



How to do

Promote neglected and underutilized species for domestic markets

Nutrition-sensitive Agriculture - Note no. 3



How To Do Notes provide tools for good practice design based on best practices collected at the field level. They guide teams on how to implement specific recommendations of IFAD's operational policies, standard project requirements or financing tools. The How To Do Notes are "living" documents and will be updated periodically based on new experiences and on feedback. If you have any comments and suggestions, please contact the originators.

Originators

IFAD Nutrition Team and Bioversity International

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List of Acronyms

ABD	Agrobiodiversity
AVL	African Leafy Vegetables
BFN	Biodiversity for Food and Nutrition
CIP	Centro internacional de la papa
COSOP	Country Strategic Opportunity Programme
CPM	Country Programme Manager
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussion
GIZ	Gesellschaft für Internationale Zusammenarbeit (Society for international cooperation)
HTDN	How To Do Note
HVCA	Holistic Value Chain Approach
ICO	IFAD Country Offices
IFAD	International Fund for Agricultural Development
IP	Indigenous People
NGO	Non Governmental Organization
NUS	Neglected and Underutilized Species
PAA	Food Acquisition Program (Brazil)
PGRFA	Plant Genetic Resources for Food and Agriculture
PMCA	Participatory Market Chain Approach
VCD	Value Chain Development

1. Introduction

Agricultural biodiversity is a strategic asset to fight climate change vulnerability, poverty, and food and nutrition insecurity. The wealth of food crops is estimated at 5,000 species (Kew Royal Botanic Gardens 2016) but global food systems are increasingly dominated by just three crops—rice, maize, and wheat—which altogether make up more than 50% of human plant-based caloric intake and cover 40% of arable land globally (FAOSTAT 2013)¹. Modern agricultural practices, uniformity in agricultural markets, and changing lifestyles are causing the disappearance of crop diversity from production and food systems. The diversity of plant species gathered in the wild for food is also threatened due to degradation of natural habitats. Such a situation is having multiple impacts on peoples' livelihoods as cultivations are becoming more susceptible to climate change, farmer assets are being eroded, and consumers have fewer choices for nutritious and healthy diets.

Neglected and underutilized species, or NUS for short, are crops that have been left at the margins of research and development. The word 'neglected' underlines the low level of research investments made on these species when compared with mainstream commodity crops and 'underutilized' alludes to their untapped livelihood potentials. NUS include wild, semi- or fully domesticated plants from various food groups (cereals, vegetables, legumes, roots and tubers, fruits, spices) with diverse growth forms (field crops, trees, shrubs, vines, etc.). NUS are an integral part of local cultures and food traditions, and they are increasingly in the spotlight of efforts for revitalizing local cuisine and celebrating the identity of the 'terroir'.

Hot spots of NUS diversity coincide with regions where indigenous peoples live—largely remote areas where standardization of agricultural practices has not been very intense and agro-ecological practices have prevailed. Many of these areas are characterized by challenging conditions for agriculture where NUS are central in traditional farming and risk management practices, owing to their early maturation, low water requirements, and capacity to thrive in marginal soils, among other characteristics. Indigenous women in particular are often the custodians and main knowledge holders of NUS because of the great relevance these crops have for household nutrition and other livelihood needs. But in spite of being so relevant in the lives of local communities around the world, NUS have been sidelined by the Green revolution and received very little investments for their research and development. Scarce attention has been directed to enhance their yields and overcome challenges in their cultivation, processing, and marketing. Such a trend needs to be reverted, as investing in these crops represents a strategic opportunity to unlock multiple livelihood benefits, especially for marginalized groups in both rural and urban settings.

A Holistic Value Chain Approach for the use-enhancement of NUS has been developed and tested through IFAD-supported research grants. This approach involves interdisciplinary and participatory interventions at different stages of the value chain to overcome bottlenecks in the use of NUS and enable resilience, nutrition, and income generation outcomes to be reaped (figure 1). The Holistic Value Chain Approach is outlined in the Operational Framework “Supporting Nutrition Sensitive Agriculture Through Neglected and Underutilized Species”, which was developed to support IFAD Country Directors, CPMs and ICOs to integrate NUS and indigenous peoples issues into their nutrition sensitive agricultural investment programmes, consistent with IFAD's 2016-2018 Action Plan on Mainstreaming Nutrition Sensitive Agriculture². This How to Do Note is part of a series of 5 NUS-focused Notes, that build on lessons learned, drawing on evidence- and experience-based insights from a number of research for development projects (including those financed by IFAD). They offer recommendations on practical methods, approaches, and tools for addressing use enhancement and mainstreaming of NUS in both design and implementation of an IFAD Project. Specific consideration is given for project design that can support the empowerment of indigenous peoples, women, and youth.

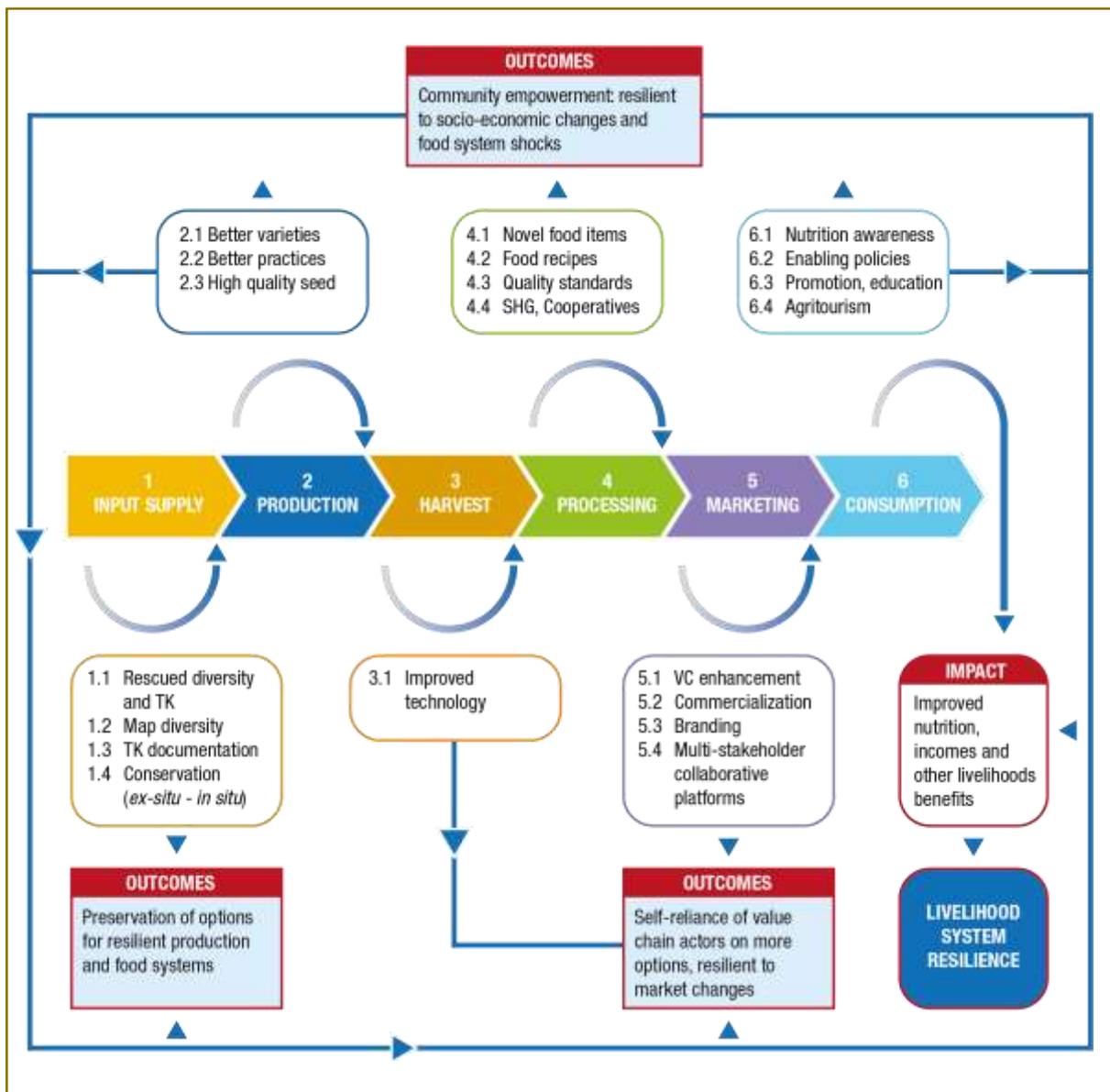
¹ FAOSTAT. Production, Food Balance, and Land Use Data. Available online: <http://www.fao.org/faostat/en/?#home> (accessed on 18 May 2018).

