

# Pathways to improved food and nutrition security of the poor - The promise of African indigenous foods and technologies

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## Abstract.

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. 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. 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 liaising 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, considering formal versus informal value chains, production for the rural or urban market or 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.

## Keywords

Local foods; traditional food processing; indigenous crops; development policy; nutritional impact

## 1. INTRODUCTION

After a decades-long decline, hunger is slowly on the rise again. Worldwide, 820 million people suffer from hunger. The situation is most alarming in Africa, where the prevalence of undernourishment<sup>1</sup> is the highest in the world at 20%. The number of people worldwide suffering from moderate and severe levels of food insecurity is even much higher at 2 billion. Not all these people may go hungry, but they all lack regular access to nutritious and sufficient food (FAO *et al.* 2019).<sup>2</sup>

The fight for food and nutrition security features in several Sustainable Development Goals (SDGs), most prominently in SDG2 (Zero Hunger), but also in SDG1, SDG5, SDG8 and SDG12.<sup>3</sup> The international community, including the Dutch government, supports nutrition-oriented solutions and acknowledges the role that the agricultural sector can play in responding to the global nutrition crisis.<sup>4</sup> Approaches to address food and nutrition insecurity that are commonly used by governments and donors, in collaboration with the private sector, include: introducing new crops, improving seeds and crop varieties, upgrading agricultural practices, and promoting all sorts of high-tech technologies.

A completely different approach is to promote indigenous foods and crops, building on the traditional knowledge and technologies, and the 'local food plate' of local farmers and communities. This approach has been largely ignored so far mainly due to the lack of (scientific) knowledge about indigenous foods and technologies as well as their case-specific nature. Advocates of this approach, however, claim that indigenous foods have a high potential to improve food and nutrition security for the poor and marginalised, by delivering positive and sustainable impacts in the social, economic and environmental domains (e.g. Baldermann *et al.*

2016, Chivenge *et al.* 2015, Li & Siddique 2018; Mabhaudhi *et al.* 2019; Muhanji *et al.* 2011; Padulosi *et al.* 2013). Or, in policy lingua, improvements in the use of indigenous foods can contribute to the people, profit and planet dimensions of the SDG Agenda.<sup>5</sup>

In this article, we use these three dimensions to illustrate the role that indigenous foods – also called ‘neglected and underutilised species’ or ‘orphan crops’ (Knaepen 2018) - can play in contributing to improved food and nutrition security as well as to food systems diversification. Our synthesis showcases knowledge and new insights as well as innovations achieved by seven research projects set in Sub-Saharan Africa (see Annex) and funded by NWO-WOTRO’s Food & Business Research programme (see page 2). We also critically reflect on the barriers and drivers that must be considered to maximise the impact of indigenous foods on food and nutrition security.

#### **[BOX 1] What are indigenous foods?**

We use the term ‘indigenous foods’ to refer to plant- and animal-based foods (such as dairy) that are naturally existing and produced in specific locations and consumed as part of traditional diets. African indigenous vegetables are defined as “all categories of plants whose leaves, fruits or roots are acceptable and used as vegetables by rural and urban communities through custom, habit and tradition” (Muhanji 2011: 194). Our synthesis also considers indigenous production and/or processing techniques and the associated traditional knowledge.

#### **A food systems approach**

This synthesis study takes a food systems approach to assess the role of indigenous foods in contributing to better food and nutrition security for the poor and marginalised. A food systems approach considers all processes that are associated with food production, utilization and diets - from growing to harvesting, processing, packing, transporting, marketing, consuming and disposing of food - as well as their outcomes and linkages (van Berkum *et al.*, 2018). Importantly, this approach considers how such processes are influenced by political, governance and market factors as well as by social, cultural, technological and environmental aspects. A food systems approach makes it possible to consider whether and how indigenous foods and their value chains connect and interact with the rest of the food system at local, national, regional or even global levels.

As illustrated by Diagram 1, the food systems approach links to social, economic, and environmental sustainability – or, people, profit, planet - because any food system operates within a socio-economic and ecological landscape which facilitates yet at the same time puts limitations to the use of human, economic and natural resources. In turn, the food system’s use of resources may have a significant impact in terms of environmental deterioration, labour price hikes, waste disposal, conflicts over scarce resources, and so forth. The food systems approach relates to poor producers and consumers through both the ‘Food system outcomes’ and ‘Food system activities’, given that in low income countries the majority of both producers and consumers that play a part in the activities in the blue central boxes in the visual, are poor.



Diagram 1. Food systems framework. Source: van Berkum et al., 2018

It is important to note that the six ARF projects in this study were not requested to take a food systems approach. Some projects did, others did not. Therefore, the interpretation of project insights from a food systems perspective is entirely that of the authors.

## 2. INSIGHTS & INNOVATIONS FOR DEVELOPMENT IMPACT

Indigenous foods, knowledge and technologies have the potential to promote food and nutrition security for the poor. However, challenges and bottlenecks to making this happen currently exist within the food system – at local, national and global levels - and such challenges indeed often shaped the context of the projects. Challenges not only concern primary production and processing or value chain logistics. Policy and governance obstacles to promoting indigenous foods, driven by local and national political and economic interests, are often important determinants. Cultural attitudes and preferences equally play a role.

In this chapter, we highlight some of the key challenges in the social, economic and environmental domains. This is followed by a discussion on new research insights and innovations that address these challenges, showing how the projects contributed to enhancing the availability and use of indigenous foods, knowledge and technologies for improved food and nutrition security.<sup>6</sup>

We stress that the promotion of certain foods and agricultural practices raises important questions about, firstly, who benefits from this promotion (e.g. smallholders or commercial producers? women or men? rural or urban consumers?) and secondly, what is the way to go about it (e.g. yes or no formalisation of indigenous foods value chains? production for the rural or urban market? for domestic consumption or export?). Where projects have addressed such critical questions, and the underlying mechanisms and power dynamics, we emphasise this in our analysis of the project insights.

## 2.1 Social benefits: improved nutrition and empowerment of vulnerable groups

Indigenous foods, knowledge and technologies can contribute to the 'People' dimension of the SDG 2030 Agenda in two important ways: firstly, by providing access to healthy and nutritious foods that are affordable for the poor, and secondly, by empowering the growers, producers and processors of these foods. Because indigenous foods are often grown and sold by women (and sometimes youth), developing this sector may empower them in terms of offering a more regular or stable income, or increasing women's freedom to make economic choices, e.g. to invest (Balderman *et al.* 2016, Chivenge *et al.* 2015). A related social dimension is that the traditional knowledge attached to indigenous foods, can lead not only to acknowledgement of and respect for people's cultural identity, but can also contribute to new or better uses or improved processing technologies of the indigenous products themselves.

### 2.1.1 Challenges in the social domain

There are two key challenges to realising the social benefits of indigenous foods: firstly, a lack of information on, especially, the nutritional value of indigenous foods and effective processing technologies that may build on proven local practices, and secondly, the lower status of indigenous foods.

