



Capitalising on knowledge: How research can enhance business opportunities that serve marginalised farmers and consumers

Outcome series - insights from a synthesis study of the Food & Business Research Programme

Authors: Daniëlle de Winter & Dr Ellen Lammers



This paper is part of a series that presents findings based on the Outcome Synthesis study of the NWO-WOTRO Food & Business Research programme conducted by Daniëlle de Winter and Ellen Lammers. The paper focuses on outcomes achieved by, for and with private sector actors in a selection of research projects (see Annex). All projects funded by the Food & Business Research programme brought together diverse groups of researchers, practitioners and business stakeholders and had the long-term aim of improving food and nutrition security (FNS) for the poor and marginalised.

About Food & Business Research

The Food & Business Research programme aims at generating new knowledge, insights and innovations to address food and nutrition insecurity in low and middle income countries (LMIC). 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. Food & Business Research is funded jointly by the Ministry of Foreign Affairs of The Netherlands and the Dutch Research Council (NWO) and managed by NWO-WOTRO Science for Global Development.

1. Introduction

This article illustrates the role of and efforts by private sector partners in research conducted and outcomes achieved for improving food and nutrition security for poor and marginalised groups in low- and middle-income countries (LMICs). The article tries to find answers to the question how the private sector can optimally capitalize on research findings and innovations that enhance business opportunities, which in turn serve marginalised farmers and consumers by potentially improving their food and nutrition security.

The outcomes presented in this article build on the results and achievements of a selection of the multi-stakeholder, transdisciplinary research projects funded by NWO-WOTRO Science for Global Development's Food & Business Research programme. The research projects set out, in differing degrees, to investigate how activities and drivers of the food system affect the success of private sector interventions and the bottlenecks experienced. Box 1 provides more detail on the Research for Impact approach adopted by NWO-WOTRO in their pursuit to increase the societal and policy impact of research projects.

It is important to note that the synthesis study is by no means an evaluation and has therefore steered clear from measuring the positive or negative 'success' of a project. Furthermore, the research projects did not take place in vacuum, but were influenced by external processes (e.g. interventions by other stakeholders, political processes and economic developments). This article therefore presents a synthesised interpretation of the most remarkable and relevant outcomes achieved during the project duration and shortly after. It also considered lessons that can be drawn from the processes that helped or hindered achieving these outcomes for the benefit of future research as well as policy and practice.

Box 1: Research for Impact

NWO-WOTRO Science for Global Development aims to support researchers in increasing the impact of their research projects on all levels, but in particular in terms of societal impact and policy influence. NWO defines societal impact of research as "the contribution that innovative research makes to understand and solve global issues, with a focus on sustainable development and poverty reduction". NWO-WOTRO recognises that achieving 'impact' is usually beyond the sphere of influence of a single research project. However, by formulating the envisioned developmental impact, a research programme defines its scope and focus, which in turn helps to design an approach that contributes to reaching the intended long-term goals.

NWO-WOTRO developed its 'Research for Impact' approach starting from the realisation that research insights and innovations do not automatically lead to changes in society. The Research for Impact approach is expected to contribute to and facilitate the relevance, and accordingly the use, of research results for policy makers, practitioners, private sector stakeholders and other relevant actors. The approach consists of three elements, also applied in the Food & Business Research programme: i. Co-creation of knowledge by transdisciplinary consortia, ii. Theories of Change and Impact Pathways as guiding frameworks for research formulation and execution, and iii. Research Uptake strategies that spell out which efforts are undertaken to enhance the potential of the research to contribute to societal impact.

The current Outcome Synthesis series of the Food & Business Research programme focuses on identifying outcomes achieved by research consortia during project execution. In WOTRO's Research for Impact approach 'outcomes' are defined as changes in behaviour (relationships, actions and activities) of stakeholders in the business and policy environment, resulting from exchange of knowledge in and the uptake of research output from the research projects.

The policy framework underlying the Food & Business Research programme builds on the premise that the private sector can contribute innovations to (aspects of) the food system so that it becomes more advantageous to groups that currently remain underserved in LMICs. The projects reviewed for this article used diverse conceptualisations of what the private sector entails and who it includes. These interpretations provided different lenses that guided the research projects: from the role of the private sector in a localised value chain to its position in the global food system. In this synthesis article, ‘the private sector’ therefore refers to a wide range of actors, from the smallest business-oriented farmers (with one acre of land) to international, export-oriented companies.

Box 2: Defining the food system

A food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes. This comprises the food value chain (all activities that move food from production to consumption); the food environment (“the physical, economic, political and socio-cultural context in which consumers engage with the food system to acquire, prepare and consume food”); and consumer behaviour (“the choices made by consumers, at household or individual levels, on what food to acquire, store, prepare and eat, and on the allocation of food within the household (including gender repartition, feeding of children”).

Before turning to the findings, it is important to emphasise two general factors that influenced the project outcomes and the uptake, and one overall finding about the assumption underlying most of the reviewed projects.

First, different partners within the research consortia reported that the visible involvement of academic researchers in the projects was an influential factor in achieving research uptake of innovative products and processes by their target groups. Solid research and scientific evidence played an important part in changing mind sets, tackling taboos and triggering informed change. Innovations can be purposely disruptive, challenging existing approaches and beliefs with the intention of improving the status quo. However, risk-averse groups, such as small-scale farmers, are not easily inclined to welcome disruptions, or might rather avoid them altogether. Innovations introduced by the private sector or developed for private sector actors, therefore, were not taken on board unless hard evidence and assurances were given about their feasibility or profitability. In this context, the fact that private sector stakeholders partnered with academic institutions proved to be a valuable asset for research results to be accepted and applied by stakeholders. The active involvement of researchers, in other words, lended more credibility to the results. Such was the case in the System Pond Farming project¹ in Vietnam where farmers were more willing to accept innovations offered to them by the private partner because they had witnessed the involvement of researchers and thus felt assured that the innovations were grounded in scientific evidence. The business partner in the Insect-based Feed project² in Kenya emphasised that it was only because of their partnership with a ‘credible’ and ‘knowledgeable’ research institution that they managed to get the use of insects in animal feed products certified by the Kenyan government. Still, in some cases the difficult decision was made to stay clear from the more disruptive route, and to choose the ‘road more travelled’ for the sake of research uptake. Box 3 provides a narrative of a number of examples where the multistakeholder nature of the projects contributed to a positive reception of project activities and to increased trust in the project results.

¹ ‘Nutritious system pond farming in Vietnam’ (see Annex).

² ‘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 (ILIPA)’ (see Annex).

