, the evaluation finds that it can be challenging to bridge the interests of consortium members for whom research is more important, and those for whom action and application is more relevant. Thus, even though the collaboration between various partners can lead to synergies, the assumption that the interests and world views of partners will align through collaboration cannot always be confirmed.
Furthermore, the evaluation finds that many ARF projects implemented fewer activities for research uptake than they initially planned. According to the online survey, challenges were that stakeholders did not feel like they had enough time to organise the research uptake and that they encountered unanticipated challenges in the research uptake process.

Moreover, the evaluation finds that some projects struggle with contributing to food security at an impact level. On this issue, the evaluation identifies challenges to achieving impacts across the programme. First, the evaluation finds that some of the basic assumptions of the Food Security Policy that underly the ARF’s revised impact pathway could not be validated. Specifically, the evaluation finds that while the projects contribute to an increase in income of the ultimate target group, this does not necessarily lead to an increase in spending on food or savings and therefore higher food security. In this regard, the case studies showed that the farmers did not see themselves as being food insecure and thus spend the additional money on transportation or education for their children. Moreover, the evaluation finds that a “trade-off” exists between the two ARF programme objectives of fostering private sector development and supporting food insecure target groups. ARF projects that aim to establish a business model do not consistently focus their efforts on vulnerable target groups that suffer under food insecure in the partner countries, but on those who can contribute to the business effort (which mostly are farmers with sufficient income and education). These are for example farmers that can deliver a certain food or seed quality to be further processed, and which are normally not part of the most vulnerable groups.

Regarding the financial sustainability, the ability to acquire additional funding during the project and to carry on project activities after the project has ended has shown to be a challenge across many of the ARF projects. This challenge was already identified in the mid-term evaluation and it has persisted after the projects have ended. In this regard, the final evaluation finds that many projects did not implement measures to ensure that financial resources were available after the projects ended. In addition to the financial sustainability, the evaluation finds that social and ecological sustainability are not taken into consideration in some ARF projects and therefore are sometimes disregarded in the project design. As a result, the case studies have shown some unintended negative effects due to consortium members not showing sufficient awareness of the potential social or ecological harms that may be caused by their projects.

**Strategic-Level Recommendations**

1. Key programme design features, like co-creation, using research uptake strategies, encouraging the regular interaction with stakeholders and the involvement of private sector stakeholders should be considered for further implementation of programmes by NWO-WOTRO and the Ministry of Foreign Affairs.

2. The Dutch Foreign Ministry and NWO-WOTRO should revise the assumptions underlying the impact pathway, especially concerning the connection between income and food security, ensuring that they reflect the realities of the contexts in which projects operate.

3. The Dutch Foreign Ministry and NWO-WOTRO should make a clear decision about the focus of the ARF instrument or acknowledge the existence of a trade-off effect between the objective of involving vulnerable groups and enhance private sector development. In this regard, the programme can either (a) focus more clearly on vulnerable groups suffering from food insecurity (b) focus more clearly on the development of inclusive private businesses and value chains or (c) accept that there is often a trade-off between the two objectives.

**Operational-Level Recommendations**

1. NWO-WOTRO should make the reduction of harm to ensure social and ecological sustainability a more explicit focus in the project planning stage.

2. To ensure the financial sustainability of the projects, NWO-WOTRO should increase its scrutiny of sustainability strategies and their implementation during the projects’ lifespan.

3. The time frame of projects and the time in which outputs and outcomes can be achieved and observed should be aligned, so that the ARF impact pathway can be accomplished to the output level and initiated to the outcome level within the allocated project time frames.

4. NWO-WOTRO should consider using a standardised online monitoring tool that supports and structures the collection of information from projects to ensure the compliance with quality standards for reporting.