² <https://bit.ly/2SYUCgn>

The five HTDN in the series are as follows:

1. Priority setting for nutrition and resilience
2. Assessing market needs and emerging opportunities in value chains
3. Interventions in support of NUS domestic markets
4. Interventions in support of NUS export market
5. Policy and mainstreaming of NUS

Figure 1. Holistic value chain approach



Source: Padulosi et al. (2014). Sustainability 2014, 6, 1283-1312. <https://bit.ly/2FftCpt>

The NUS Operational Framework is complementary to the recently published volumes of IFAD's Operational Framework "Nutrition-sensitive value chains: A guide for project design"³. NUS are likely to stand out in the commodity selection (STEP 2) of the latter framework because of their great potential for nutrition-improvement. HTDN 1 outlines approaches and methods for ensuring that NUS are considered in such crop selection processes, as they are easily overlooked as a result of being poorly known. Situation analysis (STEP 1) is a core element of the process for identifying high potential NUS. Value chain analysis (STEP 3) is a key step in the nutrition-sensitive value chains operational framework, which identifies constraints and opportunities to guide the design of interventions (STEP 4). As NUS value chains have some particularities compared to more established agricultural commodities, specific approaches and methods for value chain analysis of NUS are outlined in HTDN 2, while NUS-specific approaches for domestic and export market development are discussed in HTDN 3 and 4, respectively. The nutrition-sensitive value chains framework is supported by an enabling environment that promotes the development and integration of the different stages of the value chain. HTDN 5 discusses approaches for building an enabling environment for NUS.

Box 1. Definition of nutrition-sensitive agriculture

Nutrition-sensitive agriculture is an approach to agricultural development that prioritize nutritionally rich foods, dietary diversity, and food fortification as the means to overcome malnutrition and micronutrient deficiencies. This approach stresses the multiple benefits derived from enjoying a variety of foods, recognizing the nutritional value of food for good nutrition, and the importance and social significance of the food and agricultural sector for supporting rural livelihoods (FAO 2014).

2. IFAD and NUS

IFAD has long been supporting research projects related to promoting NUS. These projects have especially been related to strengthening NUS value chains for stimulation of smallholder economy and increased nutrition and it is thus time to have guidelines of help mainstreaming NUS more systematically. Under IFAD's Strategic Framework 2016-2025, Strategic Objective 3 *Strengthen the environmental sustainability and climate resilience of poor rural people's economic activities* it is stated that IFAD project interventions should focus on addressing the loss of habitat and biodiversity. It further says that *special attention needs to be paid to environmental sustainability and climate resilience in agriculture while also promoting a reduction of greenhouse gas emissions from agriculture and agrifood value chains, and harnessing underutilized synergies that exist between adaptation and mitigation* (IFAD 2016). NUS are a type of resources that can be leveraged to contribute to these goals both directly in strengthening adaptation and mitigation and indirectly by offering opportunities to build untapped synergies across disciplines and sectors of society owing to their multiple roles in peoples' livelihood. IFAD hold important potentials to enhance outcomes and impact of many of the agrobiodiversity-based projects that the organisation is working on or planning to develop in the future. Furthermore, as also stated in the companion NUS Operational Framework (Padulosi et al. 2019), IFAD has the capacity to influence the development of supportive national and local policies that recognize the value and importance of NUS aiming at more resilient production systems.

³ De la Peña I. and J. Garrett. 2018. Nutrition-sensitive value chains, A guide for project design (Vol II and II). IFAD <https://bit.ly/2PWITzV> and <https://bit.ly/2D8gqBf>

In this How to Do Note we encourage the broader use of NUS to improving livelihood and their mainstreaming in almost any IFAD project, because of the many potentials of these species with regard to nutrition, climate change adaptation, rural economy and empowerment of vulnerable peoples. Enhancing their use will contribute also to maintain higher levels of biodiversity, critically important for sustaining local food systems today and in the future.

Box 2. Examples of NUS from various regions

- **Cereals and pseudo-cereals:** tef (*Eragrostis tef*), fonio (*Digitaria exilis*), amaranth (*Amaranthus caudatus*), chia (*Salvia hispanica*), minor millets (*Eleusine coracana*, *Setaria italica*, *Paspalum scrobiculatum*, *Panicum miliaceum*, *Panicum sumatrense*, *Echinochloa utilis*)
- **Pulses:** Bambara groundnut (*V. subterranea*), mungbean (*V. radiata*), adzuki bean (*V. angularis*), ricebean (*V. umbellata*)
- **Vegetables:** African eggplant (*Solanum aethiopicum*), leaf amaranth (*Amaranthus spp.*), drumstick (*Moringa oleifera*), jute mallow (*Corchorus olitorius*)
- **Roots and tubers:** Yam (*Dioscorea spp.*), yacon (*Smallanthus sonchifolius*), ulluco (*Ullucus tuberosus*), galangal (*Alpinia galanga*)
- **Fruits:** Jackfruit (*Artocarpus heterophyllus*), kokum (*Garcinia indica*), breadfruit (*Artocarpus altilis*), baobab (*Adansonia digitata*), or jujube (*Ziziphus mauritiana*), açai berry (*Euterpe oleracea*).