Box 3: Approach story: Standing strong together

The requirement that all research consortia were to be transdisciplinary, supported the private actors within the consortia in achieving or progressing towards their business goals. Several of these private sector actors stated that especially the partnerships with the research and academic institutions, offered them the opportunity to approach their Research & Development from a more holistic perspective, to access more field data and facilitate collaboration in the field, and to achieve progress they would not have been able to realise on their own.

Different partners within the consortia bring in diverse expertise and viewpoints. This allowed the private sector partners to move beyond purely technical mindsets, towards a solution-oriented approach that considered contextual factors as well. The private partner in the Locally Adapted Pork project³ in Brazil confessed that their company TOPIGS was not used to exploring the causes for a problem, but rather focused on offering technical solutions. Mario Lopes: “Because of this research partnership, we learned that farmers’ attitude towards a given innovation and the hidden costs, especially transportation costs, influenced the adoption rate of our products.” Arjen Roem, who was involved in the System Pond Farming project on behalf of the Dutch company Nutreco, argued that the multistakeholder collaboration encouraged them to make bigger innovative leaps. Nutreco’s involvement in the project triggered a mind-set change within the company, which led to the development of more context-specific fish feed suitable for the conditions faced by small farmers as well.

Furthermore, **private partners shared that the research partnerships gave them better access to field testing opportunities and eased collaboration with communities.** Arjen Roem shared that “as a fish feed company it is difficult to engage in dialogue with small breeders as we have fewer avenues to reach them and only limited experience in working with them. By collaborating with researchers and practitioners, we were able to establish more trust, which allowed the fish farmers to be involved from the start in the development and testing of the pond innovations.” Julius Onen, who advised the private partner in the Cashew Nut Farming project⁴ in Uganda, stated that “working together with local organisations that have been present in the farming communities for a long time, helped in convincing the farmers of the market potential of the new cashew varieties”. The same was noted by the The private sector partner in the Locally Adapted Pork project shared a similar experience: “while normally most farmers are very hesitant to cooperate in field testing, the research partnership allowed us to work in the field, collaborate with farmers, and use the field data for relevant, contextualised product innovations”.

Lastly, **the reputation of research institutions also played a large part in achieving tangible results.** The private partner in the Insect-Based Feed project, Sanergy, stated that “without a credible and knowledgeable research partner it is very difficult to scale such innovative ideas that nobody has ever heard of”. Through their collaboration with research partner ICIPE, the project managed to certify the use of Black Soldier Flies in the production of animal feed in Kenya. Marcos Lopes (TOPIGS, Brazil) shared that the academic validity is not only relevant with public institutions: “The pork breeders who are our clients are always sceptical and scared of leaving their comfort zones. Only if we can show proof and provide them with the data to support it, will they show an interest in discussing opportunities with us.”

A second factor that influences outcomes and uptake, is the context-specific nature of food and nutrition research. Research and Development (R&D) driven private sector stakeholders often aspire to develop products and processes that provide the best possible solution for the most diverse range of conditions or clients. Some of the projects, however, showed that this one-size-*should*-fit-all business approach does not necessarily guarantee

³ ‘Locally adapted pork production in Brazil versus the Netherlands’ (see Annex).

⁴ ‘Introduction of cashew nut for income security for poor farmers in Northern Uganda’ (see Annex).

the most efficient or relevant result. This triggered a shift in mind-set among a number of private sector partners, who reported that their involvement in the research caused them to have a more nuanced attitude towards innovation and to differentiate their product portfolio to meet the specific needs of a range of clients, including those of smallholders. In the Locally Adapted Pork project, for example, a repeated call from pig breeders for a more specific proof-of-concept that fitted the reality of the Brazilian context eventually convinced the private partner TOPIGS to start, for the first time, with the establishment of a Research & Development site in the field. The site allows them to test laboratory-confined results originating from the North in specific tropical environments and in the more challenging circumstances that farmers face on a commercial pig farm in Brazil. Another example was already mentioned above: the Dutch company Nutreco started developing a product portfolio that meets the needs of a range of different fish pond systems and contexts as a result of its participation in the System Pond Farming research project.

Another important general finding that needs highlighting before we turn to specific project outcomes, concerns a key assumption that underpinned the reviewed projects and is prevalent in wider debates on food and nutrition security. The assumption is that increased income of the poor leads to improved food and nutrition security. However, as will be shown in more detail in another article published as part of this Synthesis study, improving the income of marginalised groups, whether small-scale farmers, consumers or micro agri-entrepreneurs, does not necessarily lead to improved food or nutrition security. When people earn more, it does not mean that they will spend that extra money on food, nor does it mean that when they buy food, they will make consumption decisions that help to diversify their diets for the best possible nutritional uptake. Evidence is still rather slim on the effects of higher income on food security and nutrition security.

Keeping these general remarks in mind, the following sections will present a selection of synthesized findings along the lines of two outcome areas.⁵ The two types of outcomes that have been initiated by, with and for the private sector include: firstly, agricultural product and processing innovations that intend to meet existing, new or not yet articulated needs of poor and marginalised groups in LMICs (discussed in Section 2), and secondly, new approaches or strategies to connect marginalised groups to the market (discussed in Section 3). Results in terms of context innovations or impacts towards changing the food system as a whole fall beyond the scope of the research programme and therefore this synthesis study.

2. Product and process innovations by and for marginalised groups

The research consortia set out to explore innovative ways of addressing existing, new or not yet articulated needs related to food and nutrition security of marginalised groups. They also studied the feasibility of such innovative approaches (i.e. more effective products, processes, services, technologies, policies or ideas), with the intention of making the results readily available to governments, market actors and society. This section will explore which innovations were introduced and how, which private sector actors played an important part and why, and to what extent these products and processes have been taken up by their intended target groups (i.e. farmers, policymakers, practitioners, etc.).

The following paragraphs will highlight outcomes that show (1) how new value chains have been created to benefit marginalised groups, in part by introducing value addition of raw materials, (2) how product and process innovations can improve business opportunities to the advantage of smallholders, and (3) what different approaches are available towards improving nutritional value of products consumed, especially by marginalised groups.

⁵ The findings presented in this synthesis paper have been drawn from document analysis of selected ARF and GCP research projects within the Food & Business research programme funded by NWO-WOTRO. In addition, interviews have been conducted with project leads and private partner stakeholders.

