How to increase the consumption of **neglected and underutilized fruits and vegetables** in low and middle-income countries?

An analysis of social & behaviour change communication methods and food environment adaptations

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Internship report for *Hivos*

This report is written as part of MSc programme Nutrition and Health, Wageningen University

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Photo by Hivos: Kabundaire Market in Fort Portal, Uganda

Abstract

Introduction: The consumption of fruits and vegetables (F&V) is known to be associated with various positive health outcomes(1–3). The biodiversity of plant foods which are consumed globally is extremely low, with >50% of the total energy consumption coming from three crops. Neglected and underutilized (NU) F&V are known to have a higher nutritional value and to be better adapted to the local climate, pests and soil types than exotic species. NUF&V often have a negative stigma and consumer demand and consumption is still low worldwide. Therefore, change is needed in consumer behaviour, which can be achieved by applying social behaviour change communication (SBCC) and food environment adaptations (FEA).

Methodology: The aim of this report is to examine the effectiveness of SBCC and FEA to increase the consumption of NUF&V in low- and middle-income populations by conducting interviews with experts and a (grey) literature review. Additionally, recommendations are given to the INGO *Hivos* on which activities to implement, based on evidence from literature and activities already being implemented by Hivos.

Results: In total 13 experts were interviewed, 13 scientific articles and 11 grey literature sources were reviewed in which 133 activities were gathered in total. The most frequently executed activities were trainings, the use of (social) media and recipe/product books. The most effective activities were found to be training, broad marketing and seed kits. Hivos was recommended to continue working with food ambassadors, recipe books, trainings and (social) media and to investigate the novel activity of seed kits.

Discussion and conclusion: The way experts and literature sources were identified might have caused selection bias since they were recommended by the supervisors and referred by the experts. When it comes to activities to increase the consumption of NUF&V; not one size fits all and thorough research should be invested in investigating contextual barriers and opportunities.

Foreword

During my internship at Hivos I have learned a lot in general, and specifically from conducting the interviews and literature review for this report. In my studies Nutrition and Health I have learned very little about neglected and underutilized fruits and vegetables, and I was astonished to learn about their characteristics and untapped potential. It was very inspiring to hear from experts about the work they have done on neglected and underutilized fruits and vegetables and it has made me eager to seek a focus on neglected and underutilized species in my future career.

I would like to thank Frank Mechielsen for his insightful coordination and supervision during my internship. Additionally, I want to thank Inge Brouwer for her supervision regarding the approach and methodology for the research. Lastly, I want to thank each expert for making time to share some experiences from their work with me: Sigrid Wertheim-Heck, Harriette Snoek, Sognigbe N'Danikou, Amy Ickowitz, William Chilufya, Ralph Roothaert, Céline Termote, Nicole Szucs, Gennifer Meldrum, Teresa Borelli, Silvana Paath, Hlanzeka Mpanza and Yasuyuki Morimoto.

List of acronyms

FEA	Food Environment Adaptation
FGD	Focus Group Discussion
(D)GLV	(Dark) Green Leafy Vegetables
INGO	International Non-Governmental Organization
LA	Latin-America
LMIC	Low and Middle Income Countries
MoA	Ministry of Agriculture
(NU)F&V	(Neglected and Underutilized) Fruits and Vegetables
NUS	Neglected and Underutilized Species
RDA	Recommended Daily Allowance
(S)BCC	(Social) Behaviour Change Communication
SD4All	Sustainable Diets for All
S(E)A	South (East) Asia
SSA	Sub-Saharan Africa
WUR	Wageningen University and Research

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1. Introduction

The consumption of fruits and vegetables (F&V) is known to be associated with various positive health outcomes because of relatively high levels of fibres, micronutrients and non-nutrient phytochemicals present in the plants(1–3). A sufficient consumption helps protecting against various types of cancer such as colon, cardiovascular diseases, poor vision, pancreatic diseases and depression(1,4–6). Insufficient consumption of F&V causes 2.7 million deaths annually, which makes it the 6th highest risk factor for mortality (7). The nutritional contribution of F&V consumption to the public health of a population is dependent on a) per capita consumption, b) nutrient bioavailability and c) nutrient & phytochemical content(8). A minimum daily consumption of 400 grams of F&V is recommended, which most people do not adhere to, with only 22% of the population in 52 low-and middle-income countries (LMIC) consuming the recommended amount (9,10). The latter two can differ greatly per plant species. Globally, possibly 300.000 plant species are edible, of which only 200 species are consumed by the general population (11). Out of these 200 crops, only 10% is produced in intensive cropping systems, of which three particular species provide >50 % of the total amount of calories consumed globally namely rice, maize and wheat. This trend is resulting in a relatively low amount and diversity of F&V consumed globally.

Many edible F&V species are fairly unknown and only consumed regionally. These types of crops are known as neglected and underutilized (NU) crops(12). The word 'neglected' directs to the minimum research invested in the specie while the word 'underutilized' demonstrates the possible public health potential when consumed in sufficient amounts. A study by FAO and Bioversity International estimated that more than one thousand F&V species are being cultivated globally while research have been done on only 7%(13).

These NU species (NUS) often have a higher nutritional value than exotic species and could thereby contribute in a greater extend to public health(14–17). They could even play a significant role in closing the nutrient gap for young children, since meeting the high dietary needs is very difficult with a diet consisting of mainly legumes and staples(18,19). Additionally, a study in Cameroon on NU leafy vegetables showed that the varieties contribute particularly to the consumption of iron and vitamin C which, in its turn, increases the bioavailability of iron. Moreover, NUS are generally resistant to local diseases and environmentally resilient(13,20). A study on NUS reported that pearl millet, traditional beans and amaranth grown in Sub Saharan Africa are more drought tolerant than wheat, maize and rice(21). Additionally, in Nepal local beans, millet and barley are the preferred crop for many NUS farmers since they are more water-stress and cold tolerant(22). Moreover, increased agro-biodiversity results in higher resilience of an ecosystem(13,23). Indirectly, increasing the production and consumption of NU species, and fruits and vegetables in particular, can improve food systems and livelihoods. Cultivating high-value NUS can generate a higher income for farmers. Additionally, creating or expanding the value chain for NUS will generate more jobs and establish more opportunities for entrepreneurship, for example through exchanging own-bred varieties of seeds(20,23). Next to that, protecting cultural heritage through the promotion of traditional foods can give people a sense of empowerment, pride and increased self-confidence(24). However, NUS are not neglected and underutilized for no reason.

Significantly less resources have been invested in research and breeding programmes of NUS compared to conventional crops(13,23). During the green revolution, large investments have been put in breeding programmes of a handful of major staple crops. These have evolved drastically in terms of yield increase and responsiveness to fertilizers and pesticides(20). This is resulting in a significant smaller body of information on specie properties and cultivation practices of NUS. Because of the

untapped potential in increasing consumption of fruits and vegetables described above, this report will focus specifically on NU fruits and vegetables (NUF&V).

Even though the positive health effects and climate resilient properties of NUF&V might be known, consumer demand and consumption is still low in many regions worldwide. A negative stigma is one of the reasons for this, as NUF&V are often considered as 'poor man's food' as they are associated with low status and a poor, rural way of life (23,25,26). For example *Chaya* in Guatemala is described to be perceived that way(27). Also in Kenya, NU African Leafy Vegetables are described as 'primitive' and 'inferior' compared to exotic vegetables (28). Naturally, local differences in perception of NUF&V exists, as shown by another study on NUF&V in Kenya by Snoek et al. (2012) where an increased popularity has been observed(29). Additionally, marketing strategies such as advertising are rarely applied on NUF&V. This results in low familiarity of the products and neophobia might withhold people in consuming the product. Therefore, change is needed in consumer behaviour in order to increase health and decrease climate impact of the chosen diets of the consumer(30).

Various methods exist to influence consumer behaviour, in this case to increase demand and eventually consumption of NUF&V. Essentially, to create motivation the consumer needs to desire a certain product more than the other. This desire can be created by a perceived benefit of the product, for example nutritional value, easier preparation or consumption or a new flavour(31). By using social and behaviour change communication (SBCC) methods people's motivation and perceived benefits of a product can be influenced. SBCC methods have proven to be effective in improving nutritional status (32,33). Adaptations in the food environment can be made in order to increase the opportunity and ability to purchase – in the case of markets - or obtain – in the case of home cultivation - NUF&V(23). However, consumer behaviour differs per food product and a golden standard to increase consumption of NUF&V has not yet been discovered. Commissioned by the INGO *Hivos*, successful SBCC methods and food adaptations to increase the consumption of NUF&V were investigated in this report.

Hivos is a Netherlands-based humanistic INGO which has been working on NUF&V through a programme called Sustainable Diets for All (SD4All), since 2016. For the past four years they have been working in Bolivia, Kenya, Uganda, Zambia and Indonesia on shifting the diet of LMI consumers towards a more sustainable, fair and healthy one. NUF&V can play a significant role in increasing food security, health and sustainability of a diet because of its high nutritional value and climate resilient properties(14,34,35). Findings from scientific studies were compared with performed activities in the SD4All programme and other organizations (grey literature). From this literature review and comparison with grey literature a set of recommendations for *Hivos* on methods to implement was composed.

To develop a profile of successful methods to increase the consumption of NUF&Vs in LMICs the following objectives were investigated:

1. **To perform a literature study to describe social behaviour change communication (SBCC) methods known to increase consumption of NUF&V**
   1.1. To describe successful cases of SBCC methods used in the Hivos, SD4All project

2. **To perform a literature study to describe food environment adaptations (FEA) to increase the consumption of NUF&V**
   2.1. To describe successful cases of the Hivos, SD4All of food environment adaptations to increase the consumption of NUF&V

3. **To conduct interviews to explore the experts' experience with applying SBCC and FEA to increase the consumption of NUF&V**

4. **To provide a set of (country-specific if needed) recommendations for Hivos on which SBCC and FEA to apply, to obtain the highest possibility of increasing the consumption of NUF&V**

2. Methodology

As antonym of 'NU', the term 'exotic' will be used throughout the report

2.1 Interviews

Interviews were conducted with 13 experts. Eight experts were identified and approached via the supervisors from either Hivos or Wageningen University (WUR). An additional five experts were approached through recommendations of other interviewed experts. Experts are working at Bioversity International, Wageningen University, Hivos, World Vegetable Centre, CIFOR and Unilever and represented a variety of backgrounds and expertises. Specific information on the experts can be found in appendix 4.

Semi-structured interviews were held with the experts separately, using the following broad questions. Depending on the answers given by the experts, further probing was done to discuss the answers in more detail. The starting questions were identical, but the probing questions could be different depending on the background and expertise of the interviewed expert.

1. What is your broad experience in applying methods to increase the consumption of NU and/or F&V?
2. What is your experience with applying **SBCC methods** to increase the consumption of NUF&V?
    a. Evaluation?
3. What is your experience with applying **food environment** adaptations (FEA) to increase the consumption of NUF&V?
    a. Evaluation?
4. What difference in approach is necessary to increase the consumption of **NUF&V compared to exotic F&V,** do you believe this difference should be addressed?
5. What **differences** exist between *X* versus *X* in optimal **methods** and **willingness** to increase the consumption of NUF&V?
    a. Urban versus rural
    b. Latin-America versus Africa versus South (East) Asia
    c. Women versus men
    d. Older versus younger generation

The interviews were recorded with a mobile phone. At the end of each interview, consent was asked of the experts to mention their name with organization when quotations were used in the report.