NUS is a term introduced by Bioversity International to refer to plant species (wild, semi or fully domesticated) which have been left at the margins of R&D⁴. The word 'neglected' was chosen to underline the low level of research investments made on them when compared with mainstream commodity crops, whereas the word 'underutilized' alludes to their untapped livelihood potentials. Owing to the many synonyms used when referring to NUS (e.g. minor, under-used, under-exploited, under-developed, orphan, promising, lost, alternative, traditional, niche crops, crops of the future or future smart foods), the best way to describe these species is to refer to their key features:

- Ignored by policy makers and excluded from research and development agendas: their exclusion in Green Revolution R&D investments has left them behind in terms of advances regarding their conservation, cultivation, harvest, postharvest, as well as marketability and studies related to their contribution to food and nutrition security, gender, and policies and legal frameworks to regulate their use.
- Important in local consumption and production systems: They are an integral part of local culture, widely used in traditional food preparations, associated with social and religious ceremonies, and increasingly in the spotlight of efforts for revitalizing local food cultures, and to celebrate the identity of the 'terroir'.
- Highly adapted to agro-ecological niches and marginal areas: They demonstrate comparative advantages over commodity crops due to the natural selection or users' selection against biotic and abiotic stresses which make them perform comparatively better under low input and biological agriculture techniques.
- Resilient to climate change: Closely related to the previous bullet is the high adaptation of NUS to biotic or abiotic stresses related to climate change scenarios, a feature perceived by users as being more robust if compared with major crops.
- Represented by ecotypes or landraces: Most NUS are seldom selected by breeders and represented by material requiring some degree of genetic improvement; a shortcoming that limits their promotion in competitive production systems.

⁴ Eyzaguirre P., S. Padulosi and T. Hodgkin (1999). IPGRI's strategy for neglected and underutilized species and the human dimension of agrobiodiversity. In Padulosi S. (Editor). Priority setting for underutilized and neglected plant species of the Mediterranean region. Report of the IPGRI Conference, 9-11 February 1998, ICARDA, Aleppo, Syria. International Plant Genetic Resources Institute, Rome, Italy.

- Cultivated and utilized drawing on indigenous knowledge: Most NUS are cultivated relying on farmers' knowledge, which is fast eroding due to the pervasive phenomenon of cultural erosion, which in turn contributes to the marginalization and loss of genetic diversity at inter- and intra-specific levels.
- Hardly represented in ex situ gene banks: The scarce representation of NUS in germplasm collections is a direct consequence of the low priority these crops have received in the past in national and international research programs. Consequently, the genetic diversity of NUS is maintained in situ and on-farm and (possibly) in private seed collections.
- Characterized by fragile or non-existent seed supply systems: The seed systems of NUS are usually poor; quality of seed is also generally poor and this has negative impacts on the performance of cultivations.
- For indigenous communities, NUS are the result of sophisticated trials and accumulation of experience over years: they are a manifestation of a systematic process that involved intricate ways of learning and accumulating experience throughout the years.

Lately, many companies, value chain professional and consumers speak about so-called superfoods which are NUS with important micro-nutrients such as anti-oxidants or high nutritional values that have gained substantial market share in international markets such as quinoa, jackfruit, moringa or chia. This guideline will focus on NUS that did not reach international markets yet but can contribute to domestic food market development and improvements.

3. Why working on NUS value chains for domestic markets?

Promoting NUS has proved to be an invaluable means to improving the livelihoods of local populations as seen in IFAD-supported projects on Andean grains in Bolivia (2014)⁵ and minor millets in India (2015)⁶. Their importance in contributing to food and nutrition security has been receiving substantial coverage in recent years⁷ and it is today increasingly recognized.

More generally, NUS are gaining increasing attention in development programs for several reasons which are listed below:

- A. **Unleash high nutritional value;** Various NUS have been found to have exceptionally high nutrient or nutraceutical values, which makes them termed as 'superfoods' (tables 1 and 2). Often, NUS have similar or higher nutritional values compared with equivalent commodity crops, such as quinoa or millets when compared with rice or wheat. As food security, diet diversity and nutrition is the ultimate goal of food production, NUS has great potential for creating market value as it is gaining attention as an effective and efficient supplier of key nutrients or important micro-nutrients. Identifying nutritional gaps among rural and urban populations and subsequently identifying NUS and promote tasty recipes for their wider use, to address those gaps is a valuable strategy for domestic market development⁸.
- B. **Fight persistent poverty in remote regions;** Hot spots of NUS diversity coincide with largely remote areas where high-yielding varieties of commodity crops and standardization of agricultural practices did not result in the economic growth that was expected. In these areas instead, traditional agro-ecological practices are still prevailing. It is less risky and more affordable for farmers in such remote and often marginal areas to explore markets for low input and lower investment cultivations – such as those including NUS – to safeguard home consumption and target domestic or niche markets for traditional or novel foods⁹ instead of competing directly with global markets for the supply of a single input- and investment intensive commodity crop. The case of quinoa in Peru and Bolivia¹⁰ or more recently minor millets in India¹¹ has been exemplary for this^{1,2}.
- C. **Build resilience to climate change;** NUS is often better adapted to extreme weather and soil conditions compared with high yielding commodity crops and reduces risks like harvest failure under extreme and unpredictable weather conditions, predicted to become more frequent and extreme in the future. Many nutrient-dense NUS are resistant to drought, have early maturation and short growth cycle, low water requirements, and can thrive in poor marginal soils while others can better cope with salinity, heavy rainfall and waterlogging¹². Identifying climatic trends and the prevalence of adverse weather conditions in specific agricultural regions and support the cultivation or introduction of suitable NUS into the cropping system has shown to be effective to reduce yield risks and adapt to climate change^{3,4}.
- D. **Counter soil depletion and create more sustainable farm systems;** Many agricultural production belts and river deltas that focus on monoculture of cash crops are coping with pest & disease

⁵ Padulosi S., Amaya K., Jäger M., Gotor E., Rojas W., Valdivia R. A Holistic Approach to Enhance the Use of Neglected and Underutilized Species: The Case of Andean Grains in Bolivia and Peru. *Sustainability* 2014, 6, 1283-1312.

⁶ Padulosi, S., Mal, B., King, O. I., & Gotor, E. (2015). Minor millets as a central element for sustainably enhanced incomes, empowerment, and nutrition in rural India. *Sustainability*, 7(7), 8904-8933

⁷ See Padulosi S., V. Heywood, D. Hunter and A. Jarvis (2011). Underutilized Species and Climate Change: Current Status and Outlook. In Shyam S. Yadav, Robert J. Redden and Jerry L. Hatfield Eds. *Crop Adaptation to Climate Change*, First Edition. Hermann Lotze-Campen and Anthony E. Hall. John Wiley & Sons, Ltd. Published 2011 by Blackwell Publishing Ltd. 507-521 pp.

⁸ Raneri, JE, Padulosi, S., Meldrum, G., King, O. (2019). Promoting neglected and underutilized crops for improved availability of nutritious foods in rural food environments. *UNSCN Nutrition 44: Food environments: Where people meet the food system*.