2.1 Diversifying economic opportunities by introducing new value chains & new players

The findings presented in this section address how new agro value chains can be introduced for smallholders, such as in challenging environments that experience harsh weather conditions or that face logistical challenges due to their geography. In drought-struck northern Uganda and northern Ethiopia, tree crops and exotic trees were (re-)introduced to provide alternative economic opportunities to marginalised groups, and in Kenya, insect-breeding for animal feed was tested as a new economic activity for smallholders. In all these examples, the new products and crops could potentially increase smallholder inclusion in food value chains that can help them diversify their economic opportunities.

The projects had different uptake results. The project Cashew Nut Farming project that aimed to re-introduce cashew trees in northern Uganda had difficulties winning the commitment of the target group: the small farmers who – due to the different priorities of the NGO and private partners in the project - received the cashew seedlings for free. The farmers lacked trust in the business potential of this new tree crop and as a result did not look after their growing seedlings, many of which were destroyed by animals grazing in the fields. However, even though the uptake by farmers was low, the Ugandan government is now actively promoting cashew as a new promising cash crop as part of its ‘Operation Wealth Creation’, a government programme launched to transform the Ugandan agricultural sector, focusing on poverty eradication and sustainable wealth creation for poor households. This appears to be a direct result of the research project as the research findings offered a convincing case for the high yields and commercial potential of cashew in Uganda. The fact that this message could be effectively delivered to the government, was in large part due to the good network and contacts of a private sector advisor to the project, who arranged for a pitch to be given at the prime minister’s office. The NGO involved in the project, moreover, has good rapport with local government offices at district level, which similarly helped to get the message across. In response to the government promotion, private players started setting up cashew nurseries and selling seedlings to farmers. However, the government support and consequent private interest comes at a cost. The seedlings that are raised in many of the private nurseries are not the tried and tested varieties that the Cashew Nut Farming project identified through research. This is bringing cashew seedlings on the market that need seven years to be fully fruit-bearing (and thus income-generating), rather than the three years of the projects’ cashew varieties. A difference that can have dire consequences for smallholders who invest money, land and time into trying a new crop.

In Ethiopia, the *Acacia saligna* was introduced by the Farmer-led Agroforestry project⁶ to provide biomass from the use of wood, to use the seeds and leaves as a feed for livestock, and to encourage beekeeping and honey production. In this way, the tree crop would allow for the establishment of a range of economic activities that previously were unattainable by the local communities in the area. This is especially relevant as the dry areas of northern Ethiopia do not allow many species to flourish and therefore were not included in government policy focus at the time. These circumstances offered the research team the opportunity to introduce the acacia tree, which proves very suitable for dry areas as it does not need a lot of water, nor very rich soils. The fast growth rate and the fact that it is evergreen made the acacia ideal for the area. The tree delivered on its promises – providing chicken and livestock feed, firewood, wood for furniture (i.e. acacia wood as input for particle boards), and bee keeping opportunities – and thus created new agro-business opportunities for smallholders in the area. More specifically, the project successfully established relations with a local wood processor as a potential buyer of the acacia wood produced by farmers in the area. Yet, the potential of this partnership to function as a new market opportunity for the farmers was not verified in the course of the project period. Box 4 describes how the relationship with the private sector partner came about through the efforts of the project partners.

⁶ ‘Farmer-led agroforestry innovation in Ethiopia: improving livelihoods and food security by utilizing *Acacia saligna*’ (see Annex).

Box 4: Approach story: How the private sector got on (particle-)board

The Farmer-led Agroforestry project in northern Ethiopia employed a participatory approach to instigate a mindset change among stakeholders that would eventually enable the acceptance of the *Acacia saligna* tree as a valuable multipurpose crop.

Early on, the project realised that the Technical Working Group (TWG), set up to guide the design and implementation of field trials to assess the benefits of *Acacia saligna*, needed outsiders to bring in fresh insights and wider perspectives. Representatives from the private sector were invited to be involved in the Working Group, specifically stakeholders from the Maichew Particleboard Factory – a local private sector stakeholder involved in the processing of wood used for construction purposes. The stakeholders became invested in the project, meeting in workshops to discuss results and test the value of the *Acacia saligna* tree as a multipurpose agroforestry tree, rather than only as a tree to protect degraded land. The TWG members also visited the field periodically to meet with farmers engaged in the Farmer Research and Extension Groups and to see first-hand how trees were integrated into farming systems. These regular opportunities for collaboration and co-learning led to new insights, such as the realisation that leaves can address the dry-season livestock feed-gap, that pruning can enhance leaf production, or that there are opportunities for using acacia wood for the manufacturing of particleboard.

These insights were turned into actions: through the co-creation approach, researchers worked closely with Maichew Particleboard Factory to test *Acacia saligna* samples and to encourage market-led selection of pole-type forms. Once the samples were found to be suitable for particleboard manufacture, the Factory management's initial hesitance was replaced by a growing partnership. According to project partners, factory staff now describe *Acacia saligna* as a commodity, reflecting the way private sector views the tree, and leading to further conversations on how to engage with farmers to grow woodlots and address the particle board sector's looming shortfall of eucalyptus supply.

The project aimed to better incorporate the *A.saligna* into Integrated Agroforestry Systems to significantly enhance the income and food security of Ethiopian farmers. By increasing the income earning potential of the tree through the collaboration with the particle board company, farmers were presented with the possible added value of the tree, which allowed for more benefits to follow suit that directly impacted their food security. These benefits included the use of the leaves as input for animal feed, particularly for sheep, as research showed positive results in the nutrient content of the leaves in both the dry and wet season, allowing farmers to cover the feed gap that usually occurs in the dry season. The acacia tree therefore provided the availability of fodder (from the tree) for animals that supports farmers' diet diversification (protein intake) and, moreover, showed the potential for beekeeping which contributes to overall biodiversity of the arid lands.

The introduction of such new crops and value chains allows new players to step into the game. In both cases, marginalised groups and smallholder farmers were given the opportunity to diversify their economic activities. Smallholder and subsistence farmers in northern Ethiopia were able to create a new revenue stream as a result of introducing tree species for new purposes in their gardens and farms. Similar outcomes were identified in other projects. In Brazil, the Locally Adapted Pork project encouraged the production of the macauba palm tree as an alternative agriproduct for smallholders, as it can serve as a valuable by-product for the pig feed industry, and therefore carries the potential of diversifying the income for smallholders in the region. The Insect-based Feed project in Kenya set out to introduce insect-based feed at scale as a means to reduce the production costs of livestock and fish rearing. For this innovation to take hold, black soldier flies (BSF) need to be produced at scale, an economic activity previously unknown to the target communities. The project was successful in initiating BSF rearing at farm level for on-farm consumption, which considerably reduced the production costs of small-scale livestock and fish farmers. However, so far smallholders have not yet started BSF rearing at scale for the purpose of selling to feed mills. This is due to the difficulties in meeting the required breeding standards at a cost that is affordable for small-scale farmers. The relevance of *affordable* innovations for marginalised groups

will be briefly addressed further in this article, and has been discussed more in-depth in the Thematic Synthesis article on Inclusive Business.