As for the first challenge, research has led to the generic insight that indigenous vegetables and animal-based foods contain essential vitamins (particularly A, B and C) and minerals (e.g. calcium and iron) as well as supplementary protein and calories. These can help to eliminate deficiencies among a wide range of consumers, starting from the most poor and marginalised and extending to lower class urban consumers as well as vulnerable population groups such as children, pregnant women and the elderly. Consumers, including those from middle and upper classes, suffering from diseases such as high blood pressure or other chronic conditions, have been advised to consume indigenous vegetables because of their contribution to a healthy life-style (Muhanji 2011; Okigbo *et al.*, 2009). However, accurate measurement the nutritional and medicinal value of most indigenous foods is lacking. Without such information, their impact on diets, nutrition and health cannot be quantified, resulting in disregarding these foods in food and nutrition security interventions and policy development.

The second challenge limiting social benefits is the lower status that is frequently attributed to traditional foods by consumers. Muhanji (2011) describes how traditionally fruits and green leafy vegetables used to be the mainstay of diets in Africa. During the colonial era, exotic plants such as maize, cassava and groundnuts and, later, commercial crops such as sugarcane, cocoa, coffee and cotton, were introduced. Farmers integrated these crops into their livelihood strategies and started to favour and upscale production of crops that would generate cash income. People kept growing traditional vegetables to provide for household food supply and some additional income, but they became known as "poor people's crops" and often continue to carry the stigma of "food for the poor"<sup>7</sup> (Balderman *et al.* 2016, Knaepen 2018). While these vegetables and foods still play a significant role in food and nutrition security of poor people in both urban and rural settings, many consumers in the middle and high income segments, and young consumers especially, have a negative attitude towards their consumption (Noack & Pouw 2014). They often consider globalised processed food products and brands more trustworthy, and certainly more fashionable. Recently, however, an opposing trend is emerging in some places, where traditional foods are "rediscovered" and revalued (Padulosi *et al.* 2013, Li & Siddique 2018).<sup>8</sup>

### 2.1.2. Establishing and optimising the nutritional impact of indigenous foods

A lack of information on the nutritional value of indigenous foods is a major bottleneck to their expanded use and promotion. To date, local diets traditionally incorporate indigenous foods because of the handed down knowledge about their nutritional value. However, such values are rarely quantified or measured. **Several of the projects offer new insights related to the nutritional value of indigenous foods.**

The Fermented Foods project<sup>9</sup> assessed the quantity of vitamins and minerals of two traditional fermented foods that are widely consumed by rural populations in Zambia: *mabisi* (dairy-based) and *munkoyo* (cereal-based). Laboratory tests conducted by the project showed the

high nutritional value of especially mabisi, which is a rich source of micronutrients (esp. B-vitamins, iron, zinc and calcium). Experiments that exposed intestinal bacteria to mabisi determined a shift towards a healthier composition of these bacteria, thus demonstrating its health benefits. Current follow-up research by the researchers uses a simulator of the intestinal tract to directly assess the effects of mabisi on the bacteria in different parts of the gastrointestinal tract.

The Local Infant Foods project<sup>10</sup> compiled a database with 347 plant and animal food resources from the eight agroecological zones of Benin. Information gathered included distribution of these food resources by morphological type, their seasonal availability, varying ways of inclusion into local diets, and nutritional value (macronutrients, minerals, amino and fatty acids, vitamins and anti-nutritional factors). The information documented was partly obtained through extensive review of existing (grey) literature sources, and partly through laboratory analysis conducted by the project partners. This revealed a high diversity in the nutritional value of local food resources, and their availability to consumers across the country. The research output was made available for practitioners in twelve nutritional maps for Benin (for iron, zinc, calcium and other micronutrients), indicating which are the food resources that offer these nutrients and where they can be found. It was the first time that such maps were developed in West Africa.

**Other projects enhanced the nutritional contribution of indigenous foods through improved processing.**<sup>11</sup> In the case of the Indigenous Vegetables Marketing project<sup>12</sup> in Kenya, improvements in nutrition were achieved by developing new preservation techniques, specifically the drying of indigenous leafy vegetables. Offering these vegetables in a dried form allows them to be available to consumers all-year-round (for quick preparation through boiling) and not only twice a year when the rainy seasons make wide-spread production of fresh vegetables possible. Interestingly, this project not only calculated energy, proteins, and macro/micronutrient of both dried and boiled indigenous vegetables, but also showed that using more organic fertilisers increased the amount of macro and micronutrients in the vegetables.

In the case of the Parboiled Rice<sup>13</sup> project in Benin, improving the parboiling technique for local rice varieties led to better quality and accessibility of local parboiled rice via a more competitive price. This positively contributed to diet diversification and hence nutrition improvements for the local, predominantly very poor, population. In the case of the Moringa Valorisation project<sup>14</sup>, also in Benin, a fortified infant flour formula was developed by adding *moringa*<sup>15</sup> leaf powder, while also optimising the drying parameters for moringa leaves for nutrient preservation. Improved recipes of moringa-based meals were subsequently developed and tested.

**Diet optimisation was another approach to enhancing the nutritional contribution of indigenous foods** to food and nutrition security of the poor and marginalised. Based on the nutritional maps created (see above), the Local Infant Foods project in Benin determined the best resources for complementary infant foods for weaning, considering their seasonal availability per agroecological zone. Generic infant formulas were developed for three groups of agroecological zones. These formulas were subjected to digestibility models focusing on micronutrient bioavailability. The flours were stored and tested for one year on nutritional composition, toxicity as well as technological and sensory properties. The generic formulas can be produced at home by poor households to optimize the diets of their infants. Currently, many households in rural areas use low-quality cereal-based weaning foods, which result in infant malnutrition and stunting (Chadare *et al.*, 2017). A separate infant formula using local resources, branded FARIFORTI, was developed with a commercial party, targeting consumers in the formal, mostly urban, markets in Benin. The NGO and research partners in the project insisted that the formulas per agroecological zone be made available so that poor households who cannot afford to buy the commercial product, have all the necessary information to make their own, healthy and safe infant formulas with locally available resources.

The Fermented Foods project applied the WHO-developed modelling tool Optifood<sup>16</sup> for diet optimisation. This tool enabled calculations of potential health benefits of including mabisi in people's diets, e.g. which quantity of mabisi a child needs to consume each day to have a positive health impact. A hospital in Zambia started experimenting using mabisi to treat severely malnourished infants based on these research insights. The project showed that the Optifood

model can be used to generate reliable and practical outcomes. This opens the possibility to use the same model for assessing the impact of other indigenous foods such as leafy vegetables on people's health.

### 2.1.3 Empowerment potential of indigenous foods

The reviewed projects contributed important insights into the empowerment potential of promoting indigenous foods. A common finding of several projects is that **promoting the use of indigenous foods can empower women who are the main producers of these foods**. The Indigenous Vegetables Marketing project shows that the production of indigenous vegetables and town-markets sales in Kenya are mostly women-led, and that therefore also strengthening the processing (i.e. drying) towards value addition of these vegetables can empower women by offering them a more regular and stable income (in this case via contract-farming). The Gender Responsive Seed System project<sup>17</sup> in Uganda worked on training and materials about seeds of indigenous vegetables for farmer groups, which enabled them to form seed associations that were subsequently registered with local governments as seed merchants. This demonstrated the strong empowerment potential of indigenous vegetable value chains for women and youth farmers who traditionally are the growers of such crops in Uganda.