⁹ Salvatore Di Falco, Jean-Paul Chavas, On Crop Biodiversity, Risk Exposure, and Food Security in the Highlands of Ethiopia, *American Journal of Agricultural Economics*, Volume 91, Issue 3, August 2009, Pages 599–611, <https://doi.org/10.1111/j.1467-8276.2009.01265.x>

¹⁰ <https://www.npr.org/sections/thesalt/2016/03/31/472453674/your-quinoa-habit-really-did-help-perus-poor-but-theres-trouble-ahead?t=1557827241604>

¹¹ <https://www.biodiversityinternational.org/e-library/publications/detail/minor-millets-in-south-asia/>

¹² Padulosi S., V. Heywood, D. Hunter and A. Jarvis (2011). Underutilized Species and Climate Change: Current Status and Outlook. In Shyam S. Yadav, Robert J. Redden and Jerry L. Hatfield Eds. *Crop Adaptation to Climate Change*, First Edition. Hermann Lotze-Campen and Anthony E. Hall. John Wiley & Sons, Ltd. Published 2011 by Blackwell Publishing Ltd. 507-521 pp.

outbreaks, dropping water tables due unregulated use of groundwater, salinity problems due to large-scale irrigation and exhaustion of the soil due over-use of chemical fertilizers and pesticides. Farmers in such areas can use farm diversification by including NUS to improve soil conditions and switch to organic and more sustainable farm practices. NUS can play a role to diversify the farm system as important soil fertility restorer¹³, source of animal feed¹⁴ or as rotational crop¹⁵ that provides additional income and ultimately as supportive elements for the sustainability of the overall agro-ecosystem¹⁶.

- E. **Affordable medicinal and cosmetic products;** Many NUS, often harvested in the wild, are valued for their medicinal or cosmetic values in many traditional medicines like Ayurveda, a growing market sector worldwide. In low income countries, traditional medicine plays an important role especially among the poor, offering an affordable alternative for expensive commercial pharmaceutical products. According to WHO, for millions of millions of people, herbal medicines are the main source of health care, and sometimes the only source of care¹⁷. Many NUS can be used both for food and health purposes and are being re-discovered and revitalized after showing scientific evidence of their high levels of antioxidants or contribution to weight-loss or healthy diets. Assisting forest communities in leveraging cultivated and wild NUS for medicinal or health purposes is thus very relevant. The systematic documentation of NUS and its ownership rights combined with the exploration of functional ingredients for commercial purposes has shown to be a very valuable action in support of vulnerable people and to sustain the forest eco-systems as successfully done by the Sarawak Biodiversity Centre in Malaysia¹⁸.
- F. **Cultural and natural heritage;** Hot spots of NUS diversity coincide with exactly those regions where Indigenous Peoples live. NUS are an integral part of local cultures, widely used in traditional food preparations and provide additional important benefits to farmers like animal feed or farming tools. They are increasingly in the spotlight of efforts for revitalizing local food cultures and celebrating the identity of the 'terroir'. Although the first generation of urban populations that moved to the cities often distantiates themselves from rural life and traditional foods, in emerging economies we often see affluent second- or third-generation city dwellers with expendable income, in search for re-connect to their rural past, perceived as healthier life style and to those traditional products expression of that sentiment. Remote regions are often of an exceptional natural beauty and may offer also important perspectives for agro-ecotourism development. The promotion of NUS in combination with traditional cultural celebrations and agro-ecotourism has shown to be a successful strategy in Thailand¹⁹, India²⁰, Malaysia and Bolivia²¹.

¹³ Ali, R. I., Awan, T. H., Ahmad, M., Saleem, M. U., & Akhtar, M. (2012). Diversification of rice-based cropping systems to improve soil fertility, sustainable productivity and economics. *Journal of Animal and plant sciences*, 22(1), 108-12.

¹⁴ Mal, B., Padulosi, S., & Bala Ravi, S. (2010). Minor millets in South Asia: learnings from IFAD-NUS project in India and Nepal.

¹⁵ McDaniel, M. D., Tiemann, L. K., & Grandy, A. S. (2014). Does agricultural crop diversity enhance soil microbial biomass and organic matter dynamics? A meta-analysis. *Ecological Applications*, 24(3), 560-570.

¹⁶ Tittonell, P., Klerkx, L., Baudron, F., Félix, G. F., Ruggia, A., van Apeldoorn, D., ... & Rossing, W. A. (2016). Ecological intensification: local innovation to address global challenges. In *Sustainable agriculture reviews* (pp. 1-34). Springer, Cham.

¹⁷ <https://www.who.int/dg/speeches/2008/20081107/en/>

¹⁸ <https://www.sbc.org.my/>

¹⁹ Montree Issarakraisila, Margaret C. Yoovatana and Songpol Somsri 2016 Conserving Tropical Fruit Tree Diversity by Using their Products and Promoting Agrotourism: Lessons from an Empowered Community in Southern Thailand. Chapter 24 in Sthapit, Lamers, Rao, Bailey 2016 Tropical Fruit Tree Diversity Good practices for in situ and on-farm conservation

²⁰ Awtar Singh, Vishal Nath, Sanjay Kumar Singh, Bhuwon Sthapit and B.M.C. Reddy 2016 The Role of a Traditional Festival, Chhath Puja, in the Conservation and Sustainable Use of Tropical Fruits. Chapter 17 in Sthapit, Lamers, Rao, Bailey 2016 Tropical Fruit Tree Diversity Good practices for in situ and on-farm conservation

²¹ Taranto S. and S. Padulosi. 2009. Testing the results of a joint effort. *LEISA Magazine*, volume 25 (2): 32-33.

Table 1. Minerals and anti-oxidant contents in some selected NUS fruits compared with those found in major staple fruits (apple and orange)²²

Crop	Ca (mg)	Fe (mg)	Mg (mg)	P (mg)	K (mg)	Na (mg)	Zn (mg)	Cu (mg)	Vit A (mcg)	B - carotene (mcg)	Vit E (mcg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin B6 (mg)	Folate (mcg)	Vit C (mg)
Sugar apple	28.20	1.36	38.47	40.81	283	3.11	0.22	0.19			0.19	0.13	0.09	0.69	0.07	7.60	21.51
Peach palm	44.6	4.4	11.7	162.8	-	2.7	2.1		-								62.2
Acai berry	35	0.4		16								0.1	0.04				
Salak	127.3	19.1	7.16	81.8	191.2	1.9	35.1	8.4		48		0.18	0.2	2.4	1	3	20.41 - 35.02
African locust bean	118	3.6	88	123	1674		1.4	0.23	405	2430		1.08	0.71	1.3	0		234
Wild mango	164	1.9		202	16	2	0.3	0.14				0.18	0.09	0.7			
Langsat	20			30					13			0.08	0.12				1
Jackfruit	45.74	0.31	26.6	45.9	317	9.18	0.37	0.24	150-540		0.05	0.05	0.05	0.19	0.04	35.73	17.51
Kumquat	266	1.7			-				2530								
Desert date	74-76	39			1990				-								
Apple	6	0.1	5	11	107	1	0.04	0.03	3	33	[0.18]	0.02	0.03	0.1	0.04	3	4.6
Orange	31	0.2	11	19	166	2	0.1	0.05	8	90	0.28	0.04	0.03	0.2	0.07	33	46.8

²² Padulosi, S, Roy, P. and Rosado-May, F.J. Forthcoming. Neglected and underutilized species: Past efforts, experiences, challenges and opportunities for their sustainable conservation and use. International Fund for Agricultural Development (IFAD) and Bioversity International, Rome, Italy.