Question 1 was asked in order to get a general idea of the knowledge a specific expert had on the topic of NUF&V consumption. Questions 2 and 3 were asked to obtain thorough understanding of knowledge by the expert on specific activities of interest. In case the experience was not on NUF&V but solely on either NUS or exotic F&V this was also accepted in the interview. Experts were asked to elaborate on their own experience at their current employer, at previous employers and on the experience of colleagues at their current employer. In case a colleague of an expert was interviewed after and introduction had been made, the mentioned activities have been categorized once, at the expert who was closest to the implementation of the activity.

Question 4 was included to obtain more insight in whether the experts argue different approaches are needed to increase the consumption of NUF&V versus exotic F&V. If a different approach is not relevant according to the experts, it would be recommended to broaden the background research in future program design processes of Hivos to interventions focussing on F&V in general. Questions 5a-d were included to be able to give more context-specific recommendations to Hivos.

2.2 Literature review

Supporting literature on interventions applied to increase the consumption of NUF&V was collected to complement and support the results obtained from the interviews. Literature was obtained from three different sources: 1) PubMed and Google Scholar, 2) Literature suggested by interviewed experts, 3) grey literature from Hivos and other organization.

In PubMed and Google Scholar, the articles were identified by using various search terms. Apart from neglected and/or underutilized, the terms 'indigenous', 'traditional', 'alternative', 'underused', underdeveloped', 'local' and 'orphan' were used to describe the types of food of interest. Articles focusing specifically on NU fruits and vegetables were included, as well as articles focussing in NUS in general, to broaden the scope of literature to include. Especially, because various experts had emphasized the fact that each intervention to increase consumption of a specific food was extremely context specific. Whether the focus food was a NU- fruit, -vegetable or -legume for example, context- and product-specific differences will have to be investigated when designing and intervention. Therefore, all activities to increase the consumption of NUS in general were included in the overview. Moreover, literature from various reviews was analysed on eligibility and recommendations on activities were included in the overview.

Additionally, literature suggested by experts was included in the review. The articles were either categorized with the interviews or with the literature, depending on whether the activities were implemented by themselves or colleagues or not.

Moreover, internal Hivos documents and articles from the Hivos website and Hivos' partners were included in the overview of grey literature case studies on NUF&V. Articles and blogs from other NGOs and research institutes were added when they were mentioned in high quality reviews on the consumption of NUS. All in- and exclusion criteria can be seen below in table 1.

In total 12 scientific articles and 10 sources from grey literature were included in the overview for analysis.

Table 1 In- and exclusion criteria literature

Inclusion criteria	**Exclusion criteria**
Focus food is either NUF&V or NUS	No intervention has been conducted or recommendations on intervention activities have been given
Applied region is one or multiple LMIC	Language is not English
Activities applied are SBCC and/or food environment adaptations	
Target population are LMI income populations	
The aimed outcome or impact is to increase consumption of the food or improve nutrition	

2.3 Analysis

All activities gathered from the 13 interviews (questions 1-3), 13 scientific articles and 11 grey literature sources were summarized in a Microsoft Excel spreadsheet. The recording of each interview was listened back to process the information given by the experts. The answers obtained from questions 1-3 on SBCC and FEA activities to increase consumption mentioned by the experts were categorized in a table including a general description of the activity, region and evaluation if applicable. Various categories of activities were made, based on the frequency of activities mentioned by the experts. These categories were also used to summarize the activities gathered from the literature. When the activity was conducted in various continents, the region was indicated to be 'global'. The evaluation was categorized into; no evaluation, positive output, positive outcome, negative output/outcome or recommendation given. The included outputs from the activities were: increased knowledge, awareness, sales or income. The included outcome of the activities was: increased consumption. The same matrix was used to analyse the scientific and grey literature.

Visual representations were provided with column tables to give an overview of the number of times specific activities were conducted and whether a positive outcome or output was observed. The answers from questions 4 to 5d were processed into a summary and recommendations, taking into account general similarities among the answers and specific answers and ideas of interest for Hivos.

3. Results

3.1 Literature review

In total 23 activities were gathered from scientific literature and 33 from grey literature. In appendix 1 and 2, the results from the scientific literature and grey literature sources are presented, respectively. Throughout the result chapter the activities from the literature review will be combined with the activities gathered from the interviews.

3.2 Activity gathering from interviews

Out of a total of 133 activities, 77 activities were gathered from the interviews. The categories made for the activity gathering based on the frequency the activities were mentioned by the experts can be seen in table 2. In appendix 3 the list of experts interviewed with organization and detailed results from questions 1-3 are shown.

Table 2 Activity categories

SBCC	**FEA**
Cooking shows	Seed kits
Marketing	Involvement of market vendors/ supermarkets
Workshops/ training	Involvement of local restaurants
(Social) media	Involvement schools (garden, meals)
Festivals	Home/community gardens
Recipes/product book	Value adding/processing
Food ambassadors/celebrities	Other
Documentation	
Other	

3.3

Analysis of activities

For the analysis all 133 activities gathered from literature and the interviews are combined. In figure 1 the frequency with which the activities were mentioned by the experts and the frequency they were found in literature can be seen. The activities are divided into SBCC and FEA by the black line. More SBCC activities were conducted to increase the consumption of NUF&V compared to FEA. Among the interviewed experts the activities of; *recipe/product books*, *cooking shows, (social) media* and *other* non-categorized FEA were most popular. Various FEA in 'other' were: setting up seed banks, decreasing deforestation and setting-up a local marketing cooperation. More activities in the category 'other' can be seen in table 3. The activities used most often in scientific research were *(social) media, training* and *other SBCC*. The activity found most often in grey literature was *training* by far with a frequency of seven.

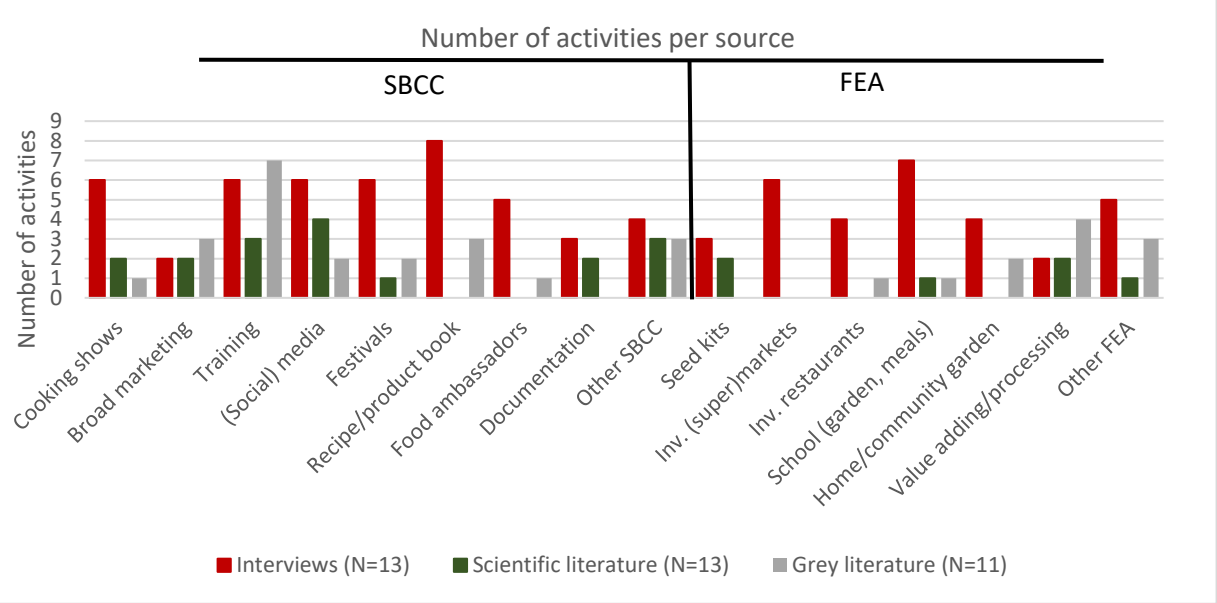


Figure 1 Number of activities in categories from the interviews, scientific- and grey literature divided in social behaviour change communication (SBCC) and food environment adaptations (FEA)

Table 3 Activities categorized as 'other' from experts and (grey) literature

SBCC	Youth documenting their food environment with their mobile camera
	Song about cassava made in Nigeria
	Capacity development on entrepreneurship
	Promoting local seed varieties
	Working with women's groups in Uganda (orugali)
	Using word of mouth
FEA	Decrease deforestation and monocultures
	Good Food Logo in Zambia
	Set up seed banks

An overview of the continents where the activities were specifically conducted is shown in figure 2. The activities conducted in multiple countries are not included in the overview, as well as recommendations given on activities. The majority of activities was conducted in Africa (55%), about a quarter of the activities in Latin-America (23%) and another quarter in South (East) Asia (22%).

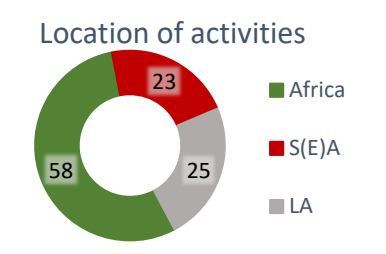


Figure 2 Overview of the location of activities for which specific regions were specified.

Evaluation of the activities

In figure 3 the frequencies of activities harvested from the interviews and the literature together are portrayed. The green colour portrays the total number of times the activity was either mentioned by the expert, or described in literature. The grey colour indicates whether an activity has been evaluated and a positive output or outcome was observed with the possible outputs being: *increased awareness, knowledge, income or sales* and the outcome being: *increased consumption*. The red bars indicates the number of times an activity was evaluated and an increased consumption was observed.

From a total of 133 activities from all three sources, 12 activities (10%) were evaluated and a positive output was found and in 39 activities (31%) evaluation was conducted and a positive outcome was found. In total, 51 activities were evaluated for either outputs or outcomes (40%). In none of the activities a negative output or outcome was found in case evaluation has taken place.

In total 85 SBCC activities were performed, while 48 FEA were identified from the sources. The most frequently executed activities were *training*, *(social) media* and *recipe/product books* (16, 12 and 11 times mentioned respectively). The activities which most often found the result of a positive output or outcome related to NUF&V or NUS were *training, broad marketing* and *involvement of schools (gardens or meals)* (10, 6 and 6 activities respectively) . When only looking at the result of a positive outcome namely an increase consumption of NUF&V or NUS, the most successful activities were *training*, *broad marketing*, *seed kits* and *other FEA* (8, 5, 4 and 4 activities respectively).