It is important to **keep a close watch on whether the empowerment of a particular stakeholder group, often accompanied by a formalisation of the value chain concerned, could cause another group to appropriate some of those benefits, thus reducing the original empowerment effect**.<sup>18</sup> In the case of the Gender Responsive Seed System project, this was addressed upfront: to avoid household tensions caused by the project possibly offering income opportunities to women without men's involvement, the project involved gender specialists and used videos to introduce the project approach to strengthen the indigenous vegetable value chain in favour of all household members. The Fermented Foods project did not have specific resources to investigate the risks connected to its empowerment potential for women (who are the main producers of mabisi and munkoyo in Zambia). However, follow-up research starting in February 2020 will focus on how to boost production of these indigenous foods while limiting the risk of this women-led business being hijacked by medium and large-scale commercial companies. To this end, upscaling and formalisation of production will be based out of cooperative groups of (female) farmers.

The Parboiled Rice project in Benin, finally, showed that **indigenous foods can also have an empowerment effect for specific value chain stakeholders other than women**. In this case, the empowerment dynamic set in motion was in favour of extension officers, a particularly important stakeholder group for any value chain development but often neglected by policies and projects. Through their role in both Farmer Field Schools and the Innovation Platform implemented by the project, the rice extension officers regained a strong status of experts at village/local level and are now called "Rice Doctors". This led to improving their professional satisfaction and is contributing to even more effective extension services for the indigenous rice sector.

### 2.1.4 The value of indigenous knowledge

Some projects in this synthesis study offer insights into understanding, preserving, using and further **promoting the traditional knowledge attached to indigenous foods and technologies**. This can lead not only to empowerment and respect for people's cultural identity, but also to a better use of the indigenous foods themselves.

The Fermented Foods project learned that at least three discrete processing methods for fermented foods coexist and are practiced and preferred by different ethnic groups in Zambia. This means that when formalising or upscaling production, this should be implemented in three distinct ways to meet the preferences of various groups of consumers. Furthermore, traditional knowledge collected in the field, and preliminary tests that were done there, provided crucial information for setting up relevant and effective laboratory experiments with the right parameters and test conditions. The project learned that, as part of the two-day production process, old men in rocking chairs shake the mabisi at the end of each day. This shaking indeed proved important for the proper fermentation process, something that the project's scientists

would never have thought of. The engagement with local producers in Zambia enabled experimental laboratory designs that generated high quality results, not only in terms of understanding the processing practices of current practitioners, but also to address scientific questions relevant to a wide scientific audience in high impact peer-reviewed biology journals<sup>19</sup>.

The Spider Plant project<sup>20</sup> documented traditional knowledge about spider plant species in indigenous communities in Benin and Kenya and integrated this into food quality and diet improvement strategies. During Farmer Field Schools, the acceptance of the species was assessed. As a result, more people have become aware of the nutritional and medicinal qualities of the plant and integrate it into their diets. This was further promoted by documenting and disseminating various ways in which spider plant species are and can be prepared as part of people's daily meals. The Local Infant Foods project, which assessed the use of local food resources for complementary infant foods (see 2.1.2), conducted an ethnobotanical survey among nearly 1000 people from 42 villages across eight agroecological zones. The survey results showed disparities in the distribution and use of the 300 surveyed local food resources.<sup>21</sup> This confirmed the usefulness of developing a generic, high-quality weaning formula for groupings of agroecological zones, while pointing to certain challenges for further research. These include assessing the quantitative availability of local food resources throughout the year, the links between food prices and purchasing power of the population, and the bioavailability of nutrients in infant foods made from local food resources in relation to food preparation methods.

### 2.1.5 Consumer preferences

To capitalise on the potential social benefits, indigenous foods must be accepted and demanded by consumers. Some of the selected projects contributed **insights that help to better understand the degree of acceptance and uptake of indigenous foods**, including through the analysis of **consumer preferences**. The Indigenous Vegetables Marketing project screened Kenyan consumer preferences about different indigenous vegetable products through market surveys, finding out that the large majority of Kenyans are used to consume the fresh vegetables and are initially sceptical of the dried version. However, urban dwellers and the middle and upper-class increasingly embrace dried indigenous vegetables because of their shorter preparation time. The project found that different products based on indigenous vegetables can be developed and targeted at different market segments, distinguishing them by both income group and point-of-sale (supermarkets versus more/less informal town markets, Kenyan diaspora versus local consumers, etc.).

The Fermented Foods project showed that people in urban areas prefer the traditionally fermented products, mabisi and munkoyo, over the commercial product currently available in Zambian supermarkets, called lacto mabisi. This is an interesting finding given the often-assumed disregard of urban consumers for 'traditional' foods. Researchers involved in the Local Infant Foods project in Benin noticed two opposing trends: people in cities especially "want to look like white people eating spaghetti and croissants", while at the same time there is an increasing interest in and revaluing of local foods. Restaurants are opening that serve only traditional foods, and during conferences and celebrations increasingly local foods and snacks are being served. The researchers, however, stressed that using local food resources for complementary feeding must fit cultural consumption patterns and beliefs about edible food resources. For instance, edible insects are available and consumed by Wama communities in some northern agroecological zones of Benin. In these regions, therefore, the introduction of edible insects in infant diets is a viable opportunity to address the scarcity of animal protein sources.

The Fermented Foods project in Zambia, based on the initial findings from the consumer survey, continued to test consumer preferences to be able to develop mabisi varieties with a higher nutritional quality and improved sensory characteristics than the existing products. This information will be used in the follow-up research project to help to set parameters in the various processing steps.

## 2.2 Economic benefits: improving livelihoods

Indigenous foods, knowledge and technologies can contribute to the 'Profit' dimension of the SDG 2030 Agenda. The advantage of indigenous foods is that they are commonly available for rural consumers as they are gathered, grown or processed by local (small-scale) producers. Many

opportunities for collaboration exist within the indigenous foods network for improved value chain governance, for instance with farmer associations, women's organisations, youth groups, community seed banks, cooperatives, consumer organisations and multi-stakeholder platforms. This section first presents some key obstacles to bringing indigenous foods to the market, and then reports what projects discovered in terms of the potential economic benefits of enhanced production and marketing of indigenous foods. In this discussion, we emphasise the possible risks and trade-offs of increasing the economic role of indigenous foods by formalising the local food value chains. These include worsened affordability for poor consumers when formalisation or upscaling cause product prices to increase, as well as the capture of the largest part of such economic benefits by the relatively stronger players due to power imbalances between small and large, informal and formal commercial parties.

### **2.2.1 Challenges in the economic domain**

Agricultural markets often favour uniform varieties of a few high-yielding staple crops such as maize or rice (Knaepen 2018). Promoting and upscaling indigenous foods and crops in this context, is difficult. We highlight three specific challenges that hamper the potential economic and livelihood benefits achieved by the promotion of indigenous foods: neglect by governments, absence of improved and reliable production practices, and the lack of suitable market conditions and value chains.

**The neglect by governments to use and promote indigenous foods and technologies is apparent in the lack of legislation and certification.** When products are not certified, they are not allowed on the formal market. Many poor consumers buy food products from informal markets, and many resource-poor farmers sell their produce at those same informal markets. However, to support small farmers who have the ambition to upscale their production beyond the household and informal market level, a certain degree of formalisation of products and production processes is required. For instance, if farmers wish to organise themselves into a farmer association and start selling produce from their association shop, their activities are considered similar to those of an SME. This means that their products need to comply with formal quality standards, and thus require certification. Fast-growing supermarket chains in large and small urban areas are outlets that demand formal certification. These supermarkets increasingly attract poor consumers in addition to the middle and upper classes. A lack of certification can also impede consumer acceptance, as not all consumers – especially in urban areas - trust the microbiological safety of uncertified products. Furthermore, extension services rarely promote indigenous foods, such as vegetables, because of government neglect (Muhanji 2011).