Table 2. Mineral and Vitamin contents in NUS cereals, pseudo-cereals, roots and tubers, compared with those of rice and wheat²³

Crop	Ca (mg)	Fe (mg)	Mg (mg)	P (mg)	K (mg)	Na (mg)	Zn (mg)	Cu (mg)	Vit A (mcg)	B - carotene (mcg)	Vit E (mcg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vit B6 (mg)	Folate (mcg)	Vit C (mg)
Quinoa	128	94.85	190	273.5	956.2					11.87 - 17.71		0.15	0.43	1.2	0.2	78.1	1.4
Amaranth	159	7.6	270	289	365	2.81	2.52	0.56				0.16	0.36	1.1	0.33	24.65	
Elephant foot yam	50	0.6	30.4	49.46	463	15.28	0.33	0.23		158	0.39	0.04	0.05	0.61	0.22	20.5	15.22
Yam	35	1.2	21	55	816	9	0.24	0.18	138	83	0.53	0.11	0.03	0.55	0.29	23	17.1
Fonio	51	10	434	234	340	8	3.8	0.44	0	0	0.05	0.26	0.1	1.7	0.74	29	0
Teff	17 - 178	9.5 - 150															
Job's tears	54	0.8										0.48	0.1	2.7			
Finger millet	370	6	137	283	408	11	2.3	0.67	0.48	1.53		0.33	0.11	1.2	0.05	34.66	
Foxtail millet	37	6.2	81	290	250	4.6	2.4	1.4				0.48	0.14	2.4		39.49	
Little millet	17	1.26	133	220	129	8.1	3.7	0.34				0.26	0.05	1.29			
Barnyard millet	96	5	82	280	/	/	3	0.6	0.36			0.11	4.5	4.2			
Buckwheat	50	3.4		355								0.41	0.2	2.3			
Rice	28	0.8	25	115	115	5	1.09	0.22	0	0	0.11	0.07	0.05	1.6	0.16	8	0
Wheat	29	3.19	126	288	363	2	2.65	0.43	9	5	1.01	0.3	0.12	5.46	0.3	38	0

²³ Padulosi, S, Roy, P. and Rosado-May, F.J. Forthcoming. Neglected and underutilized species: Past efforts, experiences, challenges and opportunities for their sustainable conservation and use. International Fund for Agricultural Development (IFAD) and Bioversity International, Rome, Italy.

4. Difference of NUS value chains and commodity crops

A value chain development strategy for NUS is in principle the same as for commodity crops and the same value chain development methods and tools can be used (see chapter 8) for both. However, NUS value chains have some peculiar characteristics. The differences of a value chain development strategy for NUS as compared with commodity crops is best explained by the Ansoff matrix (see figure 2). This matrix was developed to understand market or value chain development strategies and differentiate strategies according to their focus, viz. on existing or new products and on existing or new markets. Market risks are highest when working with new products targeting new markets (diversification strategy) as less experience and limited market intelligence is available to ensure that products are designed according to the needs, preferences or demands of its final users. On the other end, a value chain strategy that targets the promotion of existing products for existing markets (market penetration strategy) is often less risky but also results in higher competition and lower margins. Market risks are medium for bringing an existing product to a new market (market development strategy) or a new product to existing market (product development strategy) as at least the product or the target market is known pretty well.

Figure 2. Ansoff matrix showing different type of market strategies



NUS means higher market risks: Value chain development for NUS involves more risks and investments as it often entails a product development, market development or diversification strategy. Making decisions regarding investments in processing, packaging or pricing is easier for commodity crops compared with NUS value chains as a lot of information and experience is already available, whereas, for NUS it is easier to make wrong decisions, as less information is available when breaking new ground. Thus, the overall market risks in NUS value chain development are higher for private sector partners and that explains why it is often difficult to get companies on board and why they often require greater support when exploring NUS value chains. However, competition is often less pronounced for NUS value chains compared with established commodity crops. Producer organizations can develop more control and influence in domestic NUS value chains compared with global commodity crop value chains which are larger, more price

competitive and dominated by large (foreign) companies or a network of collecting traders that control the market.

NUS means higher prices and profit margins: NUS value chain development often entails the targeting of niche or subsidized/specialized markets instead of bulk markets, which means generally higher prices and profit margins. Niche or specialized markets are often preferred as supply is smaller and competition is less when targeting specific buyers and consumer segments such as the organic sector, high-end supermarkets, company canteens, school feeding programs, home-delivery or haute-cuisine restaurants. It should be noted as well that these types of buyers are usually more open and receptive to embrace new crops and novel products. While the size of these markets is smaller, the product quality requirements are often higher to meet specific demands and preferences. Thus, such a market strategy requires greater market intelligence, more investments in research & development and specific activities related to awareness raising and demand creation. NUS Value chain actors may often have some power in influencing niche markets as large dominant players do not exist and product standards or requirements are still in development and do not function as major entry barriers. It should also be noted that in cost-price competitive markets such as those of established commodity crops, the willingness to collaborate and share information among partners is usually limited and to a certain extent this is less so for NUS markets.

NUS means lower production risks: NUS are generally better adapted to local soils and weather conditions and can produce some reasonable yield also without the use of expensive fertilizers or irrigation systems. Thus a NUS value chain strategy often results in lower production risks for farmers, due to less chances of crop failures and debts, which are more apparent in high-input crops' cultivations. Moreover, NUS multi-cropping contributes to more balanced and diversified farming systems, as in the case of NUS trees and shrubs grown together with field crops, which lowers soil erosion, helps fixating nitrogen from the atmosphere, improves organic matter and moistures the soil. These longer-term benefits are very valuable for supporting healthy and productive agroecosystems, especially in marginal areas. Overall, we could say that a focus on NUS value chain development would result in less production risks for farmers, but at the same time, it would bring more risks to the other value chain partners who have to find suitable markets and consumers to sell the new products.

NUS means stronger focus on R&D: Collecting market intelligence is more demanding for NUS value chain development as it entails the exploration of new products or new markets, or even both at the same time. For instance, value chain actors interested in NUS, need to invest time and resources to understand or provide evidence of nutritional values of the product, understand buyer requirements of target markets and preferences of potential consumer groups. They also need to gather market information that is usually lacking when working on product and market innovations, in order to make a proper selection of crops, product formats, packaging materials and other decisions that would need to be tailored to the preferences of the consumers. As many NUS have not gone through intensive crop improvement programs as it has been the case of commodity crops, initial harvest results might look meagre. However, this means that there is though still large scope to make fast crop improvement by following simple breeding methods like participatory variety selection. As R&D requirements are substantial in NUS value chains, stakeholders often need to collaborate to be able to share the risks and costs in product and market development. NUS value chain development often needs greater investment in establishing the market linkage, but such a linkage is likely to remain beneficial over a longer period of time for the farming communities.