There were also projects that aimed to introduce new players into existing value chains. Unemployed youth were offered job opportunities in the collection and composting of organic waste from markets in Ghana under the Youth and Organic Waste project⁷. Market vendors who were used to pay for the collection of their waste after a market day, were now given the opportunity to have their waste collected by the youth for free. The benefit for the collectors was the waste resource, which they turned into compost to be sold to farmers in the community. To sustain the results of the project, the research partners realised that an anchor business would have to be included in the process in order to absorb the project results within established business practices. As a consequence, the new business opportunity that was piloted by the project, has since been picked up by the private company Green Energy Ghana Ltd, which continues to explore the possibilities for commercial waste collection and composting in the Greater Accra Region. The team has commenced a training programme for 500 young people, starting January 2020, to collect organics and bring them to the waste treatment plant.

It must be noted that caution is required when introducing 'new players' to the market as this causes disruptions to existing socio-economic dynamics. Such disruptions are bound to have a positive outcome for some (e.g. economic activities are replaced by more efficient processes or 'free services' for new target groups), but may also negatively influence the marketability of existing products or services and thus the income earning opportunities of others.

Supply or demand: what needs to come first?

Project findings show that two issues require serious attention when introducing new value chains and actors. First, the establishment of a guaranteed supply of resources/raw material, and second, having sufficient processing units in place with the capacity to handle the produce from the farmers. In certain projects, supply and processing capacity were not yet aligned, causing new and potentially profitable business ventures to be discontinued. The Locally Adapted Pork project in Brazil, for instance, aimed to promote the production of the macauba, because a by-product of this palm tree proved to be a cheap and highly productive feed for pigs. However, the macauba has not yet been planted at a scale that offers sufficient volumes of the by-product to be processed for the pig breeding industry. As a result, the pork industry continued to use animal feeds with a more secure supply, but which are less environmentally sustainable as well as more costly. Another example comes from the Cashew Nut Farming project, where a small cashew processing unit was set up by a private actor during the project period. However, because the farmers were "not invested enough" in the business to guarantee sufficient cashew harvests (see above), the processor can barely remain commercially viable.

A lesson taken from these projects, is that it is crucial to pay attention to *how* a value chain or a new player is introduced. Farmers need to be part and parcel of the new value chain in order to ensure their commitment and willingness to take on their (new) responsibilities. When a new product is introduced, the success of it taking off at farm level cannot rely on the good-will of farmers. Private sector actors often pointed at the fact that business initiatives require a business approach and mentality. The fact that cashew seedlings were given away for free to farmers in Uganda, was identified by the business partner of the project as one of the reasons for the very low survival rate of these seedlings. He suggested that more ownership could have been created if the farmers had been made to pay even a small amount for the seedlings. Yet he was quick to add that more factors had played a part: firstly, the project had underestimated the need for farmer training on how to care for the cashew trees, and secondly, they had had to battle an existing lack of trust in the venture based on disappointments about previously introduced cash crops that had failed to secure a market. This shows the chicken-and-egg problem that is often at stake: farmers' commitment will increase if they are convinced that there is a ready market, or at the very least enough processing capacity in place, to be able to sell their raw materials. Therefore, to maximise uptake of product or process innovations, future projects should simultaneously design and coordinate

⁷ 'Utilization of Organic Waste to Improve Agricultural Productivity in Ghana' (see Annex).

interventions in different parts of the value chain (production, processing, marketing) and start from the needs and aspirations of the farmers.

2.2 Socio-economic benefits of adding value to raw materials

A second outcome area concerns the introduction of processing and preservation technologies (e.g. fermentation or drying) for value addition. Several research projects created socio-economic benefits by introducing new or enhancing existing value addition processing technologies. These benefits include a higher and more stable income for smallholders and improved nutritional value of products for consumers, which will be discussed in the following paragraphs.

A number of research projects presented encouraging results regarding the impact of value addition for increasing the income of smallholders. In Kenya, the Indigenous Vegetables Marketing project⁸ showed that the drying of indigenous vegetables led to nearly 50% higher total farm revenue of smallholders. Box 5 shares the impact story of a woman who adopted the rice parboiling processing techniques introduced by the Parboiled Rice project⁹ in Benin. In other cases, the projections for increased income are equally promising. In Ghana, the private partner of the Solar Mango Drying project¹⁰ estimates - on the basis of the initial experiments - that mango producers will be able to increase the value of their produce by 140% as a result of the drying process. Furthermore, in Zambia, findings from the Fermented Foods project¹¹ suggest that there is a high potential for increased production of fermented foods, and ensuing revenue, if the necessary processing capacity is put in place, possibly through cooperatives. This is based on the observation that most households currently only milk half their cows because this is all that the women producers of fermented foods can now process without fresh milk going to waste. As said in Section 1, what the higher income achieved by smallholders implies for their food and nutrition security and their communities is an issue that needs further investigation.

⁸ 'Systemic approach to overcoming constraints of production and marketing of indigenous vegetables in Western Kenya' (see Annex).

⁹ 'Ensuring Sustainable and Sustained Food Security by Enhancing local parboiled rice value-Chain Competitiveness in Gogounou and Banikoara areas in Benin (PARCR)' (see Annex).

¹⁰ 'Development of automated solar powered fruit drying technology for smallholder farmers in Ghana' (see Annex).

¹¹ 'Enhanced nutrition security through traditional fermented foods in Zambia' (see Annex).

Box 5: Outcome story: Small agro-entrepreneurs benefit from improved parboiling techniques

Lékia Sabi Sinawingui, village of Dèrou in Banikoara, Benin

“By using the good practices that we have been taught, I can obtain better quality parboiled rice: the color of the grains is more uniform, it is clean, and fewer are broken. Before, when I processed 80kg of rice, it took me a long time to sell my product – sometimes it took me many weeks. Today, for each market day, I process up to 320kg and I sell it all the same day. Because of that, I have become a big supplier of parboiled rice for the women who cook rice and *watche* (a local meal) for selling. Also, the project linked us with a company specialised in the promotion of local products, based in Parakou. Now, regularly, we supply that company with quality parboiled rice, and the collaboration works very well.”