**The second challenge is a lack of approved and reliable production practices.** This results, for example, in decreased crop yields and reduces the quality and consistency of processed foods. For farmers who wish to upscale their production of indigenous crops and be included in formal value chains, consistency of quality is a must. Farmer organisation is often essential to achieve this, yet remains a challenge. How can farmer association members be supported to coordinate the quantity, type and timing of production from their small plots, so that a continuous stream of high-quality foods can be produced and collected? Another obstacle to reliable production is the absence of irrigation facilities, which moreover restricts the expansion of crop production into drier agroecological zones. Finally, the lack of approved and reliable production practices often starts with a lack of standards for seed quality and appropriate seed multiplication methods.

The third challenge limiting the potential economic benefits of indigenous foods, is **the absence of suitable logistic and market conditions, and value chains connecting local growers and processors to potential customers.** Most bottlenecks affect smallholders in general, for instance a lack of storage facilities (resulting in crop spoilage), a lack of transport facilities to reach markets, exploitation by middlemen, and a lack of up-to-date market information. Other market bottlenecks are specific to producers of indigenous foods, for instance lack of physical market space in shops or supermarkets. As a result, indigenous foods often fail to reach formal channels (i.e. supermarkets, wholesale, retail and free markets in both rural and urban centres) and remain limited to informal markets (i.e. areas near farming communities or in peri-urban areas through door-to-door selling and roadside hawking). It should be stressed that gender issues influence



the impact that such value chain barriers have on men and women producers, for instance due to a lack of time and restricted mobility of women compared to men.

### 2.2.2 Economic opportunities along the value chain

Important insights from the projects relate to the fact that **real economic benefits in different parts of the value chain can indeed occur from increasing production, distribution and consumption of indigenous foods**, and can occur within the projects' timeframe.

The Indigenous Vegetables Marketing project, which was led by MACE Foods, a local SME already in the indigenous foods processing business, identified the need to formalise the value chain for indigenous foods, as limited market access was a key factor influencing their restricted production and consumption.

Interventions based on research insights from this project led to economic benefits along the value chain. First, smallholders who decided to produce more indigenous vegetables and to enter into contract farming with MACE Foods realised an increased and more stable income (46.7% higher total farm revenues). Secondly, the interventions led to economic success for MACE Foods and its suppliers (i.e. of materials, services, etc.), including for product innovation, seed production and the marketing part of the business. Dried indigenous vegetable products are now more available in Kenyan supermarkets. For the first time, marketing is done in a vertically integrated marketing chain with a focus on product quality, also since for the fresh market, the physical characteristics of the indigenous vegetables were critical for improving market access.<sup>22</sup>

Part of the Parboiled Rice project in Benin also focused on **better processing techniques**, in this case for rice parboiling, leading to better quality rice. Co-development of a marketing model together with the women rice processors led to more market opportunities, and consequently to more income for the women, who managed to increase their selling price by 40% to 60%.<sup>23</sup>

In the Moringa Valorisation project also in Benin, women also profited economically, again as a result of having **a better product in combination with effective marketing**. Thanks to continuous behaviour change communication activities using different communication tools, the project raised the interest and awareness at household and community level on moringa and its various benefits. This led to an increased demand of moringa in villages in the Department of Couffo. The women's association also got more demand, hence income, from community members because they became aware of the uses of moringa for nutrition and economic benefits.

Various projects showed that for smallholder farmers the **input side of the indigenous foods value chain is more affordable than that of other crops**, as fewer inputs are required to produce indigenous vegetables than exotic vegetables, including financial input. This can have possible positive consequences in terms of the affordability for poor consumers when the price of the indigenous foods can be kept relatively low.

In the Gender Responsive Seed System project in Uganda, the indigenous seeds business turned out to be more profitable than just selling fresh indigenous vegetables.<sup>24</sup> The economic benefits for smallholder seed producers emerged from stabilising demand through structuring the seed supply chain with main buyers, namely four large off-takers seed companies. Neighbours, NGOs and some schools are now also buying more indigenous vegetable seeds as a result of the project.

Nonetheless, challenges remain. The Gender Responsive Seed System project in Uganda highlighted **the largely informal nature of the indigenous vegetables value chain and markets, which in turn limits the seed market** as seeds that are not certified cannot be traded and sold in formal markets, which in turn limits the upscaling of the business. The participation by women in profitable formal seed markets was especially limited even though women are the producers of vegetables.

According to the Indigenous Vegetables Marketing project, the seed distribution system in Kenya needs to develop mechanisms to guarantee that farmers only use quality seed to improve market access of their produce, as seed is the main input that influences the indigenous vegetables' physical and chemical characteristics and hence their marketability. Inadequate supply of good quality seeds in the peak season, high purchase price of seeds, lack of capital for seed import<sup>25</sup>, high research and development costs for new varieties and inadequate storage

facilities, were problems in the vegetable seed production, processing, and marketing systems within this project.

Finally, in the **agricultural production part of the value chain, higher productivity and/or profitability of indigenous vegetables compared to exotic vegetables** on the same acreage is partly due to more harvests per year. Moreover, the Indigenous Vegetables Marketing project in Kenya developed and introduced organic-based Integrated Soil Fertility Management (ISFM) technologies to improve production and enhance product quality with a view to improving market access. The project carried out studies to determine the link between soil fertility management, yield and the physical and chemical product properties of three leafy indigenous vegetables. The content of zinc and magnesium in the vegetables increased when organic manure was applied. The physical and chemical characteristics of the vegetables, achieved through regulating fertiliser rates and use of appropriate varieties, were important in developing products that can target different market segments. To some extent, this resulted in improved market access. The project also showed that investing in water use efficiency and irrigation technologies was important to create opportunities for enhanced production.

The Parboiled Rice project in Benin, in addition to improving parboiling techniques, also focused on introducing improved rice cultivation techniques, leading to increased rice yields.<sup>26</sup>

Some projects showed **the importance of building the capacity of farmer associations to sustainably support their members to produce and market indigenous foods**. The Indigenous Vegetables Marketing project demonstrated the high potential of using farmer associations to disseminate information for improving adoption of soil fertilisation technologies to improve production. Membership of farmer associations was an explanatory factor for improving farmer business also in the case of the Gender Responsive Seed System project where the 14 trained farmer groups were enabled to form seed associations registered with local governments as seed merchants, thus enhancing profitability.

### 2.2.3 Improving the policy environment: legislation, certification and standardisation

A key insight of many of the projects is **the importance of working on the policy dimensions of indigenous foods if economic benefits are to be achieved on a larger scale** (see also the [outcome synthesis article on policymakers and practitioners](#)). Existing policies and regulations, as well as the lack of specific policies and legislation, can be serious impediments to the production and marketing of indigenous foods. The Parboiled Rice project showed that the lack of a labelling/certification system for local parboiled rice was a significant bottleneck for its marketability, especially in urban areas. The Indigenous Vegetables Marketing project lamented a near total neglect of legislation targeting indigenous vegetables in Kenya at national policy level. It also found that it was easier to work at county level than national level. According to key project stakeholders, only very large companies can influence national authorities in Kenya, while county authorities are easier to approach, also for SMEs. Yet eventually the project managed to work closely with the Kenya Bureau of Standards (KEBS), with a notable result: the characteristics of MACE's four dried indigenous vegetables became the national standard for these products. The project has recommended that the national government establishes a development fund to help farmers access certified seeds and extension services for production and marketing of indigenous vegetables. While this suggestion has not yet been taken up, the project did manage to convince authorities in Trans Nzoia county to buy MACE Foods seeds for indigenous vegetables as well as other inputs, which they distributed for free to farmers.