NUS supports sustainable multi-crop approaches: When focusing on value chain development for commodity crops often the single crop approach is the norm and all investments are directed to a single crop that had been identified before or at the start of the program. This approach can be risky and not very effective if you have limited control over external factors such as market price developments or world supply trends. Worth considering as well the fact that farmers' livelihoods depends on the cultivation of several crops, each fulfilling household's food needs apart from income. Many crops help also growers to spread cultivation risks (e.g. related to climate change or price fluctuations of the produce) and ensure crop rotation in the farm system for controlling pests and diseases or limiting depletion of soil nutrients. For these reasons, a NUS value chain approach would be more advantageous, especially for poor farmers, as it is too risky to put all eggs in one basket. Owing to its great diversity, the NUS portfolio would offer many

opportunities to farmers and other stakeholders to identify the right combination of crops that would satisfy both farm's needs and those of the different market segments.

NUS are well suited for nutritious sensitive value chain approach: NUS often have remarkable high nutrition contents and are very amendable to strengthen nutrition sensitive agriculture and value chains. Such an approach can focus on rich urban households who are in search for healthy or pesticide free food, however a NUS market strategy does not always have to focus on such niche markets. The focus can also be to reach specialized/subsidized bulk markets such as the fast growing group of urban poor for improving their nutrition or school meal programs managed by the government. This latter focus would work well if input costs for NUS would be substantially low, resulting thus in lower costs of their products compared with competitive commodities. Unfortunately, as margins in such markets are generally extremely small, supportive interventions by the government are needed to bring NUS to the urban poor, including subsidized food distribution systems or procurement schemes for school feeding programs. Occasionally, large companies may as well decide to engage in such subsidized programs in fulfilment of their corporate social responsibility (CSR) or to ensure healthy food to their factory workers.

5. Examples of NUS success stories

Value chain development projects often overlook domestic market potential and prefer to directly pursue export markets. Advantage of export markets is that price levels and margins are often highest, as it is possible to target affluent consumer groups with high expendable income in developed countries. The number of potential consumers to target could be also very large. Exporting requires however substantial investment for addressing buyer requirements and meet quality, food safety and product specifications, especially when exporting to countries like USA, EU, Australia, Canada and Japan. In the companion HTD Note dedicated to NUS and export markets, the reader will find more information on opportunities and issues specifically related to the development of these types of markets.

In general, markets for NUS in developing countries are not kept in much consideration as consumers are less affluent and have lower expendable incomes. Another common condition hindering the use of NUS is the fact that these foods are being negatively perceived. They are considered a poor man's crops, or food associated to famine and periods of hardship. However, large economies from the south like India, Brazil or Nigeria have substantial and fast growing middle class and wealthy consumers living in larger cities, who can be targeted as NUS consumers, leveraging their interest for nutritious, pesticide-free and healthy foods. On the other end, well-conceived interventions targeting the needs of lower income households, can also create strong domestic demand for these crops. Good examples in that direction are the successful inclusion of NUS into school feeding programs in Brazil and the inclusion of minor millets into the national Public Distribution System (PDS) in India. Following are few successful cases studies of NUS value chain development that focus on domestic markets.

Wild mango pickles in India

Mango originates most probably from the border zone between India and Myanmar and its cultivation is already described in the old Hindu epic novel 'the Ramayana', in which forests of mangoes were reported 4000 years ago in the land of Rama, nowadays known as Uttar Pradesh⁵. Mangoes are deeply ingrained into the Indian culture where pickles, predominantly from mango or citrus species, are widely used as a side dish in afternoon or evening meals called 'thali'. In the mountainous Western Ghats farming families still gather wild mangoes called 'appe midi', that grow along streams in the forests. These wild mangoes are harvested immature and when combined with salt, mustard oil, red chilli and a special mixture of local spices are much appreciated as pickle by consumers in Karnataka, Maharashtra and Kerala states. Local farmers identified superior types and trees in the forest that produce appe mangoes such as Malanji, Haladotta and Jeerige with a pleasant 'camphor' or 'cumin' aroma and that stay crispy without losing their taste over time. The 'appe midi' are part of the vast NUS portfolio present in India that can be better used for improving incomes of local populations, especially IPs (i.e. scheduled caste and scheduled tribes) who are custodian of a great knowledge related to the harvesting and processing of these wild fruits.

In rural India pickles are often prepared at home by women. With increasing of incomes and more women working outside the house and the growing number of families moving to major towns and cities, less women make the 'appe midi' pickle at home by themselves, but want to offer their families and guests the same quality mango pickles as they were used before. Established pickle brands do not use wild mangoes or have the same taste and quality. This resulted into a sharp increase in the demand of wild mangoes (popular but rare varieties) over the last 5-10 years for the preparation of traditional home-made mango pickles, as a growing middle class living in Bangalore and other major cities surrounding the Western Ghats, is also eager to purchase pickles that have the same quality as those made at home from wild mangoes. Local pickle brands in Karnataka like 'Prathvi' and 'Namuuru' are fast growing while fetching a substantial higher price than the established industrial brands 'MTR' and 'MT'.

In consideration of this opportunity, the GEF Project for the on-farm conservation of tropical fruit tree diversity implemented by Bioversity and executed by the College of Forestry in Sirsi from 2009 to 2015²⁴, included in its framework also capacity building efforts of local communities for the development of the

²⁴ <https://bit.ly/2FYk9UM>

value chains of pickle mangoes. These activities helped women groups to be linked to farmer cooperative 'Kadamba'²⁵ and better understand the value chain of the target species by collecting market intelligence to guide business plans, foster linkages among different women groups, invest in the production of mango pickles and expand their sales beyond Sirsi, the small town where wild mangoes were sourced, to large cities like Bangalore and Dharwad. Notably, with regard to women empowerment work, the project engaged in building skills of women groups in rapid market appraisal methods, giving them competence on how to improve the packaging design also with regard to safeguard the quality of the produce, how to choose best natural ingredients and ways to refine traditional home-made recipes for greater impact on the market.

With regard to agronomic development, local grafting experts (i.e. custodian farmers) were asked to identify, mark and protect superior trees of Malanji, Jeerige and Haladotta varieties, whose scions were used for multiplying saplings, then sold in local nurseries, or local fairs, at equal to even higher price margins compared with commercial mango varieties like Alphonso. The College of Forestry engaged to document all mango varieties with their key traits and develop a conservation garden and nursery that is managed by the students where all local varieties are now being safeguarded. In only 4 years, one collective women group started the production of wild mangoes and reached a total business turnover of USD 2,000, while 5 additional groups took up production of apple midi pickles with their own traditional home-made retail brands with also good success.

African leafy vegetables in Kenya and Tanzania

French beans, sugar snaps, lettuce and broccoli are not native to Africa but over the last two or three decades became the preferred vegetables in high-end supermarkets for high and middle income consumer groups in Kenya and Tanzania. In these countries, such vegetables are produced in large-scale greenhouses or out-grower schemes, managed by foreign investors, and exported by airfreight to the European market and it became fashionable among wealthier households to eat those at home as well, similar as in the fancy and bigger hotels. Despite these huge investments in the vegetable sector, poor diet diversity and vitamin A and iron deficiency remains a concerning problem in sub Saharan Africa. Especially among children between 6 months and 5 years old in Kenya and Tanzania, this might result in stunting and serious and life-long physical and mental health repercussions.