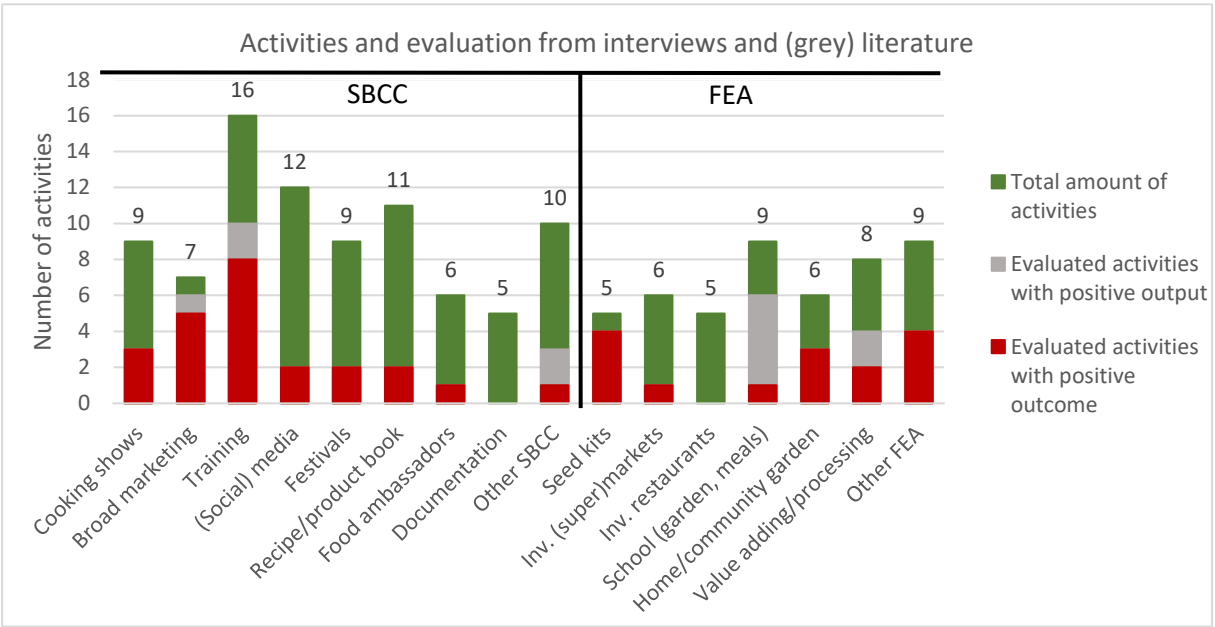
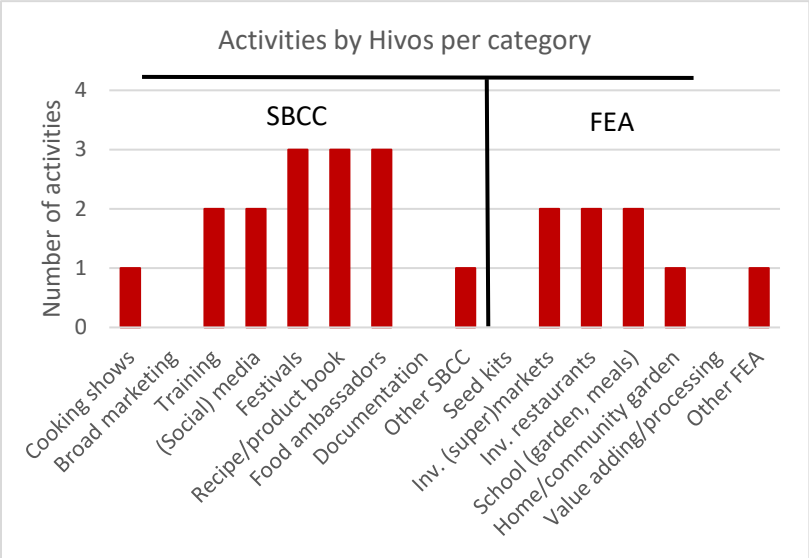


Figure 1 Frequencies and evaluation of activities from interviews, scientific- and grey literature. Outputs are awareness, knowledge, production, sales and income on or because of NUF&V. Outcome is consumption of NUF&V.



Activities by Hivos

In figure 4 the activities conducted by Hivos are shown. The activities mentioned by William, Nicole and Silvana from Hivos are included, together with the activities found in grey literature and the outcome harvesting document. Hivos is conducting more SBCC compared to FEA. None of the activities have been evaluated since the programme is still ongoing.

Figure 2 Activities conducted by Hivos per category, as explained by Hivos experts and found in grey literature

3.4 Deep dive: context specific differences in approach when increasing the consumption of NUF&V

In this chapter a summary of the answers the experts gave to questions 4-5d, including several quotes can be read. All answers given per expert which are relevant for the aim of this report are compiled in appendix 4.

3.4.1 NUF&V versus exotic F&V

Negative stigma

The experts all describe the fact that NUF&V have a negative stigma in many countries, compared to the exotic varieties such as tomato or cabbage. The NU varieties are viewed as poor man's food because of different reasons. For instance, NU green leafy vegetables can often be gathered from forests and fellows which makes it a popular crops in times of poverty. Another reason mentioned was that certain varieties are very drought resistant and are therefore grown solely in extensive drought periods, when the exotic crop yields have failed, which is adding to the 'poor man's food' – stigma. Additionally, the cleaning and preparation process for NUF&V is often labour intensive and more time consuming compared to exotic F&V. Lastly, urbanization has caused for a dietary shift and people are eating more and more ultra-processed products. Even people in rural areas desire to eat like the urban population, which, in most cases, does not include NUF&V.

These reasons have led to the fact that for the last decades people have been perceiving NUF&V as food for the poor which is causing knowledge and genetic varieties to get lost. Therefore, changing the negative perception of the product should always be incorporated when designed an intervention to increase the consumption of NUF&V. Nonetheless, this is a comment Sigrid Wertheim-Heck makes regarding the question about the differences between exotic and NUF&V:

Sigrid Wertheim-Heck – Wageningen University: *"Any product which is correctly marketed as new and exciting will be able to sell to consumers."*

Various experts have mentioned the increase in NUV popularity and consumption in Kenya over the last 10 years. It has been said it started with an enabling policy environment and an initiative of Farm Africa to link farmers to the supermarket chain Uchumi (68)

Recognition of the value

To change the way people perceive certain products it is important to make sure people become aware of the intrinsic value a product carries. A way to do this is to investigate and promote the nutritional value of a product. It was mentioned by various experts, including Teresa Borelli, that even though this can be quite expensive to determine, it can be a very lucrative method.

***Teresa Borelli – Bioversity International**: "People that are producing the food should also be aware of the nutritional value of the foods they're producing, and see the value of that. Finding out the nutritious properties lies at the basis of influencing policy makers, producers or consumers, but it is quite costly, although often some evidence is already exists."*

For example, if it has been investigated a certain NU green leafy vegetable contains a 20 times higher concentration of iron than the exotic spinach, official entities such as regional health centres or national ministries can promote the variety with stronger scientific backup. Additionally, Yasuyuki Morimoto also emphasized the importance of documenting the nutritional properties of NUS in the local language, otherwise the knowledge will be lost. Although, this does propose difficulties in the case the local population does not have a written language.

Another important aspect is the perceived value of the local food variety. Nicole Szucs from Hivos explains that in Bolivia people increasingly started acknowledging the value and taking pride in Andean grains after quinoa had been labelled a 'super food' in the Western world. Céline Termote shared an experience that happened during her PhD fieldwork in Congo on wild edible plants. She stayed in a rural village for three weeks and just observed and documented peoples' knowledge. In the interview this is what she said about the fieldwork:

***Céline Termote – Bioversity International:** "After three weeks, the villagers approached me full of astonishment about the fact that I just stayed there to document* their *knowledge. This made people realize that their knowledge was worth something and they could possibly contribute something. It created a sense of importance of passing the local knowledge to the younger generation. Without having it as an objective [of my PhD], by giving attention to the local knowledge I unconsciously started a shift in the thinking pattern.*

Another method which is broadly applied, is the use of food ambassadors; respected people in the community, celebrities or well-known chefs are used to promote a certain food product. External validation from other parties such as the ministry of agriculture can also significantly increase the perceived value of NU foods. Developing an official document such as a book with local varieties can also spark pride in the local communities. In the overall communication style, the cultural heritage of the foods should be emphasized in order to inspire and move people. Gennifer Meldrum makes the following comment regarding recognition of the value of NUS:

***Gennifer Meldrum – Bioversity International:** "You have to glamorize NUS. You have to find out where the bottle necks are often people have a good reason for why they're not consuming certain crops."*

The necessity of supporting policies was mentioned by various experts. Farmers need to be able to find the right seed varieties so that consumers have access to a diverse range of vegetables. Additionally, the right stakeholders need to be involved from the beginning of the designing process.

***Teresa Borelli – Bioversity International:** "Make sure you have supporting policies in place. Smallholder farmers cannot take a big risk [by producing a novel product] so make sure that there is a market for the product."*

Through adding value to a product, more income can be generated for the farmer and people will become more aware of the possibilities of NUF&V. This is something Yasuyuki Morimoto also emphasized.

***Yasuyuki Morimoto – Bioversity International**: "You need to promote local foods to be used for processed foods because now most processed foods are still exotic, which is not needed [e.g. popcorn from local millet varieties]."*

3.4.2 Urban areas versus rural areas

In urban areas time constraints are more often a limiting factor for the consumption of NUF&V, while in rural areas availability is usually a barrier. In some areas urban communities are more affected by the perceived status a food has and gives them, while in other areas the negative stigma of NUS is more present in rural areas. Wherever the negative stigma is present, marketing will be of great relevance. Amy Ickowitz mentions the following difference between urban and rural areas:

***Amy Ickowitz - CIFOR**: "In urban areas people could view NUF&V in a romanticized way, they can feel nostalgic about it: the rural way of life. This might be harder in rural areas because people are just going through a transition. In rural areas a focus on the pride people feel of NUF&V might be more compelling."*

Harriette Snoek illustrates a difference regarding NUF&V between urban and rural areas in Nigeria, as observed in Lagos:

***Harriette Snoek – Wageningen University:** "Images people have on traditional dishes is different in urban versus rural areas: in urban they can be seen as good, 'something that's ours', while in rural areas traditional dishes are perceived as old-fashioned. In Nigeria Lagos, people go to certain markets because the vegetables of their tribes are sold there."*

In rural areas production and consumption are more closely linked, making rural areas more suitable for FEA such as the distribution of seed kits or the promotion of home/community gardens. Universally, spreading recipes as a SBCC method are expected to work quite well, in either urban or rural areas.

The coverage of internet and television access will influence the strength of interventions using (social) media. Globally, urban areas will have better internet and television connection than rural areas. Another SBCC method that has been suggested to work better in urban areas is the use of celebrity chefs.

***Silvana Paath - Hivos:** "In [Indonesian] rural areas people are forgetting about indigenous foods (which are perceived as 'not sophisticated') because they are adapting a more urban lifestyle, which is prestigious. In urban areas people are aware of the indigenous foods but they choose not to eat it because of convenience."*

Linking SBCC or FEA to SMEs through social entrepreneurship is a more suitable method in urban areas, as explained by Silvana Paath from Hivos. In urban areas people have a higher tendency to eat out, as opposed to rural areas where most people cook at home. Also William Chilufya highlights the awareness people in urban regions have of NUS, in East-Africa.

***William Chilufya - Hivos:** "[In East Africa] the [urban] middle class is growing and they are choosing indigenous foods. They are concerned about health."*

Perishability of NUF&V can be an issue for the urban area. This is why value adding through processing such as drying or fermenting can be a great opportunity for urban populations to have an increased access to NUF&V.

3.4.3 Latin-America versus Africa versus South (East) Asia

While enormous differences exist within continents and within countries, some careful generalizations can be made between the three Southern regions of interest: Latin America, Africa and South (East) Asia. Especially in Africa, food safety is still a big issue, which influences daily food decisions. Harriette Snoek addressed food safety in the Veg-on-wheels by using vegetables from the university farm, which automatically have an increased perceived safety.

In most Asian countries technology is deeply penetrated in the daily lives of the population, which is something that can be used when promoting the consumption of NUF&V, for example with social

media or apps. Sigrid Wertheim-Heck shares another observation she noticed when conducting research in Asia.

Sigrid Wertheim-Heck – Wageningen University: *"Generally speaking, in Asia people are more aware of healthy eating and will be more willing to respond to messages promoting healthy foods."*

Moreover, the variety of produce available differs greatly per region and generally greater varieties are found in Latin-American countries and Asian countries, compared to African countries, especially the more arid regions. Large differences exist between regions in how people view NUF&V. In some areas people are very proud of their indigenous products, while in other regions the varieties are viewed as food of the poor.