Overall, farmer incomes benefit from these preservation and other processing technologies as they contribute to reducing post-harvest losses, one of the most detrimental factors influencing farmer income security.¹² Dried vegetables can be stored much longer than fresh ones; fermented dairy products can be made from lower quality milk that otherwise is wasted and moreover have a longer shelf-life than fresh milk. This has created new business opportunities for smallholders who can sell their (processed) products in supermarkets, an outlet that was previously unavailable to them.

Other research projects have shown that the nutritional value of products can be maintained, and even strengthened, by applying certain processing techniques. The Parboiled Rice project in Benin enhanced the parboiling technique for rice which has improved its nutritional quality. The Fermented Foods project in Zambia established the high nutritional value of traditional fermented products. Follow-up research will work on further strengthening this value, not least by identifying through lab research the pathogens – bacteria, viruses and other microorganisms that cause disease - that appear to be present in some of the traditional products, thus improving food safety. Section 4 will provide more insights into private sector contributions to enhanced nutrition security for marginalised groups.

Applicability, affordability and reliability are key for successful value addition

Three key factors influenced the success and uptake of value addition processes. Two of these, applicability and affordability, primarily concern the uptake by smallholders and. The third, reliability of produce/raw material availability, is a key factor especially for processing businesses. Value addition processes require careful application of techniques as well as scientific testing of the resulting products to guarantee their safety and quality. Such processes may demand specific skills and equipment, which smallholders do not necessarily have access to. Private sector partners involved in the projects argued that governments or private companies need to be willing to invest in a better enabling environment if processing units are to cooperate constructively with smallholders. These investments are needed to ensure that the necessary know-how, technology and credit facilities are available to smallholders (e.g. Parboiled Rice, Solar Mango Drying, Insect-based Feed). The Parboiled Rice project, for example, showed that limited access to credit was a bottleneck for the women who wanted to buy the necessary parboiling equipment.

¹² <http://www.fao.org/cfs/home/blog/blog-articles/article/en/c/1052829/>

For processors, the economic viability of their processing factories and facilities relies on a steady supply of raw materials, such as mangoes for mango drying, by-products of the macauba palm for producing animal feed, raw cashew nuts for cashew processing and packaging, and rice for parboiling. However, when reliant on the harvests of smallholders, private sector partners experienced difficulties in ensuring a guaranteed supply of sufficient quality and quantity. Solutions were introduced (e.g. Solar Mango Drying) to develop a mixed production system, where part of the produce was ensured through own plantations and the other part was dependent on smallholder input. This approach helps to guarantee a minimum production at all times, showing promising results for business viability in the case of mango processing units in Ghana. In Uganda too, a pioneer investor in cashew who was closely involved with the Cashew Nut Farming project, aims to enhance the viability of his planned processing plant by working simultaneously with raw material from own orchards, from smallholders across the district, and from coordinated cashew planting promoted by UNHCR in refugee settlements¹³.

2.3 Improving business opportunities

Beyond introducing new products or adding value to existing products, there are also research projects that showed that applying innovative approaches to existing processes and products can create better business opportunities, especially for small agro-entrepreneurs.

Different projects proved that it pays off to repackage and certify food for local and/or formal markets as this can make the product more appealing to buyers and consumers, while at the same time ensuring product safety. In Kenya, the Women Food Entrepreneurs project¹⁴ enabled women to work together with scientific institutes to get a stamp of approval from the Kenyan Bureau of Standards for the safety of their slum-grown fruits and vegetables. The project showed that consumers were more willing to buy the products after they were carefully labelled, as this took away their concerns over water contamination in urban slums that might affect the safety of the produce. In Uganda, the Affordable Food Cereals project¹⁵ showed that waterproof packaging of the newly developed infant food formula contributed to its longer shelf-life, an obvious advantage for customers. Making the product available to these customers took a while because of delays in the certification process. The Ugandan Bureau of Standards lacked a ready set of parameters to apply to the innovative product. Yet in the end, and thanks to the private partner's persistence and cooperation, the new infant food was officially certified.

Other outcomes were achieved – or are foreseeable in the future - through the process of product standardisation. Delivering consistent quality is especially key when smallholders wish to sell their produce to processors or to formal markets and supermarkets. In Zambia, for instance, the Fermented Foods project established a high interest from urban consumers in the fermented products traditionally produced by women in rural areas. However, these urban consumers demand consistency in terms of both the sensory qualities of the product and its safety. A follow-up project implemented by the project team and funded by INREF therefore includes a large food technology component, which among other things will develop starter cultures for fermentation to promote product standardisation. Achieving high quality standards, however, requires a certain level of training and monitoring. When smallholders are expected to deliver such standards, investments will have to be made in terms of time and resources (for training, processing equipment, storage facilities, etc.) by

¹³ For further reading on the benefits and challenges with outgrower models and contract farming, please refer to Ton et al (2018) Contract farming for improving smallholder incomes: What can we learn from effectiveness studies? World Development 104: 46-64

¹⁴ 'Women Food Entrepreneurs in Kenya and Burkina Faso: Building inclusive business models for food security in the city slums of Kisumu and Ouagadougou' (see Annex).

¹⁵ 'Macro Nutrient Fortification of first-line food cereals with milk protein to produce affordable value added cereal products in Uganda/East Africa' (see Annex).

the buyers to get them up to standard. Box 6 provides a private sector perspective on the opportunities and challenges that come with including smallholders while still meeting required standards.

Overall, to ensure sufficient and continuous supply of standardised products and raw materials requires a vast number of smallholders to produce at the same standard for processors or markets, which in turn requires a high level of logistical coordination. Box 6 presents an outcome story that describes the private sector perspective on the challenge of including smallholders in the production chain.

Box 6: Outcome story: The economic potential of including smallholders

Based on interview with Michael Lwoyelo, Managing Director, Sanergy

Poultry, pig and fish farming are the fastest growing agribusiness activities in East Africa. However, the high cost of feeds greatly hampers profitable gains for small and medium-holder farmers in these sectors. The Insect-based Feed project conducted research into alternative sources of low-cost feed supplements. The project has studied the potential of insects, mainly the Black Soldier Fly (BSF), in commercial production of a low-cost, high-quality protein source to supplement feeds for poultry, pig and fish farmers. The research partners set out to create awareness and wished to explore market opportunities in the production of insect-based protein for the livestock industry.

Predominantly, the project worked on exploring the conditions and strengthening the capacity of small-scale farmers (incl. women and youth) to rear BSF on their own farms for their own use. In addition, the project explored opportunities to market insect-based products in order to ensure farmer participation in the establishment of intensive insect-based agribusiness enterprises.