That **liaising with relevant authorities and policy-makers is important**, was also found by other projects. The Local Infant Foods project in Benin worked with the National Agency of Food Safety to certify the commercial infant formula developed (FARIFORTI), based on Codex Alimentarius. It was the first ever certification of infant food by the agency's laboratory. The methods developed can in the future be applied for certification of other infant foods. As a project result, FARIFORTI is now allowed for sale on national and regional markets.

In the case of the Fermented Foods project, it clearly emerged that in Zambia there is a need for legislation to allow indigenous food products, in this case fermented foods, on the formal market. Both mabisi (based on raw milk) and munkoyo (produced using plant roots) are currently not allowed on the market. Interestingly, the Food and Nutrition Commission of the

Zambia Bureau of Standards (ZABS) actively engaged with the research project. This was facilitated by the fact that upscaling traditional and local foods has become one of the Zambian government's priorities to promote food and nutrition security as well as to foster small-scale and larger business opportunities. The project findings suggest that an effective and transparent certification process would significantly improve profitability in the fermented foods sector.

The first step would be for ZABS to devise guidelines for the production of mabisi and other fermented products. The research contributes to this policy development as it provided new knowledge on the different production methods of mabisi and their associated microbial communities composition and dynamics. This made it possible to establish process conditions that can be used to produce good quality products that meet consumer expectations in Zambia and which can subsequently be certified. Current work by the researchers includes the validation of traditional processing methods by identifying food safety risks and formulating control points at key processing steps. This information is crucial for the development by ZABS of production protocols and standards to regulate mabisi production in order to improve its trade and production.<sup>27</sup>

Other projects also found that **attention needs to be paid to product and production process standardisation to support the process of certification.** The Indigenous Vegetables Marketing project in Kenya noted that low quality standards lead to differences in physical and chemical properties of the vegetables: for the same 'popular name' of an indigenous vegetable (e.g. *managu*) the different farmers have very different plants (and seeds) and thus grow very different products in different plots/soils/rain conditions. The Gender Responsive Seed System project found that a lack of standards for certification of indigenous vegetable seeds and seed multiplication methods in Uganda limits the access to quality seeds, and in particular limits participation by women in profitable formal seed markets where the sale of uncertified seeds and products is illegal. Addressing this obstacle of lacking standards was considered more important and potentially beneficial for the small-scale producers than leaving the seed market entirely informal only to avoid the risk that formalising may reduce the affordability of seeds. In fact, the project managed to make seed registration cheaper for local communities by successfully lobbying, together with other partners and initiatives in Uganda, for the Ministry of Agriculture to issue a new regulation for an improved legal recognition of indigenous vegetable seeds.<sup>28</sup> This new regulation distinguishes a third seed category: the "quality declared seeds", which refers to a lower grade standard for indigenous vegetable seeds. The aim is to formally recognise seeds that stay or are traded within villages/communities, instead of on formal markets, and of which the quality is established via self-declaration by local communities. This third seed category complements the "foundation seeds" (top quality obtained through research) and the "certified seeds" sold by companies on formal markets. This policy development was achieved because quality assurance and inspection by the Agricultural Ministry for seed producers was an important collaboration within the project.

#### 2.2.4 Risks and trade-offs

The project findings suggest that, to achieve significant economic benefits from the production of indigenous foods, the indigenous foods value chains need at least some degree of formalisation as part of the wider food system in a country. However, there are also risks and trade-offs to formalising local food value chains. In the case of Zambia, the potential for higher production of traditional fermented foods is certainly there, as most families milk only half their cows because they cannot store the milk long enough without it being wasted. In the follow-up research project, serious attention will therefore be paid to the opportunities of upscaling mabisi production. One focus will be on using women's producer organisations to enable this upscaling process. However, **there is of course a real risk that if this turns out to be a profitable business that can supply urban markets, the business concept might be copied or even hijacked by other, commercial parties. This might well reduce the economic empowerment benefits for the existing women producers.** Meanwhile, the follow-up research project has lots of technical challenges to tackle before upscaling can become reality: e.g. what is needed to make 400 litres of mabisi at a time as opposed to the current 20 litres produced by women in a bucket? How to keep the temperature consistent, how long does it take, working with large quantities, how do you ensure a safe product, how can it be packaged (considering that gas is generated by bacteria),

etc.? The current small-scale process is based on spontaneous fermentation; with large quantities would it be better to first make milk sterile and then add standard starter cultures? How much variation is accepted by consumers in the final product? And how to organise distribution networks other than the currently informal market sales that go per cup?

The Indigenous Vegetables Marketing project in Kenya also reveals some trade-offs. While the project succeeded to improve competitiveness of indigenous vegetables via dried products, such processed products also cost more than the original fresh product. Hence, at present MACE Foods' clients are mostly middle and higher classes. This begs the question of a limited nutritional impact in numbers compared to the general population. The vertical integration of the value chain through MACE Foods' activities led to several economic benefits as outlined above. However, according to some small-scale farmers supplying MACE through contract farming, the price they get for their vegetables is low, and the price of the standardised seeds they get from MACE is high, thus limiting their profitability.

## **2.3 Environmental and ecological benefits, including climate resilience**

Indigenous foods, knowledge and technologies can contribute to the 'Planet' dimension of the SDG 2030 Agenda. Indigenous foods have the potential to improve environmental sustainability through, firstly, agrobiodiversity preservation (e.g. increased crop diversity spreads the risk of total crop failure due to climatic conditions and/or the incidence of pests and diseases) (Knaepen 2018), secondly, strengthening climate resilience (e.g. because of the genetic diversity within the farmer varieties of indigenous crops), and thirdly because of often shorter value chains (with smaller negative environmental impacts) and lower natural resource requirements compared to more commercial and intensively farmed crops. The fact that indigenous vegetables are often produced organically offers considerable potential to consistently apply organic conservation practices to their production (Knaepen 2018). On the other hand, there may also be instances where indigenous foods are grown with little attention for possible negative environmental consequences. The selected projects seem to show that this is a largely under-researched (or under-reported) topic, as it was not formally captured in most projects' initial objectives.

### **2.3.1 Challenges in the environmental domain**

Key environmental challenges relate to the decline of biodiversity in cropping systems, leading to problems of resilience of crops against disease pressure and resilience against climatic fluctuations. Indigenous crops may enable protection of genetic/biodiversity. However, the preservation of indigenous crops and associated farmer know-how is on the decline. Moreover, the negative environmental impacts of intensive/industrial agri-business models in many countries, such as the decline in bees and other pollinators due to exposure to agrochemicals and land use changes, is contributing to the current difficulty of maintaining or increasing production of indigenous foods because decreases in biodiversity in crops are resulting in higher vulnerability to disease (HLPE 2017: 67).