Most experts agreed that each activity will have to be fitted to the specific context, while marketing and gastronomy will probably work for each region. Furthermore, working with school feeding programmes will be an effective method to universally increase knowledge, awareness and consumption of NUF&V. Ralph Roothaert indicates that home gardening might be more suitable in Southeast Asia:

Ralph Roothaert – World Vegetable Centre: *"In Southeast Asia a higher home cultivation of vegetables is seen while in Africa most vegetables are bought at markets. Therefore a focus on home gardens will be less effective in Africa."*

3.4.4 Women versus men

The general consensus most experts agree on is the fact that fruit and vegetable production is generally a women's job. The men will take over when the production will become significantly profitable, since they are usually more interested in cash crops. In order for the woman to start cultivating a new crop the man need to understand the important in order to agree to the development. Therefore, when setting up an intervention focussing on production, it is recommend to involve both men and women from the beginning, as also explained by Céline Termote.

Céline Termote – Bioversity International: *"Men should always be involved in activities, otherwise if women learn something in a workshop but the men don't understand it, they will not be allowed to apply their newly obtained knowledge. Also for cooking activities, all family members are encouraged to join, but eventually it will be the woman cooking."*

Worldwide, women are usually the ones preparing the food. Therefore, activities such as cooking shows and recipe promotion will mostly attract women. Whoever is the decision-maker in which foods to prepare differs per region. Sognigbe N'Danikou explains the gender influence on the use of food ambassadors in Eastern Africa.

Sognigbe N'Danikou – World Vegetable Centre: *"Food ambassadors [in Eastern Africa] are more focussed on men because a man speaking will reach a broader audience, since vegetables is not a men's crop they need to change more."*

In most contexts, women are more aware of what a healthy diet is. She will be more willing to educate herself when it comes to novel, healthy products. On top of that, men often consume lesser amounts of fruits and vegetables in general, something that Nicole Szucs also illustrates as a reality in Bolivia.

Nicole Szucs - Hivos: *"[In Bolivia] women are more aware of healthy foods/diets. Men don't care, they just want to get full."*

3.4.5 Younger generations versus older generations

Typically the older generations are more familiar with the NUF&V and have a higher consumption, while the younger generations will be more susceptible for marketing strategies aiming at making a specific food 'cool'.

It is extremely relevant to involve the younger generation and increase their knowledge and awareness on NUF&V, otherwise this knowledge will die out with the older generation. Amy Ickowitz also emphasizes this importance.

***Amy Ickowitz - CIFOR**: "It is important to involve youth in NUF&V, they seem to be diverging from traditional eating habits more and more."*

Hlanzeka Mpanza describes why the younger generation in South-Africa is becoming more interested in NUF&V.

***Hlanzeka Mpanza - Unilever:** "The younger generation [of South-Africa] is looking to expend their repertoire of cooking and people want to define who they are by what they cook."*

In order to reach the younger generations, adopting NUF&V in school feeding programmes was suggested as a possible successful method by several experts.

4. Recommendations for Hivos

In figure 5 an overview of the recommendations for Hivos based on the results from the interviews and the literature. The recommendations are divided into *quick-wins* and *investment opportunities*, dependant on the estimated financial and human resources to be invested in the implementation of the activity.

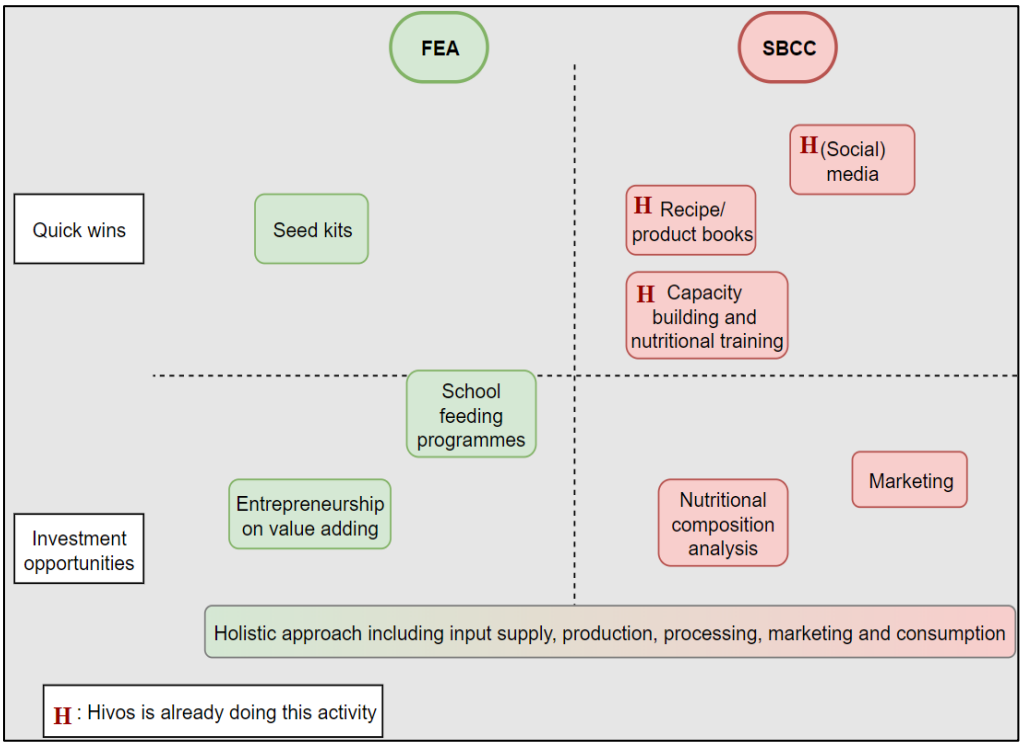


Figure 3: Overview of the recommended activities for Hivos to increase the consumption of NUF&V in LMIC, based on the results from the interviews and literature review.

4.1 Quick wins

4.1.1 Seed kits

Home garden kits including seeds, fertilizers and pesticides have proven to be successful in various contexts and can easily be adapted. An example of how seed kits with traditional African varieties linked to gene banks are distributed to small-scale farmers in Eastern Africa is described by Stoilova et al., including Ralph Roothaert from World Vegetable Centre(36). In total 42 thousand seed kits were distributed, including 20 different varieties of vegetables with the three most popular varieties being amaranth, African nightshade and African eggplant. Muhanji et al. describes an intervention in Kenya and Tanzania on increasing the production and consumption of NUV(37). The World Vegetable Centre has enhanced various varieties of African NUV to increase productivity and utilization. Although not included in the activities of SD4All, Hivos is already working with indigenous seeds in Eastern Africa, which makes the seed kit activity a quick win. It would be an opportunity to include enhanced seed varieties of NUF&V to seed kits, in collaboration with the existing seed banks of Hivos' partners.

*Take care of **language**: in a conversation with different stakeholders you need to make sure you are talking about the same thing. As described by Harriette Snoek: in Nigeria, Lagos, tomatoes and onions are not seen as vegetables, but as taste enhancers.*

4.1.2 Trainings

As shown in the results, trainings have most often been proven to increase the consumption of NUF&V. The trainings described in the activities covered topics such as agricultural practices, gardening, nutrition, food preparation and seed varieties or kits. The target group can be children, men, women or a combination. Generally, involvement of women and men in trainings is relevant, since both should be aware of newly obtained information for the training to be effective. In specific cases, the trainings can be targeted on one gender, for example in the case of working with the Ugandan women group 'orugali's'. The trainers can be members of local farming organizations, community health workers, government officials or employees from (local) NGOs. Trainings can be given as individual activities or as part of an intervention with a combination of activities.

Hivos' track record of giving capacity building trainings can be applied in this context. Trainings can be given on the implementation of various mentioned activities by the local population, such as the use of media or entrepreneurship on value adding through processing.

4.1.3 Media and recipes & product books

Although not evaluated often, the use of social media and the development of recipes or recipe-, product books have both been applied frequently. Especially the development of recipes and product-books have been indicated by the experts as being a useful SBCC method. Hivos already applied this method in Zambia with the development of the Food Value Book and it is recommended to duplicate this method to another region. Using media such as newspapers or television shows was also described as a useful SBCC method, which is already being applied in the SD4All programme. Also social media can be useful in contexts where internet connection is widely spread, this method needs relatively low financial inputs.

4.2 Investment opportunities

Recommendations have been given on investment opportunities for Hivos, which are activities Hivos has no to little experience with and will therefore require more investment time and resources. The activities has been selected based on the results from the interviews and (grey) literature, novel properties and fit with Hivos' vision.

4.2.1 Marketing

One of the most important factors of successful marketing of NUF&V is to make consumers aware of the benefits of the product. This can and will be different per product and therefore tailor-made campaigns are needed in order to have the highest impact(23,31). For this it is recommended to hire a marketing specialist. For examples the website of freshstudio.vn can be accessed, the consultancy firm where Sigrid Wertheim-Heck worked on increasing demand for nutritious food in the base of the pyramid. A partnership or consult with/from BoP Innovation Center could also be considered to increase commercial and marketing strength of conducted activities to target LMI consumers. Hlanzeka Mpanza from Unilever stressed the fact that behaviour change takes time, hence long-term thorough marketing is needed.

4.2.2 School feeding programmes

As described by Teresa Borelli from Bioversity International, connecting farmers to schools can be successful in adopting NUF&V in school feeding programmes. This strategy was applied in the programme Teresa worked on called Bioversity for Food and Nutrition (B4FN). This strategy creates a steady supply and demand for the farmer and the school which decreases the risks. For the farmer this means (s)he can invest in cultivating novel crops with the certainty they are able to sell the crop. On the other hand, the school will be able to change the menu of the school feeding into a healthier one by including NUF&V without the risk of low availability of the crop. She emphasized that enabling policies are crucial, such as the one in place in Brazil, one of the four countries of the B4FN programme. This Brazilian policy is supporting 100 different NUS and stating that 30% of food for school feeding programmes has to come from family farms.

4.2.3 Social entrepreneurship and value adding

Yasuyuki Morimoto addressed the fact that for farmers in Eastern Africa, income is the main motivation for behaviour change, while the motivation to improve health comes second. Strategies which are combining the outcomes of an increase in consumption of NUF&V and an increased income for the farmer through support of social entrepreneurship are especially of interest for Hivos. The intervention Harriette Snoek discussed is an excellent example of such a method. The veg-on-wheels was successful on both topics; the purchase of NUF&V increased by the local consumers (no evaluation on increase of consumption has been performed) and the business idea was copied by multiple groups, thereby increasing entrepreneurship of Akure, Nigeria (38). Snoek describes the time constraint is a barrier experienced by consumers to consume NU green leafy vegetables (GLV). These plants often have to be gathered in the wild and take a lot of time to clean. This is also described in the policy brief by Alive and Thrive(18). Opportunity costs are stated as one of the most important barriers, next to cultural perceptions. This obstacle is also described in the internal Hivos discussion paper on indigenous foods in Uganda. Therefore processing (cleaning, cutting, packaging) NUF&V and bringing them to the consumers, might take away the barrier of having to take time for gathering and cleaning of the product. Tackling this problem and thereby strengthening capacity development in entrepreneurship is therefore recommended.

An example of a value adding with processing of a NU vegetable is fermented-dried cowpea leaf in Kenya, as tested by Muchoki et al.(39). By consuming 10 grams of the product, for children and adults 22.5% and 15% of the recommended daily allowance (RDA) is reached, respectively. While with the same portion, 100% of the RDA for beta-carotene for both children and adults is reached. Moreover, storage time is significantly increased, value is added to the raw product and consumers indicated to easily adapt the novel product. However, it should be noted that the nutritional value of the cowpea leaf decreased significantly when applying a different method, namely drying. Thus, appropriate

research should be invested in choosing the processing method in relation to changes in nutritional content of the product, when designing a programme.