Sanergy, a private partner in the Insect-based Feed project noted that building a large-scale facility and infrastructure to rear Black Soldier Flies and produce feed at the precise standards desired by feed millers is a costly venture – one that individual farmers may find difficult to achieve. Therefore, Sanergy is committed to support projects like the one being run by ICIPE to conduct research aimed at establishing suitable business models that incentivise investors to build partnerships with smallholder farmers. “ICIPE is doing a good job of training small holder farmers on the rearing of Black Soldier Flies” explains Managing Director of Sanergy, Michael Lwoyelo.

According to Sanergy, a successful model is one that potentially involves collaboration with farmer groups or cooperatives in providing eggs, and young larvae or by offtaking mature larvae from farmers for processing. “This will contribute to the development of a business model that will be sustainable for all actors – farmers, investors, and feed millers,” says Mr Lwoyelo.

Sanergy is currently expanding its capacity to treat waste from 10,000T/year to 72,000T/year. This provides an opportunity to produce 3600T/year of insect-based protein. Sanergy will also further produce 12000T/year of organic fertilizer. Both of these products are vital to the transformation of the agricultural sector, through provision of sustainable animal nutrition and organic fertilizer for integrated soil fertility management.



Figure 1: News clipping of Insect-based Feed project

Results in terms of increased demand were achieved by rebranding local products. Local (indigenous) products are in some cases presented as a ‘niche’ product, making it more attractive to urban consumers. This was the case in Benin, where locally grown rice is being promoted under the banner of *ris blanc* to encourage pride in

producing and consuming a domestic product. The Parboiled Rice project that kick-started the 'ris blanc' marketing (by first focusing on increasing farmers' rice yields through the System of Rice Intensification (SRI) methodology), has secured funding for a follow-up project that will scale up the approach to increase the competitiveness of local rice production and processing with a consortium of new private and public actors. Dried indigenous vegetables in Kenya, which have been successfully marketed by the private sector lead MACE Foods in the Indigenous Vegetables Marketing project, as well as the locally parboiled rice in Benin, are moreover branded as locally grown 'health food' products, tapping into the emerging interest in healthy lifestyles among young, urban consumers in certain African cities.

In all these cases – repackaging, rebranding, certifying and standardising existing products – the question needs to be posed what implications these innovations have for the affordability of the products for the poor and marginalised.

More generally, business opportunities were enhanced by improving the productivity of farms at a reduced cost. The introduction of more efficient animal feed by the Insect-based Feed project in Kenya, improved nutritious pond systems developed by the System Pond Farming project in Vietnam, and enhanced cultivation techniques introduced by the Local Parboiled Rice project in Benin all show potential or already have contributed to higher, more reliable yields and therefore enhanced market opportunities. The outcome synthesis article on smallholders provides more detail on the effects of innovations on the productivity of smallholders, and on how this does or does not translate into improved food and nutrition security for these same farmer households.

When research projects were able to show how business opportunities could be improved, interest from external stakeholders was quick to follow suit. When the potential for food produced in city slums was made apparent, the municipal government in Western Kenya became interested and adopted a 'green spaces' strategy in their planning cycle to allow room for urban food production (i.e. project Women Food Entrepreneurs). In Benin, the introduction of the newly branded *ris blanc* 'Delice' is well aligned with the new agricultural policy of the central government, which promotes the production of high-quality local rice that can compete with imported rice. Currently only 2% of all rice consumption in Benin is produced within the country. This favourable government environment at least in part explains the success of this project in bringing together important actors in the rice sector to upscale the results in a follow-up project. Seeing the opportunities, three private rice processors, each with supply networks of 400+ farmers and supported by a brand organisation, were quick to come on board the new project. Another example is presented in Box 7.

Box 7: Approach story: From evidence to new commercial potential

In the System Pond Farming project, the chosen approach to evidence development, through collaboration with farmers on field test sites, allowed for multiple rounds of learning and engagement. These engagements, argues Arjen Roem, Technical Director at Nutreco Africa, are normally much more challenging for the company to achieve - being a big fish feed company with limited access to farmers on the ground. The continuous engagement with farmers in the field and the feedback loops these engagements offered, allowed Nutreco to better understand farmers' considerations and conditions and thus to refine their products on the basis of that heightened understanding.

The research process presented relevant findings that triggered a mind shift at the fish feed company. The evidence showed that it is possible and valuable to create multiple *context-specific* fish feeds. Such context-specific feed is a novelty for the company, as the commercial benefits of such product development (in contrast to generic product development) was unclear before. Based on the field testing, the research showed that the product can be developed at cheaper costs and with higher benefit for the productivity of fish and shrimp ponds – meeting the diverse needs of the Vietnamese farmers. These findings have created new opportunities for the company in Viet Nam and the region. Similar context-specific results are also seen to carry potential in Nutreco's African markets. In the two years following project closure, the company continues testing and developing the new fish feed product for the commercial market.

2.4 Improving nutritional value for improving food and nutrition security of marginalised consumers

Lastly, private sector actors played an important role in introducing innovations to improve the nutritional value of products that are consumed or produced by marginalised groups. Outcomes from the research projects show that improving the recipes or composition of products, can lead to more affordable products while maintaining or even enhancing their nutritional value. Laboratory tests allowed the Affordable Food Cereals project to develop an infant food based on a newly developed formula that is more affordable, has a longer shelf-life and has a higher nutritional value than alternative products on the market in the same segment. The product has been readily adopted by a dietary clinic for improved antenatal care. The private partner who was the initiator and lead of the project has increased its production and is providing seven times more formula to supermarkets in Uganda than prior to the project. In Benin, the Local Infant Foods project¹⁶ also managed to bring a new infant food (FARIFORTI) on the market in cooperation with a private partner. It is the first infant food made of locally available animal and plant resources that has ever been certified in Benin. Scientific tests show it is more nutritional and a higher quality product than most other weaning foods available in shops and supermarkets. Similarly, the Fermented Foods project scientifically proved the high nutritional value of traditional fermented foods. This insight convinced hospitals in Zambia to prepare fermented versions of special foods aimed at severely and acutely malnourished children.

However, it must be stressed that enhanced products are not necessarily more affordable. The weaning food FARIFORTI, for instance, is cheaper than some other imported infant formulas, but still too expensive for most poor, rural households. To ensure that these poor households are the primary beneficiaries of the research findings, the project partners decided on a two-pronged marketing approach: on the one hand the commercial formula FARIFORTI was sold in a ready-made format, and on the other hand, three high-quality, generic formulas based on locally available food resources were developed for households to produce themselves. This decision

¹⁶ 'Infant foods from local resources as a pathway to a better food and nutrition security in Benin' (see Annex).

was not taken easily, as the private partner reportedly had doubts about the commercial viability of this two-pronged approach. In Kenya, the Indigenous Vegetables Marketing project proved the nutritional value of indigenous vegetables in dried form and is successfully marketing them. However, the dried products cost more than the original fresh product. Hence, at present those who buy and consume the new healthy products are mostly middle and higher classes in Kenya's urban areas.