Native African leafy vegetables like amaranth (*Amaranthus* spp), spider plant (*Cleome gynandra*), jute mallow (*Corchorus olitorius*), pumpkin leaves (*Cucurbita* spp), African nightshade (*Solanum* spp), nettles (*Urtica massaica*) or cowpea (*Vigna unguiculata*) have been for long considered food of the poor, in spite of their excellent nutritional values and their much higher vitamin A and iron content compared with the introduced vegetables that are grown for export. Farmers were aware that these traditional vegetables could grow on marginal soils with limited farm inputs and pest and disease problems, but lost knowledge somehow of their nutritional values. Researchers neglected them in their work, because of the sheer number and the limited resources available, because of their very localized use, and also for their common wild or weedy status rather than improved horticulture crops. Consumers avoided to buy these vegetables as they found them scarcely appealing: produce was of poor quality and sold in precarious hygienic conditions such as on the floor of dusty road sides. Marketing channels represented also another challenge as usually traditional leafy vegetables are collected at the farm gate and sold by traders in fresh markets in the nearest larger city, often passing through several intermediary traders²⁶ whereas non-traditional vegetables are sold to agro-companies selling directly to supermarkets or for exports through out-grower systems or large-scale greenhouses.

With support from the International Vegetable Centre and Bioversity International the situation of NUS vegetables has changed. Bioversity started working on these species in Kenya and Tanzania since the mid 1990s and this has contributed to a number of important developments that supported their popularization such as; a) nutritional assessment of more than 100 African leafy vegetables (ALV); b) development of improved cultivation practices; and c) support towards value chain actors with public awareness and

²⁵ https://kadambafoundation.in/rural_marketing

²⁶ <http://www.b4fn.org/case-studies/case-studies/african-leafy-vegetables-alvs/>

advert campaigns (involving highly visible politicians) and inform households how to add them to their meals for improving the diets. In Kenya, the NGO “Farm Concern” trained value chain actors to improve quality, consistency of the supply of their produce and linked farmers to markets such as the popular ‘Uchumi’ supermarket chain. Emphasis was on the empowerment of women, much involved in producing ALV, through building their marketing skills, which helped to raise also their confidence and self-esteem.

In Tanzania, the World Vegetable Centre has been working with farmers also for several years to promote ALV by developing demonstration plots where male and female farmers were trained on improved cultivation practices and awareness about their nutritional values. Packages containing improved seeds of various species were also provided to them for carrying out home trials as part of a farmer field school concept, which has helped a lot since farmers before had only access to low-yielding varieties. As seed companies focus mostly on non-traditional commodity crops, more investment in nutritious and high-yielding varieties of ALV remains an important area of action to further advance the economic profitability of these cultivations in Tanzania.

Garcinia tea in Indonesia

A study that was carried out in 2015 among tea growers in Girimukti village of Tasikmalaya district in West Java, Indonesia, showed that over years a few wealthy tea value chain actors have accumulated assets and established themselves as nodal actors within the tea value chain with strong control of the tea market by owning tea drying factories, being the key intermediary, provider of inputs, informal rural bank and function as rural philanthropist for the rest of the tea growers⁶. The study shows that this resulted in increasing rural inequality and without efforts to improve horizontal collaboration and collective action, smallholders will get further marginalized, especially when taking into account the recent droughts in the area, and this will increase urban-rural migration for jobs in nearby or far away cities. Bringing more social equity and fairness towards the smallholders in this value chain is expected to be a rather challenging effort from both a political, cultural and social perspective, according to this study.

In contrast, fast economic and social gains were made in Sumatra from 2013-2018 through the marketing of an alternative tea made from a wild relative of *Garcinia* species. Starting its journey from an on-farm conservation project carried out in West Sumatra by the Horticulture Research Center, Garci-Tea was born as a processed product made from tamarind leaves and the sour leaves of *Garcinia atroviridis* which grows wild in the interior of Sijunjung Regency. This wild relative of the more common Mangosteen (*Garcinia mangostana*) originates from South East Asia and similar *G.* species are found in Thailand, Malaysia and Indonesia. *Garcinia* species contains a chemical, hydroxycitric acid (HCA), which is considered as a remedy to prevent fat accumulation, control appetite and increase exercise endurance among other health claims such as lowering blood pressure and regulating menstruation. This compound, can be extracted into powder and liquid form and is increasingly used by the food and beverage industry in functional foods or dietary supplements.

A few years ago, an entrepreneurial woman in West Sumatra, Ms. Syas Junita, started her own company and women group to produce garcinia tea and since then she has gained substantial market volumes. The species was almost extinct in the region but could be revived after the exploration of local genetic resources in Sijunjung district for its potential use. The species was identified as potential for market development and the project introduced the species to several farmer groups. Furthermore, the project that was supported by the Sijunjung government and the Indonesian Agency for Agricultural Research and Development (IAARD) coordinated the conservation, propagation and distribution of seeds and saplings, the training of farmer groups and the exploration of various potential products. Until now, the small company has been able to employ 14 women farmers with sales in Sumatra, Java, Bali and there has even been demand and requests from Malaysia and the Netherlands, even though processing equipment used is still very simple.

Ms. Syas Junita bagged with her novel product two prizes in 2015 in the annual CITI Bank Microentrepreneurship Award organized by the CITI Bank Foundation, Ministry of Cooperation and University of Indonesia; namely 1st Place for Cultural Conservation and 1st place for Micro Entrepreneurship category, out of 330 contestants from all corners of Indonesia. Ms. Syas Junita and her

company is continuing to make further improvements by the procurement of leaf dryers, using improved tea packaging materials, and tailoring the packaging design.

Natural products and traditional homestays by eco-tourism village in Thailand

Nakhon Si Thammarat, a province in the south of Thailand, has abundant tropical fruit trees, and Kiriwong Village has developed a wide range of products from *Garcinia* and *Nephelium* fruit species, i.e., soap, cosmetics, candies, juices, natural cloth dye colours and many health products. Several local villagers such as Mr. Sontaya who managed the *Garcinia* processing group developed themselves as very talented entrepreneurs. He developed various new products based on local wild *Garcinia* species such as natural soap and shampoo which he managed to sell to tourists directly and through various hotels and homestays. Aside from the development of various products, they established agro-tourism activities to generate sales for the local and naturally sourced and processed products.

The flood that devastated the village in 1987 triggered the community's concerted effort to protect the fragile but highly diverse local ecosystem of steep mountains covered in forests. In order to encourage the participation of all community members in this initiative, the community focused on activities that derive direct livelihood benefits from the indigenous plant species and local resources. The area was already known for its waterfalls, rain forest and beautiful landscape. The communities in the area grow fruit trees like *Garcinia mangostana* already for several generations and are known as one of the major production belts of mangosteen in Thailand. The main income sources of the farming community are durian, mangosteen, rambutan, *Langsium domesticum* Corr. (known as longkong) and bitter beans, known as petai (*Parkia speciosa*).⁷

There are in total about seven activity groups established in the village, focusing on specific livelihood activities or the utilization of their products including; three groups for the natural dyeing of various cloths and apparel items, durian paste group, home spices group, handicraft product group and a group making necklaces made from local plants. Agro-tourism has been developed, from sightseeing walks to visiting the different product groups to see how they are made. Nowadays different kinds of home-stay and resorts were established, and more activities are provided, such as fishing, mountain biking, cultural tours and hiking the trails between villages. Community members get direct income from the sales of fresh fruits to the village cooperative and capture now a higher value since they created the processing and product-making groups. Several community members receive a wage by working for the various product groups and as shareholders in the village cooperative. The community also earns income from agro-tourism, which provides many new jobs, such as guide, driver or by hosting guests at their homestay and, subsequently, the tourists increase the sales of the products. The improved environment also helps to improve the health condition of the community; as the area is known for its fresh air in Thailand people from Bangkok or Nakorn like to come for a weekend or one-day visit. Especially government agencies or companies who organize social events for their staffs or workers come by groups and busload and are the major source of income.