In Zambia, Nguni and Mwila investigated value adding opportunities for NULV(40). They found that, at times of excess yield, preservation of NULV was a common activity for the local communities. An example of the applied preservation methods are sun drying, blanching or a combination. Accordingly, it is recommended to hold a survey in the local community to investigate which processing methods are already applied and people are already used to. This should be done prior to designing the programme, in order to assure increased compliance and sustainability of the project.

4.2.4 Documenting nutritional composition

By chemically investigating the nutritional value of a specie, making a case to increase either production or consumption will be substantiated more strongly. Afari-sefa et al. investigated the determinants for smallholder farmers in Tanzania to decide to produce NUV. The analysis showed that when farmers are aware of the importance of the nutritional value in the traditional crops they are more likely to decide to produce the crops.

Furthermore, in focus group discussions the participants addressed the fact that efforts to promote nutritional awareness by development agencies have contributed to a significant increase in the consumption in the household(41). The need to invest in the analysis of nutrient contents is also emphasized in the internal Hivos discussion paper on indigenous foods in Uganda. As stated by Angela Kimani, this evidence is relevant in order to create awareness and influence policies.

Multiple external variables should be taken into consideration when interpreting the nutritional value of a crop. First of all, soil quality has a large influence on the nutrient content(42). Cultivating a high-nutrient crop variety on a nutrient-poor soil will withhold the crop to absorb its highest possible nutrient content. Secondly, the bioavailability of nutrients from a certain food can vary greatly and directly influence the effect a certain food can have on the nutrient status. Apart from variations in bioavailability per food, differences also exist per individual. Diet, nutrient status, age, sex and infectious disease status of the host, all play a role in the bioavailability of nutrients(43,44). Therefore, individual physiological nutrient requirements differ, influencing dietary needs.

4.2.5 Holistic food system approach with multi-stakeholder involvement

Even though this report has mainly focused on individual activities the consumption side, a holistic food system approach is ideal. In such an approach a combination of activities taking into account both the production/supply and consumption/demand side of the same product/focus foods are implemented, creating a nutrition sensitive value-chain. A study of Farm Concern International in Kenya described by Kuria investigated the challenges farmers were facing in the production of NUGLV(45). It turned out none of the farmers experienced challenges in marketing, while 57% stated lack of irrigation was one of the challenges, and 19% felt like poor roads during rainy season were a significant challenge. Therefore, the recommendation would be to take on a holistic approach and invest in mapping the main barriers producers and consumers experience around the production and consumption of NUF&V.

The community action plan as described by Céline Termote from Bioversity International was a novel holistic approach where the target population was put in the centre and given ownership of the intervention(46). Céline Termote explained that in rural Kenya, often people do not feel like they have an influence on their own future, this lowers motivation to invest in it. If something happens to them, people say this is caused by a God or external powers. By working from a deep respect for the farmer and the traditional knowledge, people will gain a realization of being able to have an influence in the

future. In the holistic community action plan, all activities were designed and financed by the community itself, which gave them a great sense of ownership and significantly increased the consumption of NUF&V.

Another example of such an approach is given by Padulosi et al., which has been developed for the NUS programme by IFAD and Bioversity International. This framework consists of six segments of the value chain where NUS can be integrated, namely 1) input supply, 2) production, 3) harvest, 4) processing, 5) marketing and 6) consumption. In this report only the latter three have been addressed, with FEA mainly looking at processing and marketing and SBCC covering marketing and consumption. An interpretation of the approach can be seen in appendix 6.

Lastly, the Bioversity for Food and Nutrition approach describes how to increase biodiversity in a holistic manner, including researchers, consumers, producers and policymakers. In appendix 7 an overview of the approach can be seen.

5. Discussion and conclusion

The way experts were identified might have caused selection bias. Initially, experts were identified through the supervisors from WUR and Hivos. The ones identified through Inge Brouwer from WUR are all working at universities or knowledge institutes. The experts identified through Frank Mechielsen from Hivos all work for Hivos except for one expert from Unilever. On top of that, five of the thirteen experts were directed through other experts, leading to a high representation of people from the organization Bioversity International (4/13). In total, three experts are working at INGOs, nine at research institutes or universities and one in the private sector. This method of identification might have influenced the results and a more equal distribution of sectors the experts were working in would have been more desirable. Moreover, by selecting literature through the experts, a skewed division of sources is seen, with many scientific papers being related to Bioversity International or World Vegetable Centre. Additionally, the majority of the activities has been implemented in Africa, while less have been implemented in Latin-America and South (East) Asia. Also, the region of expertise was Africa for the majority of the experts. This might have influenced the variety and frequency of activities found in literature and from the interviews.

The aim of this investigation was to examine effective interventions to increase the consumption of NUF&V in LMI populations and to compare these findings with the activities Hivos is already doing. However, since the SD4All programme of Hivos is still running, no evaluation has been executed yet. Therefore, the effectiveness of Hivos' activities cannot be defined, hence comparison in effectiveness is not appropriate. Additionally, Hivos does not have the capacity nor the ambition to evaluate the implemented activities on effectiveness with regards to aimed outputs, outcomes or impact. Also activities from other grey literature sources were often not evaluated, ending up with a total of 40% of the activities being evaluated. Thus, the analysis of evaluation of the activities might have helped with making educated recommendations, positive evaluation should not have been a leading criterion to judge the quality of activities.

In the analysis of this report, each activity was entered individually, also in programmes where multiple activities were implemented together such as in the *B4FN* programme and the *community action plan.* In these types of programmes, the evaluation has been performed as a whole, not individually per activity. Even though, in this case each activity has individually received a score of having a positive output or outcome. This might have influenced the results of most effective single activities, since the positive evaluation should actually be granted to a set of activities. Therefore, caution should be taken with the interpretation of the results.

The focus on SBCC and FEA in this report could have limited the thoroughness of research on which methods are most effective in increasing consumption of NUF&V. When looking at the framework on the promotion of NUS by Bioversity International, it becomes clear that also production plays a major role in the consumption. Additionally, enabling policies regulating agricultural practices & diversity, public procurement, education and commercialization of NUS influence the possibilities for an increased consumption. Therefore, it is recommended to perform further research into NUF&V consumption with a holistic approach.

Because the experience of experts on activities to increase the consumption of specifically NUF&V was not sufficient, NUS in general were included in the analysed activities. One can imagine, significant differences exist in opportunities to increase the consumption of NUF&V versus NUS. NUS also include NU staples such as millets and NU animal sourced proteins, such as indigenous bush meat. In most cultures, staples and animal sourced proteins are a more popular part of the diet than fruits and vegetables and perceived barriers to increase behaviour will therefore vary. The decision was made to broaden the focus food to NUS instead of all F&V, since the negative perception of NUS is generally a significant hindrance in the consumption which should be addressed specifically.

Lastly, activities implemented by Hivos' SD4All programme have been gathered from the interviews with three Hivos experts, and internal programme documents of 2018 and 2019. Yet, the SD4All programme has been running since 2016 and in those first years additional eligible activities could have been implemented. However, due to time constraints it was not feasible to thoroughly search through more documents, as the priority has been given to external documents. After all, as this is a report to written to recommended Hivos, it is assumed Hivos staff is aware of the activities executed in their programme.

Overall, it is important to be aware that not one size fits all. When designing an intervention to increase the consumption of NUF&V, sufficient time and resources should be invested to investigate the local contextual barriers and possibilities which are present with regards to NUF&V. Additionally, it is recommended to include relevant evaluation elements to activities being implemented. Thereby the ability is created to keep adding onto the evidence base on NUF&V, which could possibly be the secret key to improving food security and increase resilience of low- and middle-income populations by unlocking the untapped potential of this food group.

To conclude, quick wins for Hivos are to continue working with recipe/product books, trainings and (social) media and to expand the activities where possible. A novel activity that is recommended to investigate is the use of seed kits. Investment opportunities for Hivos are to work with school feeding programmes, entrepreneurship on value adding, documentation and analysis of nutritional composition and marketing. Ideally a holistic food system approach is used when conducting activities to increase the consumption of NUF&V, taking into account both the supply and demand side.

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Appendix 1: Results scientific literature review

Author	Year	Focus food	Region	Methods and study design	SBCC/FEA adaptation	Recommendations	Evaluation
Obel-Lawson(28)	2006	NULV	Kenya	Public awareness campaign Message must be: -credible -high quality -repeated exposure -informal + mass media	SBCC	Interpersonal Comms channels of family/social network stronger than mass media	-NULV no longer viewed as 'low status' food -Raised awareness -14% behaviour change -10% increase demand
Van der Lans et al.(29)	2011	V	Kenya	Review of methods to increase consumption	Review	- Urban + home gardening (kit) - formation of farming cooperatives - promotion and education of vegetables - ready-to-eat meals - increase marketing	N/A
Chadha and Olouch(47)	2007	NUV	Various African countries	Seed kits including NUV distributed over 10.000 poor households.	FEA		Crop varieties have been adopted. Increased consumption of NUV
Virchow(48)	2008	NUV	Kenya, Tanzania	extensive promotions and awareness creation in (in)formal markets	SBCC		more indigenous vegetables in the informal markets
Kuria/ Farm Concern International(45)	2015	NUV	Kenya	Communication to promote the use of NUV -Barazas (multi-stakeholder meetings with high participation between audience and communicator) - Cooking shows -Drama	SBCC	- make more use of demonstrations than barazas because most small-holder farmers have had no to little education. - Boreholes should be installed by the MoA to ensure irrigation during dry season. -train farmers on agricultural practices and financial literacy by using other forms of communication such as television, radio or internet	-increased consumption (75% because of higher nutritional value) and increased production
Afari-Sefa et al. (41)	2015	NUV	Tanzania	Promotion of nutritional value of NUV	SBCC	- Make farmers aware of nutritional value of a crop in order to increase production - Access to seeds is crucial; farmers will decrease NUV production if they are not certain of the availability of seeds for next season	Increased consumption in various households (result FGD)
Baldermann(23)	2016	NUS	Worldwide	Review of methods to increase consumption	Review from high level training	- Cooking shows - involvement television, social media reduce prejudices and fears toward food security and nutritional quality	N/A
Nwapa(49)	1986	NUS	Nigeria	Promoting traditional value Cassava song	SBCC	The song was a protest against the growing import of rice and a way of showing appreciation for the indigenous cassava(23)	no
Beltrame et al. (50)	2016	NUS	Brazil	Adopting NUS in public procurement policies for school feeding programmes	FEA		Increased procurement of NUS

Kansiime et al. (51–53)	2018	NUV	Tanzania	Community based intervention of Good Seed Initiative - seed rallies - cooking shows - road shows - nutritional events - agricultural events - radio	SBCC	Increase focus on changing perception of men towards NUV. They are the main decision makers in the household and traditionally consuming NUV was considered a taboo for men in the region in Tanzania.	Large increase in consumption of NUV
Ravi et al.(54)	2010	NU millet	India	- training on agricultural practices - value adding by processing - seed promotion/selection	FEA, SBCC	NUS are very suitable for value adding and processing, to create more income for the farmers.	Increase of yield and income
Broegaard et al. (55)	2017	NUS	Laos	Review of the effect of commercial agriculture expansion on the consumption of wild foods collected in the forest	Review	Incorporate nutrition-sensitive activities when linking commercial agriculture and biodiversity conservation. Protect natural forest lands	N/A