Overall, measuring nutritional impact requires longitudinal studies, for which the Food & Business Research programme could not provide the necessary resources. This means that post-research surveys and studies into the nutritional impact of products have either not been conducted or have not provided conclusive results. What projects have determined, however, is that to achieve a high adoption of new nutritional products, prevailing attitudes need to be challenged and understanding needs to be raised. The Moringa Valorisation project¹⁷ in Benin managed to raise the interest and awareness at household and community level on the multiple health benefits of *Moringa oleifera*¹⁸ thanks to continuous behaviour change communication activities using different communication tools. The Local Infant Foods project, also in Benin, recommends introducing community education programmes on nutrition and developing a national policy specifically directed at the promotion and use of local food resources with high nutritional value. Valuable information established and documented by the project in twelve nutritional maps (for iron, zinc, calcium and other micronutrients), indicating which are the food resources that offer these nutrients and where in Benin they can be found, is currently not made available to practitioners in rural areas due to a lack of funds and means for dissemination. Overall, the Affordable Food Cereals in Uganda project shared the collective position that exploring consumer preferences (i.e. ensuring long-shelf life, offering ready-to-use products, preferred flavour and textures) upfront is crucial if private partners want their products with improved nutritional value to be successfully marketed and consumed.

3. Facilitating factors supporting the link between smallholders and the market

As mentioned earlier, private sector partners involved in the food and nutrition sector emphasised on several occasions that smallholders are crucial to feeding a growing population. The product and process innovations discussed in Section 2 are a first and vital step towards strengthening and enhancing the role that smallholders can play. However, for these innovations to be successfully adopted and applied, smallholders will often need support from other actors in the food system, that is, from both the policy/political and private business sectors. Yet several private partners in the reviewed projects emphasised that 'it has to make economic sense to invest in smallholders' (see Box 6). Currently, the costs associated with including smallholder and marginalised communities in the market seem to outweigh the benefits for the private sector.¹⁹ A lack of organisation, logistical infrastructure, as well as training and knowledge, make that private sector players often cannot reap the benefits from smallholder inclusion at scale. A number of research projects under the Food & Business Research programme explored what private sector opportunities or facilitating factors exist to connect smallholders to the market.

Many of the facilitating factors presented in the following paragraphs are not new to those working in the sector. This section emphasises the (innovative) solutions that were offered by and for the private sector to address the challenging task of connecting smallholders and markets. It discusses a few dynamics that project

¹⁷ 'Valorisation of Moringa leaves to alleviate malnutrition among vulnerable groups in Benin' (see Annex).

¹⁸ *Moringa oleifera* is a drought-resistant plant that grows in Africa, Asia and South America and which has been traditionally used for its medicinal properties and health benefits. It has recently been gaining popularity as a new nutritious superfood.

¹⁹ Important to note, is that this synthesis study is not intended as a plea in favour of formalising the production and food businesses of the poor and marginalised, and the markets and value chains in which they participate in any given situation or at any cost.

partners regularly mentioned as affecting the potential outcomes for linking smallholders and the market, interpreted from a private sector perspective.

The projects have brought to light certain factors that can aid farmers and small agro-entrepreneurs working at the fringes of the market to strengthen their position as a value chain actor. Better organisation and improved access to information and knowledge are two aspects that were mentioned across the range of projects. For buyers and processors to collaborate efficiently with smallholders, their skill level, understanding and ability to meet required standards need to be in place. One of the key factors to facilitate this, is establishing a sound logistical and/or infrastructural network that streamlines knowledge, produce and revenues throughout the value chain. Large agri-firms can supply knowledge to smaller producers or breeders (i.e. the approach that Nutreco is promoting after engaging in the System Pond Farming project). This way, smaller producers can benefit from the available knowledge to improve their production and their income, while other value chain players can benefit from an improved quality and quantity of the supply provided by the smaller producers. It is important to ensure that local communities and marginalised consumers can still reap the benefits from such improved products and processes, and that these do not become unaffordable as a result of the upgrading.

Furthermore, private sector players further along the value chain (i.e. processors, buyers, supermarkets, etc.) remain reliant on the collaboration with government for innovations that may benefit smallholders and small agro-entrepreneurs to take hold. They require a supportive government willing to create the legal and policy frameworks that can benefit smallholders' access to the market. At the basis lies the need for efficient processing of certification requests of innovative products by designated government agencies (i.e. Bureau of Standards). Research and Development investments can be discouraged if such processes are expected to take too long. The partnership between private partners and academic institutions proved a valuable tool in this process, as partners could benefit from each other's unique qualifications and networks in the field (see Box 3 for a description of the experiences with private/academic/public collaborations).

In addition, governments can play a role by introducing specific policies or laws that support the roll-out of innovative products or processes. In the case of the Youth and Organic Waste project in Ghana, by-laws need to be created that can motivate market stall vendors to segregate their waste at communal waste depots. This would in turn provide the new businesses of compost-makers in Greater Accra Region with more reliable input. The Women Food Entrepreneurs project sees great potential in the fact that, inspired by the project findings, municipal governments are now allowing for 'green spaces' in urban planning policies in order to promote the production of food in urban slums. However, the promotion of innovations can also have unintended negative consequences. As mentioned earlier, the Cashew Nut Farming project was pleased to see that the Ugandan government picked up the promising project findings and started promoting cashew trees as a cash crop. However, this unforeseen spin-off may prove to have unintended negative outcomes in the near future if the government does not introduce close monitoring of the type of cashew being bred in commercial nurseries and promoted among smallholders.