### **2.3.2 Innovations for sustainable production and climate resilience**

The Moringa Valorisation project determined the optimal conditions and practices for farmers growing moringa to maximise their production and preserve the moringa seeds. These practices include, for instance, the appropriate cutting height and the type and method of fertilisation that increases leaves yield, thus offering suggestions on how to increase moringa production in an environmentally sustainable way.

The Parboiled Rice project in Benin mitigated concerns about the impact of increased local production of rice on scarce water resources in the area by including **water-saving techniques** in its Intensive Rice System approach. In addition, the project recommended a higher use of compost hence less chemical fertiliser. Moreover, even if rice uses more water than other locally produced crops like maize, the production techniques and soils needed for these two crops are very different. Therefore, the increased rice production resulting from this project does not seem to be at the expense of more water-saving farming choices. The improved processing technique for parboiled rice introduced by the project moreover leads to a more efficient use of firewood, which **contributes to conservation of local forest resources**.

The two projects about indigenous vegetables in Eastern Africa [Indigenous Vegetables Marketing and Gender Responsive Seed System projects], indicate the strong potential for environmental sustainability and climate resilience. The use of **organic fertilisers and pest-management tools** largely associated with indigenous vegetable production is generally more environmentally sustainable than commercial horticulture and staples such as maize that have higher chemical input requirements. On aggregate, environmental benefits can be attributed to the expanded production of indigenous vegetables thanks to contract-farming by MACE Foods in Kenya and the better seed supply chain by the Uganda project. Moreover, most of the vegetables occupy little space on the plot and are intercropped and even rotated with other crops, so their expanded production does not necessarily have negative consequences in terms of land use or soil over-exploitation. Finally, indigenous vegetables grow faster and can be harvested more times per year compared to many other crops, hence **supporting farmer resilience against droughts, erratic rainfall and other unpredictable weather conditions** that are increasing in Africa due to climate change.

### 3. REFLECTIONS AND WAYS FORWARD

In this article, we focussed on key challenges with respect to the use of indigenous foods, knowledge and processing technologies to promote food and nutrition security. Grouping these challenges in three categories (social, economic and environmental; or People, Profit and Planet), we analysed the new knowledge, insights and innovations generated by the selected research projects to synthesise what opportunities exist to overcome these challenges.

#### 3.1 From challenges to benefits

Our analysis revealed that the use of indigenous foods, knowledge and technologies can promote **social benefits** in terms of improved nutrition and empowerment of marginalised and vulnerable groups. Three issues prove to be key to promoting improved nutrition. Firstly, the nutritional value of indigenous foods needs to be scientifically determined and documented. If their contribution to improved diets cannot be quantified, these foods will not be included in formal food security programmes and campaigns. Secondly, the nutritional composition and associated nutritional impact may vary depending on what specific (traditional) processing method is used. Thus, when formalising traditional processing practices, special attention is required to ensure that processing variations are used that maximise nutritional quality. Thirdly, when optimising traditional processing, the consumer perspective must be taken into account. Several projects revealed that, especially urban, consumers have clear preferences regarding the sensory qualities of different indigenous products, as well as their ease of preparation.

The promotion of indigenous plants and foods enhances – cultural - **empowerment** of local communities as these plants and foods are inextricably associated with traditional knowledge, for instance concerning medicinal applications that serve as home remedies for common ailments (van Andel et al., 2012). Several projects reviewed for this study hint at the fact that the empowerment potential of promoting indigenous foods especially concerns women, who are often the main producers of these foods. Increased production and consumption may thus increase women's freedom to make economic choices. Most research projects used for this synthesis study were inspired by technological and other technical aspects surrounding the improvement and formalisation of local foods and technologies. However, a formal gender analysis was beyond the scope of most of these studies, which largely focused on the more technical aspects of improving and marketing indigenous foods and technologies. However, such an analysis on gendered power dynamics in the cultivation and marketing of indigenous foods should be included in any follow-up studies or promotion and upscaling measures that might be derived from these more technical studies. For instance, the Fermented Foods project in Zambia identified the need to incorporate aspects of women entrepreneurship in further formalisation and upscaling of the value chain of traditionally fermented foods. Women entrepreneurship has therefore been prominently incorporated into the follow-up research project.<sup>29</sup>

Research-based insights from several projects show that the use of indigenous foods presents opportunities for **economic benefits**, mostly through the development and optimisation of value chains of such foods. Since in most cases little has been done to optimise these value chains, relatively small measures can have a large impact. In the primary production part of the value chain, indigenous crops can have higher and more reliable yields than exotic crops. Marketing, distribution and awareness have not been promoted much so far. Thus, for instance, improved value chain logistics can greatly increase product availability to a wider range of consumers. Projects have shown that real economic benefits (increased and more stable income) can occur for both smallholders, small producers and SMEs. To allow for upgrading of the value chain, projects highlighted the importance of capacity building of farmers and their associations. Further, policy measures such as formal certification of indigenous foods (also to address consumers' safety concerns) and processing that is affordable for small-scale producers, is required to help producers gain access to formal markets and thus promote bottom-up scaling, as well as to better reach the many poor consumers in the growing urban and peri-urban areas of Africa.

Furthermore, although this was not a key research objective of the projects, findings suggest that the use of indigenous crops and foods presents **environmental benefits**. These are based on the higher level of adaptation of local crops to the local conditions, the fact that these crops are more resilient to variations in weather conditions and have higher resistance to pests and diseases, and the higher levels of genetic diversity of indigenous crops. These ecological benefits are currently under-researched. Further research and emphasis on these benefits are much needed in the light of climate change and the increasing levels of resistance to pesticides and antibiotics used with mainstream crops.

### **3.2 Opportunities for the diversification of food systems**

Several projects pointed out what these insights tell us on the potential role of indigenous foods towards the diversification of food systems, which has been described as one of the key factors to further enhance food and nutrition security worldwide (IPES-Food 2016). The high levels of food and nutrition insecurity across most countries in Sub Saharan Africa, are at least in part caused by the lack of crop diversification, due to dominant monocultural systems that have increased the dependency on chemical fertiliser, often with repercussions for human health, agrobiodiversity and the soil (De Schutter, 2015). The Fermented Foods project concludes that in this context indigenous foods and technologies present opportunities since they are an untapped, and mostly neglected, resource that can be mobilised through farmer associations for bottom-up upscaling across Zambia. The fermented products mabisi and mukoyo have a high intrinsic consumer acceptance that can connect rural-urban producers and consumers at low-cost. This is echoed by other projects, such as the Indigenous Vegetables Marketing project in Kenya and Gender Responsive Seed System project in Uganda. Researchers in the latter project soon realised that it is the right time to work on the role of indigenous foods for improved food and nutrition security and food systems diversification, since indigenous vegetables are clearly becoming fashionable in Uganda. More broadly, opting for healthy and nutritious foods (like vegetable juices etc.) is an emerging trend for many (urban) consumers. Consumer organisations and their growing importance are heavily involved in these developments in Uganda, so the project increasingly interacts with them to promote healthy indigenous foods.