Appendix 2: Results grey literature review

Organization	Year	Focus food	Region	Methods and study design	SBCC/FEA	Recommendations	Evaluation
Bioversity International, IFAD Padulosi et al.(35,56,57)	2019	NUS	general	Framework on incorporating NUS in nutrition-sensitive agriculture		Key focus areas to realize impact are women's empowerment and nutrition awareness among consumers	recommendations
	2014	NUS, Andean grains	Bolivia, Peru	Holistic value chain approach. Activities on genetic diversity, selection & cultivation, harvest, value addition, marketing and consumption were applied. Activities included - capacity building - marketing - recipe books -value adding: amaranth energy bars, ice-cream, quinoa beer, pre-cooked soup, cañahua flan.	SBCC and FEA	- Taking into account cultural, gender and nutrition aspects is crucial. - Make sure policy makers support multi-stakeholder platform to increase stability and sustainability.	Significant increase of production and consumption of Andean grains. Increased income.
	2015	NUS, minor millet	India	Use of the six segments holistic value chain approach as used for the Andean grains (appendix 6) with a focus on: capacity building and gender With regard to CB: Self-help group and farmer groups established their own savings to finance their own small scale industries and hand out loans. - Promotion of millet use in canteens and hospitals -Developing millet-based snacks (noodles, baked-goods, drink) with attractive packaging	SBCC and FEA	Men and women have different knowledge about plants and agriculture, relevant to involve both. Women select varieties useful for the household, men the ones to generate income.	Increased yield, improved post-harvest processing, increased consumption, increased income
Hivos (outcome harvesting)		NUV	Uganda	40 diet champions to increase access to NUV seeds	SBCC		no
	2018	NUS	Zambia	Food Value Book			
	2018	NUS	Zambia	Good Food Logo, a front-of-pack seal logo introduced to help consumers to make healthier and more sustainable food choices, including NUS			
	2018	NUS	Bolivia	Workshops for students from a gastronomy school			
	2018	NUS	Bolivia	Media coverage through various outlets to promote sustainable food via gastronomy and the Bolivian Food Heritage			
		NUV	Uganda	20-30 acres of home gardens planted with NUV (80% home consumption)	FEA		
	2018	NUS	Indonesia	Local catering business is promoting food with NUS			
PELUM Uganda (internal hivos paper)	2018	NUS	Uganda	Promoting local seed varieties	SBCC		no
	2018			Indigenous Food Fair			
Slow Food Uganda (internal hivos paper)		NUS	Uganda	Promotion of policy dialogues Food fairs Radio talk shows Community gardens Trainings	SBCC, FEA		no

Kabarole Research and Resource Centre (internal hivos paper)		NUS	Uganda	Working with local chefs in Fort Portal Working with women groups (orugali)	SBCC		no
Padulosi et al.(20) **Bioversity Int**	2013	NUS	Global	Review	FEA, SBCC	- Raise awareness - Training on NUS -generate evidence on NUS - capacity development - value adding - increase agricultural practices - improve processing methods -multi-stakeholder involvement	N/A
Alive and Thrive(18)	2013	NUS	Global	Technical brief on closing nutrient gap for children with NUS	FEA	Because of palatability it is recommended to add NUS to plain foods such as porridge.	Adding fermented néré seeds to gruel have shown to increase haemoglobin concentration in children (19)
Mennonite Central Committee(58)		Moringa	Burkina Faso, Ethiopia, India, Kenya, Zambia Lao	Educating on cultivation and daily consumption of moringa trees. - training - cooking shows - school gardens	FEA, SBCC	Moringa is highly nutritious and drought resilient and is therefore a favourable crop. Add leaves as a whole or as powder to porridge.	Increased production and consumption
International Union for Conservation of Nature (IUCN)(59)	2015	Non Timber Food Products (NTFP) including NUF&V	Burkina Faso	Restoring forest lands to improve ecological integrity and livelihoods of the local population. Restored forests are enhanced in vegetation varieties.	FEA		Restored land were perceived to be of high importance to household food security.
			Brazilian Amazon	Promotion of cocoa-based agroforestry with forest landscape restoration, including various NUF&V species.			Increased food security through economic benefits of cocoa production and restored forests
			Guatemala	Promotion of agroforestry system 'Kuxur Rum'. - home gardens - improved seeds - training on farming practices		Invest in research and increase awareness among policy makers on the interconnectedness of food security and forest landscapes	Increased food and nutrition security: -availability (production) -access (higher availability of fire wood and fertilizer) -utilization (reduction of chemical fertilizers, pesticides) - stability (decreased crop failures)
			Vietnam	Restoration of mangrove forests			Increased food security, increased financial resilience poor women
			Ghana	Promotion of cocoa agroforestry with restoration of forest landscapes			98% of respondents stated that products from the cocoa agroforestry system contribute to their food security
			Ethiopia	Restoration of forest			- Increased availability NUF&V - Increased food security
			Philippines	Community based forest restoration			Increased food security
Helen Keller International(60)	2017	NUS	Africa, Asia	*Enhanced Homestead Food Production* program - Training of women on production: gardening and farming and nutrition - Increase capacity on entrepreneurship	SBCC		Empowered women of poor households

Appendix 3: Results interviews

Name expert	Organization	Region		Method	Evaluation
Sigrid Wertheim-Heck	Wageningen University	Vietnam	Other	Set up marketing cooperative (61)	no
		General	SBCC	Broad marketing strategies	
		Vietnam		Handing out leaflets at wet markets and supermarkets	
Harriette Snoek	WUR	Nigeria	FEA	Vegetables on wheels, increase opportunity (moa), accessibility NU GLV (amaranth, pumpkin leaves and spinach)	no
Sognigbé N'Danikou,	World Vegetable Centre	East and West Africa	SBCC	Promoting nutritious crops, healthy lifestyles	No, but increase in cultivation
		Tanzania, rural		Cooking shows, fairs	no
				Recipe books, used as training material in schools, food vendors organized by womens groups	
				Food ambassadors, traditional vegetables champions, theatre	Yes, successful, helps to penetrate areas with little interest in traditional veg, website!
				Use media (news, tv) to talk about good agricultural practices and traditional vegetables to reach beyond farming community and reach policy makers	Policy influencing; no info on impact.
		Madagascar	FEA	Healthy seed kits, nutrient dense crops for home/school garden	Yes, publication
			Other	Involve private sector in vegetables research → gene bank. Will trickle down. Working together with seed companies that have a low collection of indigenous seeds, make them available for smallholders.	
Amy Ickowitz	CIFOR	general	SBCC	Recommend increasing consumption F&V based on gaps after research dietary patterns.	no
		West Kalimantan		Wild food festival by NGO Riak Bumi. A nutritionist spoke at the festival about the value of local products	
		General	FEA	Focus on natural environment: decrease deforestation and monocultures, especially for DGLV	
		Borneo, Papua		Recommend home garden, involve oil palm plantation (if they own company store, make sure F&V are in there)	
Celine Termote	Bioversity Int.	Nairobi		DGLV promotion with cooking shows, contacting supermarkets and ask to sell products	Higher purchase
William Chilufya	Hivos	Tanzania	SBCC	Cooking demonstrations with NUF&V (involving celebrities in the future)	No
				Food festival with NUF&V	
				Local food value book	estimated 1500 reached, excited reactions
Ralph Roothaert	World Vegetables Centre	General	SBCC	Cooking shows, also involve men	no
		General		Campaigns in villages; focus on superiority of NUV, now seen as weeds	
		General		Link with existing initiatives of MoH, create synergies. Eg education on nutrition	
				Field days: mass communication	Yes but difficult to differentiate
				Link with media, radio for farmers, social media	

		Kenya		Messaging, private vs MoH	Yes: MoH worked better, higher knowledge attitudes
				Developing recipes with vegetables	
		Bhutan(62)	FEA	School gardens, education on nutrition for children	Increase in knowledge and awareness of F&V. probability for children to include V in their meals
		Nepal (63)	FEA, SBCC	School gardens, education on nutrition for children. Recommended to also work with parents	Increase in knowledge and awareness of F&V, not in consumption
		Bangladesh(64)		Seed kits and training of women in nutrition and home gardening provided	Increase in NUV consumption
		Africa, Asia	FEA	Seed kits for home gardens	Yes: increased consumption
		Kenya(65)		Seed kit with training	Yes: increased consumption
Celine Termote	Bioversity Int.	Kenya	SBCC	Workshop nutrition counselling (health belief model, find motivation)	no
				Cooking workshops	
				Use community health volunteers	
				Let people decide for themselves	
			FEA	Home gardens	
				Teaching garden for community	Yes, plots were copied by many community members
				Community action plan(46)	Yes, consumption NUS increase
Nicole Szucs	Hivos	Bolivia	SBCC	Festival (los ningunes)	No
				Social media	
				Work with students from gastronomy school	
				Work with artists, comic book	
				National newspaper, weekly recipe with NUS coming out	
			FEA	Ambassadors at market stalls with info and recipes	
				Working with local restaurants to put NUS in recipes	
				Working with cooks at the market to put NUS in recipes	
				Putting NUS in school meals	Positive reaction from kids, bad from parents because of less sweet taste
Gennifer Meldrum	Bioversity Int.	Guatemala	SBCC	Cooking workshops	no
				Recipe book, also in Mali	
				Working with national chef	
				Market stands with nutritional info	
			FEA	Involvement local restaurants to use the products	
				School feeding programmes, by law schools have to spend a proportion on local products	2 recipes with Chaya
Teresa Borelli b4fn.org(25)	Bioversity Int.	Global	Other	Mainstreaming toolkit(66)	
				Providing evidence of nutritional value crops	no
		Kenya		Use government extension services	
		Brazil		Creating enabling environment for producers	
		Brazil, Kenya	FEA	Link farmers to schools, create stable supply and demand	
		Kenya		Market survey of producers to look at possibilities where demand is for the product.	
		Sri Lanka	FEA	Creation of market outlets with NUS, train women to cook + sell them: Hela Bojun	

		Turkey		Connect with large supermarket chain to sell NUS	no
		Kenya		Farmer business school, providing agricultural and nutrition information for NUS	
		Kenya, Brazil, Turkey, Sri Lanka	SBCC	Working with gastronomy	
				Working with famous chefs	
				Documentation of recipes (books)	
				Using media (national tv)	
		Turkey		NUS Fairs: alacati herb festival, including scientific seminars	
Silvana Paath	Hivos	Indonesia, Jakarta	SBCC	Food festivals, exhibitions	no
		Indonesia		National celebration world food day	
				Working with local chef	
				Provide nutrition info in capacity building to culinary SME group	Sales went up
				Cooking event (at monthly market) for children to cook	no
			FEA	Healthy canteen in schools, providing nutritious snacks for children with focus on parents, by a food champion	Good reaction from parents
				Monthly food market for SMEs to sell food.	no
Hlanzeka Mpanza	Unilever	South-Africa	SBCC	Work with chefs	no
				Social media	
				Create recipes, put on social media	
			FEA	Increase availability, most people in SA buy from supermarkets	
				Link farmers to market, link to supply chain to decrease risk	
Yasuyuki Morimoto	Bioversity Int.	East Africa	FEA	Seed distribution	no
				Community seed centres	
				Value adding activities eg popcorn of millet, mixed with dried fruit Kenya	
				Working with restaurants on GLV, Nairobi	
			SBCC	Creating awareness through general marketing	
				Documenting agrobiodiversity, processing, preparation and consumption habits	
				Providing nutritional feedback; what is lacking in the diet, individual and group level	
				Cooking demonstrations	Yes (in the package, with seed centres)
				Seed fairs	
				Let youth document food environment with mobile phone photos	no
		Nairobi(67)	FEA	Storage and processing techniques	Increased production and consumption of ALV, mostly dominated by women. HH marketing ALV were better off than those who did not.
				Improve seed quality	
				Seed banks	
			SBCC	Document indigenous knowledge on NUGLV	
				Analysis of nutritional composition	
				General marketing	

Appendix 4: List of experts interviewed

Name	Organization	Sector	Countries working/experience
Sigrid Wertheim-Heck	Wageningen University	University	Vietnam, Global
Harriette Snoek	Wageningen University	University	Nigeria
Sognigbe N'Danikou	World Vegetable Centre	Research institute	Eastern and Southern Africa
Amy Ickowitz	CIFOR	Research institute	Indonesia, Global
William Chilufya	Hivos	INGO	Southern Africa
Ralph Roothaert	World Vegetable Centre	Research institute	Sub Saharan Africa, Global
Céline Termote	Bioversity International	Research institute	Kenya
Nicole Szucs	Hivos	INGO	Bolivia
Gennifer Meldrum	Bioversity International	Research institute	Guatemala, Global
Teresa Borelli	Bioversity International	Research institute	Sri-Lanka, Brazil, Kenya, Turkey
Silvana Paath	Hivos	INGO	Indonesia
Hlanzeka Mpanza	Unilever	Private company	South-Africa
Yasuyuki Morimoto	Bioversity International	Research institute	Eastern Africa

Appendix 5: Results from in-depth questions 4-5d per expert

Question 4: Difference approach NUF&V and F&V

Sigrid Wertheim-Heck: Any product which is correctly marketed as new and excited will be able to sell to consumers.