Lastly, consumer preference and supermarket sales are important factors determining the possibility for scaling innovations. Yet this relationship too is faced with a chicken-or-egg dilemma: when market demand cannot be met because production quantity is too low, (super)markets will not likely be willing to market certain products. At the same time, when (super)markets are not willing to market and actively promote certain products, private partners will be hesitant to invest in increasing production and/or processing levels to meet the (potential) demand. Projects have shown how consumer and market surveys are essential components in developing products that are likely to meet consumer demands and needs in terms of food and nutritional security (see also Box 7). The Women Food Entrepreneurs project, which tried to influence dietary habits, pointed at how hard this can be: "We have a joke in Kenya that when people are told they need to change their staple diet of fish and *ugali*²⁰, they respond that they will happily change it to ugali and fish." To encourage consumers to buy and consume vegetables (produced in urban slums) required intensive awareness raising. Also in Kenya, consumer

²⁰ Ugali is a type of maize flour porridge that is consumed as a staple food in many sub-Saharan African countries.

surveys helped the project lead of the Indigenous Vegetables Marketing project, a Kenyan SME, to develop different products from dried indigenous vegetables that target specific sectors of the urban market. In Zambia, surveys among urban consumers proved that there is a ready market for the highly nutritious fermented products that are traditionally produced by women in rural areas. This has been one important reason for the Fermented Foods project to continue with a follow-up research project, which even includes two more countries (Benin, Zimbabwe) that also have a potential for upscaling traditional fermented foods to a both rural and urban market.

4. Reflections

This synthesis article started out with the aim of finding answers to the question ‘how can the private sector optimally capitalise on research findings and innovations related to business opportunities that serve the food and nutrition security of marginalised farmers and consumers?’ This final section provides four key summarising reflections based on the outcomes presented in this article.

Firstly, projects have shown it is possible to introduce new value chains and actors with the intention to structurally diversify economic activities of small agro-entrepreneurs. However, the approach that was taken determined the level of uptake: future projects should consider carefully *where* to intervene in the value chain (e.g. by both guaranteeing supply of raw materials *and* by establishing sufficient capacity to process produce) and *how* different stakeholders will be engaged in the process (e.g. putting needs and aspirations of marginalised producers first), as these factors have shown to be key for uptake potential. Secondly, the synthesis shows that adding value to raw materials can significantly raise the income of agro-entrepreneurs and positively impact the nutritional value of their produce. In this case, the actual uptake of such value addition innovations by marginalised communities was influenced by systemic factors such as access to knowledge, skills and a logistical network to coordinate supply and demand. Thirdly, business opportunities that benefit marginalised groups can be improved, the projects show, through either relatively simple interventions (e.g. repackaging, rebranding) or more technical interventions (e.g. standardising production and processing for more efficiency, reliability and food safety). Fourthly, the research projects have demonstrated that the nutritional value of food products can be improved (e.g. through vegetable drying, improved fermenting processes) to benefit nutrition security. Yet, as long as these improved products are not marketed at a price affordable for poor consumers, this will only benefit the middle classes who in some African countries are increasingly interested in health foods. Several projects emphasised that, to get consumers on board, there is a need for awareness raising about the importance of improving the nutritional value of food products and a more diversified diet.

Overall, the research projects demonstrated a range of possibilities for the private sector to capitalise on business opportunities. Promising results have been achieved in improving productivity, increasing income for the marginalised, and diversifying business and consumption opportunities. A key assumption of many of the projects was that these results would contribute to improved food and nutrition security of the poor and marginalised. It is, however, too early to argue that this has indeed happened. The projects have not been able to either verify or falsify this assumption, as they did not have the time or resources to collect solid evidence on how their outcomes have impacted – or may impact in the near future - the daily lives of the marginalised in terms of their food and consumption patterns. A separate study would need to be designed and implemented to investigate this critical assumption.

Lastly, the synthesis identified that insights and innovations were eagerly taken up if, firstly, the projects made a convincing, research-based case for the potential of their findings for improved food or nutrition security, and secondly, if this potential was aligned with private sector or government interests and priorities. This realisation emphasises the relevance of the Food & Business Research programme approach, which starts from the notion that bringing together stakeholders with different and complementary capacities, knowledge and networks offers the best chances for contributing to lasting impact in the food system.

Annex: ARF projects

Indigenous Vegetables Marketing

'Systemic approach to overcoming constraints of production and marketing of indigenous vegetables in Western Kenya'

Margaret Komen (MACE Foods, Kenya)

<https://www.nwo.nl/en/research-and-results/research-projects/i/14/12214.html>

Local Infant Foods

'Infant foods from local resources as a pathway to a better food and nutrition security in Benin'

Professor Joseph Hounhouigan (University of Abomey-Calavi, Benin), Sébastienne Adjadogbedji-Avouzoukan (Groupe Pépité d'Or, Benin)

<https://www.nwo.nl/en/research-and-results/research-projects/i/61/12561.html>

Parboiled Rice

'Ensuring sustainable and sustained food security by enhancing local parboiled rice value-chain competitiveness in Gogounou and Banikoara areas in Benin (PARCR)'

Jean Kpetere (DEDRAS, Benin)

<https://www.nwo.nl/en/research-and-results/research-projects/i/80/13180.html>

Moringa Valorisation

'Valorisation of Moringa leaves to alleviate malnutrition among vulnerable groups in Benin'

Ir. Pascal Djohossou (The Hunger Project, Benin)

<https://www.nwo.nl/en/research-and-results/research-projects/i/38/27638.html>

NB Project will end only in 2020

Cashew Nut Farming

'Introduction of cashew nut for income security for poor farmers in Northern Uganda'

Hellen Acham (North East Chilli Producers Association)

Farmer-led Agroforestry

Famer-led agroforestry innovation in Ethiopia: improving livelihoods and food security by utilizing *Acacia saligna*'

Mariame Asfaw (World Vision Ethiopia)

Youth and Organic Waste

'Utilization of Organic Waste to Improve Agricultural Productivity in Ghana'

Richard Yeboah (MDF Ghana)

Solar Mango Drying

'Development of automated solar powered fruit drying technology for smallholder farmers in Ghana'

Kwasi Etu-Bonde (Sustenance Agro Ventures, Ghana)

Affordable Food Cereals

'Macro Nutrient Fortification of first-line food cereals with milk protein to produce affordable value added cereal products in Uganda/East Africa'

Dr Gaston Ampe Tumuhimbise (Value Addition Institute, Uganda)

Annex: GCP projects

Fermented Foods

Enhanced nutrition security through traditional fermented foods in Zambia

Dr Sijmen Schoustra (WUR, the Netherlands)

<https://www.nwo.nl/en/research-and-results/research-projects/i/07/11507.html>

Insect-based feed

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 (ILIPA)

Dr Marcel Dicke (WUR, the Netherlands)

System-pond farming

'Nutritious system pond farming in Vietnam'

Dr Marc Verdegem (WUR, the Netherlands)

Locally adapted pork

'Locally adapted pork production in Brazil versus the Netherlands'

Dr ir. John Bastiaansen (WUR, the Netherlands)

Women Food Entrepreneurs

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 Pouw (UvA, the Netherlands)