While it was known that poor consumers in rural areas generally are sympathetic to indigenous foods since they are affordable and part of their heritage, several projects thus showed that urban consumers too are increasingly interested in indigenous and traditional food products, especially if these products have proven health benefits. This is a very important finding because it questions the common assumption that promoting indigenous foods is complicated because of their lower status among consumers. The findings from the projects in this review seem to suggest the opposite: that these foods should be recognised and promoted as "indigenous" to maximise consumer acceptance and uptake. In addition, given that indigenous vegetables are often organically produced, it has been argued elsewhere that indigenous vegetables stand a good chance to benefit from the overall advancements in the organic labeling and certification sector (Knaepen 2018).

The availability of a ready and growing market for organic and health foods, provides interesting business opportunities to capitalise on. This high potential is reinforced by the findings that indigenous foods generally have low production costs (e.g. use of locally available manure), few pests and diseases compared to exotic vegetables like kales, and in several cases faster maturity to harvest.

### 3.3 Drivers and barriers to promoting indigenous foods

Insights from the projects showed the *opportunities* for social, economic and, to a lesser extent, environmental benefits. When it comes to the *practical prospects* to promote and upscale indigenous foods in diversified food systems, several drivers and barriers can be distinguished based on project findings. We stress that the eventual success factors for promoting indigenous foods and technologies for improved food and nutrition security are context-specific. The approaches used in the projects we reviewed, which were all set in Sub Saharan Africa, can be used for inspiration and guidance, but not as blueprints for implementation in other countries or other climatic, socio-economic and political contexts.

First, and as mentioned above, despite many challenges such as indigenous foods largely being an informal business, neglected in policies, suboptimal value chains and difficult market conditions, the **demand for indigenous vegetables is growing significantly** in all markets considered, both formal and informal. This can be a motivation and key driver to address challenges since ultimately “money talks”. Supply will follow increased demand, thus potentially keeping the prices of indigenous foods stable and thereby addressing legitimate concerns about affordability for resource-poor consumers. Moreover, several projects show that **raising the reputation of indigenous vegetables can indeed convince policy-makers** at local level to support optimisation of the value chain, e.g. by allocating funds to support farmers to obtain quality seeds or to get more indigenous vegetables to markets, including via extension officers promoting these as priority crops.

Ensuring the buy-in of policy-makers at national level, appears to be a more difficult barrier to overcome. Nevertheless, various projects (Fermented Foods, Local Infant Foods, Gender Responsive Seed System, and Indigenous Vegetables Marketing) managed to engage national government agencies in the efforts to obtain formal certification for their indigenous vegetables, foods and seeds. The appropriate level at which policy can be effectively influenced depends on the country context and will thus have to be determined on a case to case basis.

A second crosscutting driver appears to be **taking a participatory approach with stakeholders at different levels** and covering various steps in the value chain. Governance challenges that now often limit the growth prospects of indigenous foods despite technical solutions to specific challenges, can be addressed via multi-stakeholder engagement. Examples include the participatory approach through Farmer Field Schools and Platforms for Innovations set up in each municipality for stakeholders of the rice sector, which was developed by the Parboiled Rice project in Benin. Organisations of rice farmers and parboiling women, traders and food sellers, public administrations and other actors came together to devise innovative solutions through a participatory approach. This helped bringing together the economic, social and environmental dimensions to the planning process.

Similarly, in the Gender Responsive Seed System project, the multi-stakeholder platform of farmers, researchers, traders, and policy-makers provides an important overarching coordination and governance framework to the more specific technical solutions put forward by the project. This partnership approach has been referred to as a “game changer”: the project partners with formal seed companies (who were not producing indigenous vegetable seeds before) and the National Agricultural Research Organisation (now also working on releasing new improved varieties of the same indigenous vegetables that the farmers in this project are using). Other projects too highlighted the need for co-creation with local stakeholders, as it leads to research outputs that can more easily be used and adopted.

However, if the research outputs call for more expenses from beneficiaries, their uptake is slowed down. Moreover, it cannot be concluded that specific multi-stakeholder activities in one country or context will also work and lead to upscaling indigenous vegetables in food systems in other countries or contexts. For instance, the ‘gender empowerment’ focus and activities of the

Gender Responsive Seed System project might not be equally applicable elsewhere. More generally, differences in power and interests based on gender, socio-economic or political positions that are not sufficiently taken into account, will act as a barrier to effective multi-stakeholder processes.

Governance improvements, not only as a co-creation approach, but also in the **strengthening of local institutions** is a third positive driver in several projects. Strengthening farmer associations provided an opportunity for ensuring continuous training of farmers and adequate uptake of project results (e.g. soil fertility technology) as well as for achieving economies of scale in marketing indigenous vegetables.

Again, it is key to carefully consider who needs to be included, making sure all relevant stakeholders are and feel represented when optimising a value chain through the strengthening of formal and informal institutions. In this context, a key to success seems the explicit project efforts to link economic growth of indigenous foods value chains through institution strengthening with social improvements in the provision of indigenous foods. One example is the Gender Responsive Seed System project that combines activities for profitability with actions to ensure empowerment while avoiding gender tensions.

Lastly, the **active dissemination of (research) findings and new approaches** is important to move from opportunities to potential impacts. Dissemination of results can be performed in several ways. Projects have shown (e.g. Gender Responsive Seed System) that it was a success factor to introduce the project to local communities via videos, including to explain the approach for overall family cooperation and benefits not only for women. This led to family discussions and a later start of the project, yet to good reception also by men who got prepared for the indigenous vegetable business as well.

### 3.4 Knowledge as input for policy

Indigenous foods need to become part of policy-making in order to capitalise on the opportunities presented by their production and use and to have increased impact on food and nutrition security of the poor and marginalised. How to best guide policy makers in maximising the impact of indigenous foods was not an explicit objective due to the set-up of the Food & Business Research programme under which the projects were funded. Nonetheless, the consortium partners who participated in the seven projects we reviewed, were all motivated to ensure their findings would make a tangible impact on improved food and nutrition security. Their active involvement firstly implies capacity building in this area of farmers and small-scale producers, project staff, technicians, practitioners, BSc, MSc and PhD students. Furthermore, the dynamics of those involved in the execution of the projects with their own social and professional networks ensured dissemination of the new knowledge and insights with word-of-mouth and other communication channels when they explained what they were doing and why. The exchange of information on new approaches and their potentialities was also communicated to policy makers in many ways. This included television interviews, YouTube movies, newspaper articles and the participation of policy-makers in learning platforms; with projects like Indigenous Vegetables Marketing, Parboiled Rice and Gender Responsive Seed System projects showing success in influencing relevant policy-making, especially at local level.

In the future, more effective knowledge provision as input for policy-making could emerge from analysing more thoroughly the insights of the projects through a food systems approach. With proper time and resources, this would allow to better connect insights on indigenous foods to other food value chains in local food systems, and to consider to what extent and how the indigenous food value chains interact with national, regional and global level dynamics, ultimately shedding light on what today could be defined as a general “food system bias” against indigenous foods.<sup>30</sup>

Moreover, the selected projects showed they were able to combine their explicit contributions to improving both economic and social outcomes of the local food system, and more could be dedicated in the future to also analyse and improve the environmental drivers and outcomes of promoting indigenous foods and technologies for the food system.



Finally, as shown above, “money talks” and policy makers were willing to be involved in and get feedback from the projects when they were specifically targeted and when project success linked to positive market prospects for indigenous foods. We stress that in the engagement with policy-makers, critical questions about the power dynamics at play in both political and market arenas, must always be made explicit. In each individual situation, this requires a critical assessment of *who* will benefit from the promotion of indigenous foods, and *how* this can be best achieved, or: which elements of value chain optimisation should be prioritised with which purpose?