Sognigbe N'Danikou: [In Eastern and Southern Africa] Exotic vegetables are well known and sold everywhere, such as tomato and cabbage. NUS have a low status, they have a stigma of *poor man's food,* and this prevents consumption. Changing perception should be part of the method to increase consumption by promoting nutritional value and thereby creating more awareness. This can be done by using food ambassadors, someone with a strong voice in the community. This can increase adoption of different varieties

It is important to get long term commitment of investment. Creating an enabling environment through policy changes is important, so that farmers can grow different varieties and consumers have access to a diverse range of vegetables. Include NU crops in national policies and seed catalogues. 10 years ago the consumption was a lot lower than now, many interventions have paid off.

Amy Ickowitz: When you look at why people are not consuming NUS: NUS are sometimes seen as more primitive foods. When looking at people with a higher SES, processed foods become more attractive. They will have less time for collecting NUF&V (growing wild as weeds).

It is important to emphasize the value of the food culture, people take pride in that. You can get famous people to promote the foods, going to communities, expressing admiration for food. External validation from ministry of agriculture can increase perceived value of NU foods. Often marginalized

people don't feel part of a nation, recognition can play an important role. After the development of a local food book people were very happy to see their foods represented in an 'official' document.

Sometimes NUS are NUS for a reason: they don't taste so good, have short seasons and a lot of variation. NUF&V should be promoted in addition to exotic F&V, e.g. mangos taste good and are very healthy and popular everywhere so we should not only focus on NUF&V.

William Chilufya: The types of foods that we need are foods that grow in harsh climate conditions. In Zambia local foods are becoming more popular.

Ralph Roothaert: Vegetable consumption increase in general is important but NUV sometimes have 10-20 times the nutrient content of an exotic variety. Cabbage and tomato etc. have relatively low nutrient content. But NUV have a low status because they can also be harvested as weed. In Kenya for example, NUV are now in the markets, they are more expensive and people know they are more nutritious. The change in attitude might have started with the intervention with the Uchumi supermarket chain in collaboration with Farm Africa.

Céline Termote: Focus on higher nutritional value and climate resilience. In Kenya a policy is in place on agrobiodiversity, which came through because of iron content NU GLV which is about 10 times higher than e.g. spinach.

Nicole Szucs: Focus on higher nutritional value and quality of NUF&V. Promoting local foods from the country means shorter transportation times and less use of pesticides and fertilizers because of the adaptations of the crop to the local environment and pests. Focus on the relevance of bringing back flavour and knowledge and make sure this doesn't get lost. We don't need to eat exactly what we ate 200 years ago, but it's important to know where the customs come from.

Hivos Bolivia wants to partner with 'old peoples university' to have them tell stories about food culture. The negative stigma of NUS is in the transition. Quinoa becoming a super food worldwide made people realize to appreciate what they have and it took away stigma, even though consumption has not increased yet.

Gennifer Meldrum: There is a negative stigma on NUGLV in Guatemala. Involving chefs is helpful to change this stigma. People are more open to novel, processed foods, which often have a higher social prestige. The 'Food of the poor' stigma can be significant. You have to glamorize NUS and find out where the bottle necks is. Often people have a good reason for why they're not consuming certain crops. E.g. difficult and long time to prepare. Perishability is sometimes the issue for NUF&V. Therefore processing is key. Also, NUF&V often have less of an appeal than exotic crops.

Teresa Borelli: Products that are gathered in the wild are often seen as poor man's food. Therefore the approach should be holistic. Approach stakeholders right from the beginning and think creatively about which ones to involve. Make sure you have policy support. Smallholder farmers cannot take big risk so make sure that there is a market for the product.

Silvana Paath: In Indonesia, for a while now people have been forgetting indigenous foods and the fact they are edible, because people are changing to a more urban lifestyle. Now people are becoming more and more familiar with the indigenous foods. More events like food festivals are organized. In marketing, minimal resistance will be started when using the term 'traditional', instead of when using 'healthy' or 'organic', which people question quicker. The term 'traditional' is accepted easily and automatically seen as positive.

Hlanzeka Mpanza: In South-Africa, people see NUS as poverty foods, people have grown up with eating these foods, now they want to eat more modern foods. Therefore you have to create inspiration for how to cook with NUS. Put emphasis on heritage, emotion, inspire people and call to action, don't just tell people to eat them because it's good for you. NUS resonate with people, they are interested in their heritage and food can be part of this.

Yasuyuki Morimoto: Dietary advice needs to be culturally acceptable. You need to promote local foods to use for processed foods. Now, most processed foods are still made from exotic varieties which is not needed, e.g. popcorn of other grains such as millet.

Question 5a: Urban versus rural

Sigrid Wertheim-Heck: In rural areas word-of-mouth is more important and stronger than in urban communities. Recipes is a method that work everywhere. People expect different properties from foods obtained at different locations. For example; people expect vegetables bought at wet-markets to be a little bit dirty, while at the supermarket they are expected to be completely clean. If the vegetables are sold in a different state, this will raise distrust for the consumers.

Harriette Snoek: The images that people have on traditional dishes are good, it is seen as *something that's ours* or as *old-fashioned*, although this might be different in urban versus rural. In Nigeria Lagos, people go to certain markets because the vegetables of their tribes are sold there. Onions and tomatoes not seen as vegetables but as taste enhancers.

Sognigbe N'Danikou: In Africa television is good in urban areas but not in rural areas. In urban you can reach a higher number of people. The use of YouTube works in urban areas where you can reach large audiences.

Amy Ickowitz: In middle-class urban populations the promotion of NUF&V has a better change because people could view NUF&V in a romanticized way, they can feel nostalgic about it: *the rural way of life*. Creating this image is harder in rural areas because people are just going through a transition. In rural areas focussing on the pride angle might be stronger. In rural areas with forests, the consumption of DGLV is higher than in areas where palm production dominates.

William Chilufya: [In Eastern-Africa] the middle class is growing and they are choosing indigenous foods. They are concerned about their health, as also demonstrated by the study performed by CUTS in Lusaka. Cooking demonstrations and festivals are more important in rural areas. In urban areas awareness raising is important, which can be done by using media: radio, community meetings or demonstrations.

Ralph Roothaert: In urban areas time constraints more important. Also status is more important in urban areas, therefore the communication strategy of making a food 'cool' could be more effective. In rural areas availability, affordability and knowledge are more important.

Céline Termote: In rural areas there is a direct link between production and consumption. In urban areas food prices play a larger role.

Gennifer Meldrum: In urban areas it's easier to popularize NUS. People in cities are looking for healthy food options. In urban areas there is a low awareness of the existence of NUS. In rural areas there is a higher presence of the negative stigma around NUS. Methods can be adapted for each region. Workshops would be more for rural. Access is an issue in urban areas.

Teresa Borelli: The line between urban and rural areas is becoming thinner because of urbanization. Using celebrity chefs is a better activity for urban areas. School feeding would be for both urban and

rural, although more for rural. Fairs or festivals could work for both. All activities can be adapted to both urban and rural areas.

Silvana Paath: In [Indonesian] rural areas, people are forgetting about indigenous foods, because they are adapting a more urban lifestyle. People perceive the urban lifestyle to be sophisticated and prestigious, while NUS are perceived as the opposite. In urban areas people are aware of the indigenous foods but they choose not to eat it because of convenience since NUF&V are not widely available and very expensive. In Bandung, around 80% of food comes from outside of the city. In urban areas people have a higher tendency to eat outside/order from outside, therefore engaging with local SMEs is a better method in urban areas. More branding and marketing is needed. Using young male celebrity chefs works well for urban areas (mothers love them).

Hlanzeka Mpanza: [In South-Africa] dietary diversity is higher in urban households. In rural areas there is a lot of poverty but people are still not growing food. In urban areas, time restraints are more of an issue. Awareness of NUS is higher in rural areas although the intake might be similar.

Yasuyuki Morimoto: Urban people need processed foods and conservation is difficult of fresh NUS. In urban areas people are familiar with NUS and are interested to eat it but often it is not available.

Question 5b: LA versus Africa versus S(E)A

Sigrid Wertheim-Heck: Generalization is not really possible and no one size fits all, although when it comes to marketing messages, in general African populations are more prone to respond to aspirational messages than the Asian populations. Generally speaking, in Asia people are more aware of healthy eating and will be more willing to respond to messages promoting healthy foods.

Harriette Snoek: In the Balkan region people have a high appreciation for vegetables from own gardens. Also in urban areas vegetables from their mother's rural garden would be brought home. In Africa food safety is important and especially in urban areas a greater risk is perceived. Vegetables from Veg-on-wheels were perceived safer because the vegetables came from the university farm.

Sognigbe N'Danikou: The methods vary a lot per region. In Asia, information technology penetration is higher than in SSA, they use internet more frequently. A lot of information on health available on the internet, they use this in Asia but less in SSA. Vegetable consumption is more of a tradition in Asia than in SSA, which is why the adoption of vegetables is higher in Asia than in SSA.

Amy Ickowitz: Large differences exist also within the African continent. In Zambia people take more pride in NU foods, including vegetables. In Cameroon, NUV are valued and traded widely. In Ethiopia, NUS are not valued outside of the region, especially in marginalized areas, where they are seen as primitive. Although, people in the area were proud of their foods. In Uganda people do not use non-cultivated food, this is similar all over the country.

In Indonesia Papua there is not much F&V consumption while in Indonesia Borne there is a lot of wild vegetable consumption. The promotion of F&V by NGOs might make a difference. In Indonesia the NGO Riak Bumi organized a successful traditional food festival. A nutritionist went to the festival and spoke about the nutritional benefits of the foods, this was very well received, and people are looking for this scientific validation. But be aware that the countries are extremely heterogeneous and context specific.

Ralph Roothaert: In SEA there is a higher home cultivation of vegetables while in SSA most vegetables are bought at markets. Therefore a focus on home gardens will be less effective in SSA than in SEA. In Taiwan people have a sweet tooth in Taiwan, all vegetables have higher sugar content.