NWO-WOTRO and other organisations should continue the organisation of research-policy dialogue meetings to inform policy-makers on the knowledge generated, to discuss these critical questions and to determine the most promising pathways to promoting the use of indigenous foods for improved food security of the poor.

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- The Global Challenges Programme (GCP), which promotes 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 Applied Research Fund (ARF), which promotes research-supported innovations that contribute to food security and private sector development in the partner countries of Dutch development cooperation.

The research themes relate to the Food & Business Knowledge Agenda of the Netherlands Ministry of Foreign Affairs. All projects are run by a consortium of academic, private sector and NGO partners to promote research uptake by relevant local, national and international stakeholders.

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[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-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.

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## ANNEX

### ARF projects reviewed for this synthesis article:

#### **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>

#### **Spider Plant**

'Utilizing the genome of the vegetable species *Cleome gynandra* for the development of improved cultivars for the West and East African markets'

Edgar Deguenon (Hortitechs Developpement, Benin)

<https://www.nwo.nl/en/research-and-results/research-projects/i/59/12559.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>

#### **Gender Responsive Seed System**

Development of a Gender Responsive Commercial Seed System for African Indigenous Vegetables in Uganda

Dr. Apolo Kasharu (CHAIN Uganda Ltd., Uganda)

<https://www.nwo.nl/en/research-and-results/research-projects/i/24/29024.html>

*NB Project will end only in 2020*

#### **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*

### GCP projects reviewed for this synthesis article:

#### **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>

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<sup>1</sup> FAO defines undernourishment as the daily energy intake of a person being too low to meet their daily minimum dietary energy requirements (kcal/day per person).

<sup>2</sup> People experiencing *moderate food insecurity* face uncertainties about their ability to obtain food and have been forced to reduce, at times during the year, the quality and/or quantity of food they consume due to lack of money or other resources. It thus refers to a lack of consistent access to food, which diminishes dietary quality, disrupts normal eating patterns, and can have negative consequences for nutrition, health and well-being. People facing *severe food insecurity*, on the other hand, have

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likely run out of food, experienced hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk (FAO et al 2019: 5)

<sup>3</sup> <https://www.globalnutritionreport.org/2017/11/03/press-release/>

<http://scalingupnutrition.org/nutrition/nutrition-and-the-sustainable-development-goals/>

<sup>4</sup> The Dutch government for example supports programmes to enhance the fortification of foods (e.g. iodized salt), provide micronutrient supplementation, and test the options for biofortification (e.g. maize with increased levels of vitamin A); while SAM (severe acute malnutrition) treatment and kitchen gardens are supported too.

<sup>5</sup> The authors acknowledge the criticism about this 'Triple Bottom Line' concept that has been put forward by, for instance, Wayne Norman and Chris MacDonald.

<sup>6</sup> Importantly, the projects that are included in this synthesis study did not have the objective to provide insight in the mitigation of these key challenges, rather they had a technological or agricultural focus on the indigenous foods, for instance, by studying their current primary production or processing practices and value chains. The insights presented here are obtained by directed study of project results in the context of the key challenges.

<sup>7</sup> Another reason why they are labelled as such, is that e.g. cassava can be kept under ground for a long time, only to harvest in times of food crisis.

<sup>8</sup> Interesting examples coming from the AgriProFocus network include a weekend of meetings organised in Mali ('Made in Mali') to explore how local produce can be transformed for the local/urban markets/consumers, calling for a boost to these local value chains (<https://agriprofocus.com/post/5def9abf26b72a0a110ec6cd>) and a similar initiative in Benin (<https://agriprofocus.com/post/5c6d6d3a26b72a2d63084ac1>).

<sup>9</sup> 'Enhanced nutrition security through traditional fermented foods in Zambia' (see Annex).

<sup>10</sup> 'Infant foods from local resources as a pathway to a better food and nutrition security in Benin' (see Annex).

<sup>11</sup> See the outcome articles of this synthesis study for further discussion on the outcomes for policy and practice achieved by some of these projects: [outcome article on the private sector](#) and [outcome article on small-scale farmers](#).

<sup>12</sup> 'Systemic approach to overcoming constraints of production and marketing of indigenous vegetables in Western Kenya' (see Annex).

<sup>13</sup> 'Ensuring sustainable and sustained food security by enhancing local parboiled rice value-chain competitiveness in Gogounou and Banikoara areas in Benin' (see Annex).

<sup>14</sup> 'Valorisation of Moringa leaves to alleviate malnutrition among vulnerable groups in Benin' (see Annex).

<sup>15</sup> 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.

<sup>16</sup> <https://www.fantaproject.org/tools/optifood>

<sup>17</sup> 'Development of a Gender Responsive Commercial Seed System for African Indigenous Vegetables in Uganda' (see Annex).

<sup>18</sup> The projects studied for this synthesis did not mention this happening and we are not aware of literature reporting this for the case of indigenous foods. In other value chains, e.g. dairy, this has been reported, e.g.: <https://www.iiid.org/lessons-informality-kenyas-dairy-sector>.

<sup>19</sup> [Ecology dictates evolution? About the importance of genetic and ecological constraints in adaptation](#) MGJ de Vos, SE Schoustra, JAGM de Visser EPL (Europhysics Letters) 122 (5), 58002;

[Robust sampling and preservation of DNA for microbial community profiling in field experiments](#) AE Groenenboom, EJ Smid, SE Schoustra BMC research notes 12 (1), 159; [The art of mabisi production: A traditional fermented milk](#) HB Moonga, SE Schoustra, AR Linnemann, E Kuntashula, J Shindano, ...PloS one 14 (3), e0213541; [Fermented cereal-based Munkoyo beverage: Processing practices, microbial diversity and aroma compounds](#) S Phiri, SE Schoustra, J van den Heuvel, EJ Smid, J Shindano, ...PloS one 14 (10).

<sup>20</sup> 'Utilizing the genome of the vegetable species *Cleome gynandra* for the development of improved cultivars for the West and East African markets' (see Annex).

<sup>21</sup> Flora J Chadare et al. Indigenous food ingredients for complementary food formulations to combat infant malnutrition in Benin: a review. (wileyonlinelibrary.com) DOI 10.1002/jsfa.8568

<sup>22</sup> Also see the [outcome synthesis article on the private sector](#) for more information.

<sup>23</sup> Also see the [outcome synthesis article on small-scale farmers](#) for more information.

<sup>24</sup> This finding is in line with the fact that in many value chains the seed market is profitable. See the Integrated Seed Sector Development (ISSD) in Africa programme launched in 2019.

<sup>25</sup> Indigenous seeds could for instance be imported from Tanzania where the World Vegetable Centre produces indigenous vegetable seeds, but a lack of capital as well as complicated trade procedures limit this option.

<sup>26</sup> Also see the [outcome synthesis article on small-scale farmers](#) for more information.

<sup>27</sup> See also the [outcome synthesis article on policymakers and practitioners](#) for more information on this case.

<sup>29</sup> <https://www.wur.nl/en/project/Traditional-fermented-foods-to-promote-food-and-nutrition-security-in-Africa.htm>

<sup>30</sup> For an example on how to use the food systems approach to analyse indigenous vegetables and as an input for policy-making, see Rampa and Knaepen 2019.