Gennifer Meldrum: It is all very context specific but basic interventions could work in each region. General marketing strategies will work everywhere, when they are adapted to the local context. In Nepal there is a higher variety of NUF&V than in Mali, where people don't have much to choose from.

Teresa Borelli: No one size fits all, work with government to see what works. The use of gastronomy might work everywhere. School feeding is universal.

Silvana Paath: In all regions revitalizing traditional recipes will work.

Yasuyuki Morimoto: Documentation is the local language is important, otherwise the knowledge will be lost. This is especially difficult when a people does not have a written language.

Question 5c: Gender

Sigrid Wertheim-Heck: Women mostly do groceries at wet-markets, men at supermarkets.

Sognigbe N'Danikou: Vegetables are women's crop in general. Promoting NUV always starts with women, men are more interested in cash crops. Women are more interested in household consumption, which is why vegetables are of more interest to women. Often women make the decision in which crops to cultivate, depending on which crop is most liked in the household.

Both husband and wife are involved in the seed kit programme. Women are being taught different methods to grow and cook vegetables. Men are taught the different potential of the vegetables being promoted and being used by the women → this increased adoption of the seed kits.

Cooking demonstrations focussed on women, they are the ones in the kitchen. Food ambassadors are more focussed on men because a male ambassador will reach a broader audience and since vegetables are not a men's crop, they need to change more. This way, the probability to adopt for women is higher.

Amy Ickowitz: In some cultures, men don't seem to eat fruits at all.

William Chilufya: In Zambia: women are responsible for preparations: activities as cooking demonstrations and the promotion of diversity on the plate are targeted at women. Men are responsible for production, a promotion of diversity on the farm will be targeted at men. The activities of festivals and famous food ambassadors will be for both genders.

Céline Termote: In the community action plan in Kenya, we kept a balance between men and women in the activities of one-third to two-thirds. Eventually the groups automatically evolved to more women since they are more aware of nutrition and are usually the seed custodians. Until larger amounts of money play a role, than men take over. But men should always be involved, otherwise if women learn something in a workshop, but the men don't understand, the women won't be allowed to apply their newly obtained knowledge. Also for cooking activities, all family members are encouraged to join but eventually it will be the woman doing the cooking.

Nicole Szucs: [In Bolivia] women are more aware of healthy foods/diets. Men don't care, they just want to get full. Hivos is running a food and masculinity programme in Bolivia; the culture is still very sexist. If a man doesn't like a certain type of food, the woman won't cook it. An activity of the programme is a book with recipes for the whole family to get involved, and cooking workshops specifically for men.

Gennifer Meldrum: [In Guatemala] men are often working/eating away. Cooking workshops are targeted on women, it just would not make sense to teach men. Reaching women is the only way to reach men with food. In India, men sometimes cook if women are menstruating.

Teresa Borelli: Generally, in Africa cultivating NUS is a women's job, when it becomes a cash crop the men will take over. Additionally, the return of investment is higher for women.

Silvana Paath: In Indonesia, a resistance from husbands comes when wives want to reduce additives such as MSG. The recommendation is to reach out to husbands as well, since they often decide what the mother will cook.

Hlanzeka Mpanza: Females tend to be the decision makers on what is eaten at home, they are the target market for the programme [from Unilever in South-Africa].

Yasuyuki Morimoto: In most African countries, women prepare the food while men are more involved in obtaining the food.

Question 5d: Younger generation versus older generation

Sigrid Wertheim-Heck: In Asia, younger generations are living more and more in nuclear families, this will influence the food decisions they are making.

Sognigbe N'Danikou: Children are more resistant to consuming vegetables. That is why a tailored methodology for school teaching is needed.

Amy Ickowitz: It is important to involve youth in NUF&V, they seem to be diverging from traditional eating habits more. School gardening could help with this. Nutritional value specifics of local foods would be relevant to stress the potential.

William Chilufya: I do not see that much segregation between young and older generations

Nicole Szucs: Now NUS are more popular with the older population. To involve kids, the NUS should be included in the school meals.

Hlanzeka Mpanza: In South-Africa, the older generation is more familiar with NUS, they have a higher consumption. The younger generation is more interested in NUS because of the attention to food on social media, but the consumption is still lower. The younger generation is looking to expending their repertoire of cooking and define who they are by what they cook.

Yasuyuki Morimoto: In Africa, the older generation have more information on traditional foods, the young generation is more influenced by the internet and is less interested in NUS.

Appendix 6: Framework on a nutrition-sensitive value chain for NUS

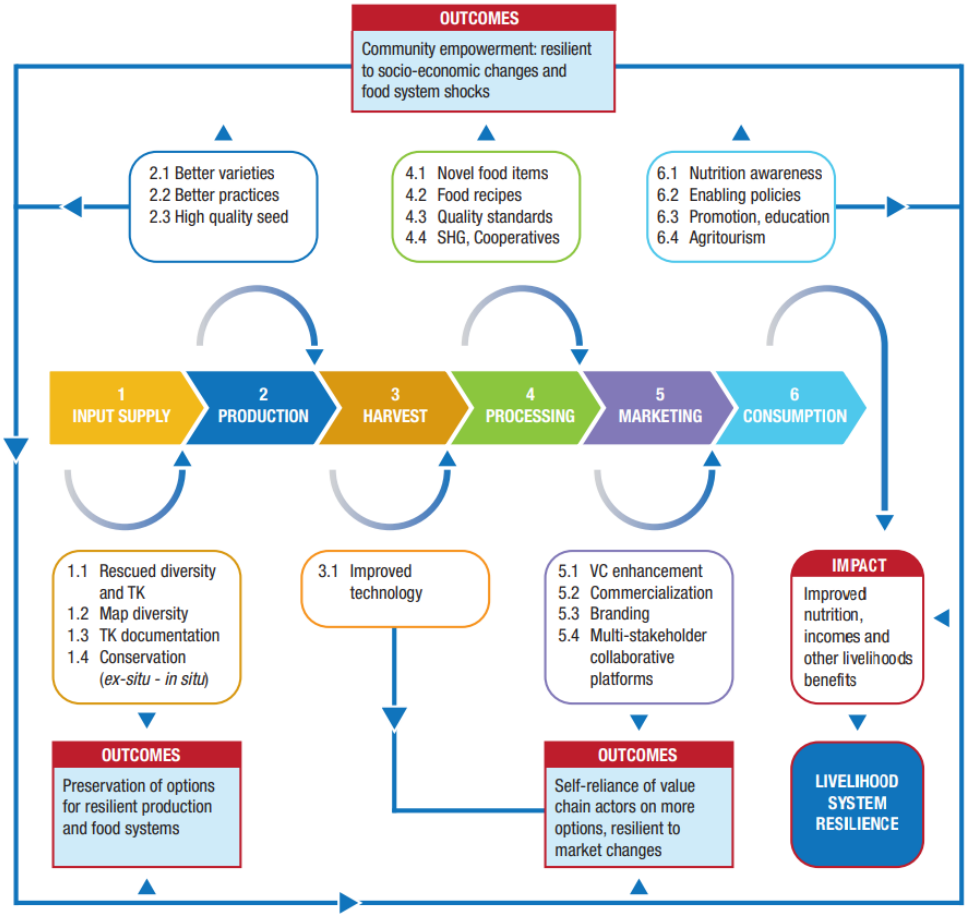

Figure 4 Holistic value chain framework for the promotion of NUS from Padulosi et al. (2014 & 2015)(56,57)

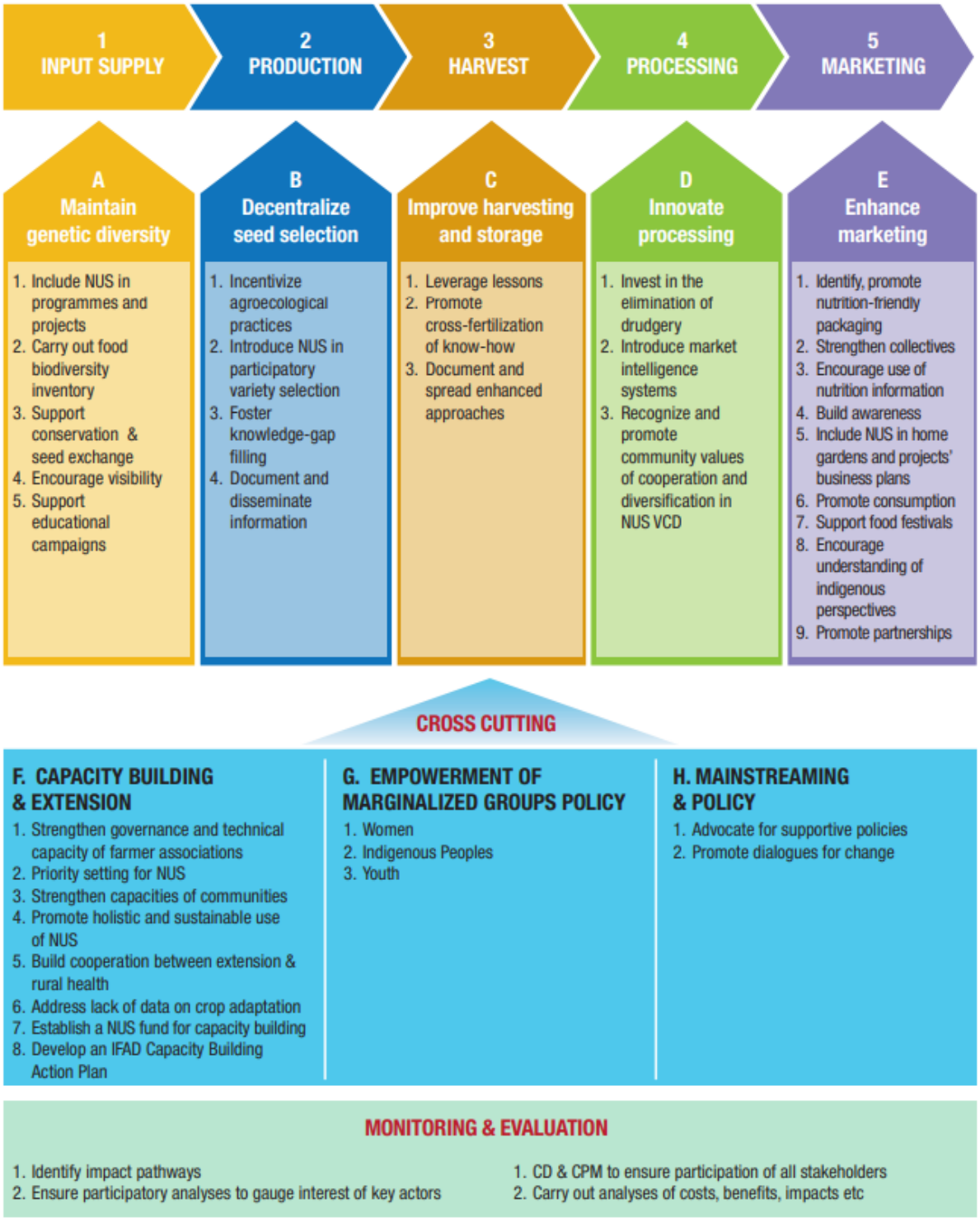

Figure 5 Entry points to reinforce nutritional outcomes in NUS value chains from holistic value-chain framework by Bioversity International and IFAD(35)

Appendix 7: Bioversity for Food and Nutrition approach

Figure 6 Framework of Bioversity for Food and Nutrition programme by Bioversity International, from the mainstreaming toolkit publication(66).