School feeding program for NUS in Brazil

The Brazilian government launched in 2003 the Zero Hunger Programme or Food Acquisition Program (PAA), which acquires family farm products and forwards them to public programmes and social organizations supporting people with limited access to food or suffering from food insecurity.

The program included i) price regulation of specific products and the formation of public security food stocks; ii) the acquisition of food during the growing season to be stored and subsequently sold through farmer organizations (i.e. associations and cooperatives) that can, thereby, position themselves on the market under more favourable terms and; iii) the purchase and donation of milk to socially vulnerable families.

In many regions of Brazil, the "modernization of agriculture" has led farmers to specialize in the production of a limited number of commodity crops and to adopt unsustainable agricultural practices based on the intensive use of pesticides and other chemical inputs, which, in turn, has exposed these families to

economic, social and health vulnerability. Furthermore, food customs and local cultures associated with these foods have been lost over the generations because of the negative perceptions associated with them, such as the perception that traditional foods are 'old fashioned'.

A survey conducted in the state of Paraná (southern region of Brazil) showed that only 4% of the farming households were selling traditional vegetables to the market while 98% still used them for their home consumption²⁷. In many contexts, the PAA has promoted significant changes, such as in food security and nutrition of urban impoverished households but also regarding the diversification of the farming system of rural family farmers. The Food Acquisition Program (PAA) encouraged the diversification of crop production, thus connecting agricultural supply to a diversified demand, and worked to rescue, recover, and commercially promote forgotten regional and local products, some of which had never been marketed before. Foods such as hominy (dried maize), babassu palm (*Attalea speciosa*) flour, pine nuts, coconut oil, baru nut (*Dipteryx alata*) flour, cupuaçu (*Theobroma grandiflora*), palm hearts, umbu (*Spondias* sp.), maxixe (*Cucumis anguria*) and jambú (*Syzygium* sp.), among others, are being served now more frequently in schools and social care organizations⁸.

Minor millets in India

Minor millets comprise a group of cereal species that are genetically diverse and adapted to a range of marginal growing conditions where major cereals such as wheat, rice, and maize cannot perform well. Millets require few inputs and withstand severe biotic and abiotic stresses. They are also more nutritious than major cereals (see Fig 1). Despite these advantages, neglect in several arenas has resulted in a steady decline of their cultivation in India over the past few decades. As part of the IFAD NUS Project²⁸, Bioversity and its Indian partners (the MS Swaminathan Research Foundation and Action for Social Advancement) undertook action research intended to stem the decline in cultivation and enhance the conservation and use of minor millets in 753 households spread across 34 villages in four states of India. The aim of this work was to improve incomes, nutritional status, and empowerment, especially for women. Overall, the holistic approach to mainstreaming species such as finger millet, little millet, foxtail millet, and barnyard millet that has been pursued by the project, indicates that these neglected and underutilized species can emerge from their marginalization and play a strategic role in improving many livelihood dimensions of local communities.

Improved dehusking and milling equipment adapted for specific types of millet which are often operated by women groups, farmer producer organizations and farmer cooperatives has helped a lot to reduce drudgery in processing the millets before they are ready to be marketed. Many NGOs have supported farmers and producer companies in the cultivation of superior varieties, the aggregation and reducing the drudgery in dehusking and milling the minor millets. Recipes have been widely promoted that make use of minor millets in collaboration with chefs, hotel chains and popular opinion leaders. Retail products and brands such as cookies or bakery products have been developed and launched but most successful is the promotion of using minor millets flour in daily food items like chapatis, upma or other dishes by popular cooking books, blogs and Bollywood stars. For 60 years, India's agriculture policy has focused on rice and wheat and neglected millets. But these nutri cereals are gradually making a successful comeback. Nowadays, minor millets receive a lot of attention in Indian media and a specific trade fair was organized for millets and derived products by the Agricultural Minister of Karnataka State in 2018. A great boost in expanding the use of millets in India is also expected to come as a result of a major policy change: the Narendra Modi government has formally enacted on April 2018 a policy for the inclusion of millets in the public distribution system, requesting all states of India to procure these grains at federally fixed minimum support prices²⁹.

²⁷ Ghizelini, A.A.M. (2010) 'Atores sociais, agricultura familiar camponesa e o espaço local: uma análise a partir do Programa de Aquisição de Alimentos,' Tese de Doutorado, Universidade Federal do Paraná, PR/Brasil.

²⁸ <http://www.nuscommunity.org/initiatives/ifad-eu-ccafs-nus/>

²⁹ More on this policy can be found in the HTD note related to policy and mainstreaming of NUS.

6. How to involve Indigenous Peoples, youth and women

NUS can provide ample opportunities to make IFAD programs more gender and social inclusive as these species are often the domain of women of poor households. They are also typically grown by Indigenous Peoples and thus supporting their use enhancement is a strategic way to contribute to improve the livelihood of these groups as well. It is also a great opportunity to reach out to youth as business development and entrepreneurship is often an attractive topic for young men and women. Having said that, it should be also noted that it is not always easy to ensure the equal participation of earlier excluded groups such as women or certain ethnic groups into a program. Our work has experienced that this may cause tensions among families or between ethnic or socio-cultural groups. Experience has shown us that these conflicts arise when solutions are presented as a 'zero-sum game' in which certain groups are the loser and others the sole winner. The lessons learnt here is that social inclusion is best achieved when you are able to show that all groups will be benefiting of an inclusive approach, i.e. putting in a simple way, working all together will allow to get a 'bigger cake' for all, instead of redistributing slices of the cake to each participants.

To be effective, facilitators should reach out to all groups from the very beginning of a program, that is, from its very design stage. Organizing workshops and open discussions during which all groups can offer their views on NUS and the particular issues and problems they face in their cultivation and marketing, is most valuable for developing socially inclusive project frameworks! Creating so-called safe spaces for excluded groups to discuss particular issues they face is crucial and so is the creation of moments of interaction with other groups and stakeholders engaged in the value chain. Sharing of the available traditional knowledge among different groups and discuss differences in type of knowledge across community members has shown to be a powerful tool to engage weaker groups like younger women and lower-caste groups in India⁹. Such a process requires though the involved of well trained staff with good facilitation skills needed for coordinating participatory group discussions.

Such a process, does also help in creating a good understanding of why certain groups are not represented and why other have a dominant position. A positive step in that direction is for instance, having the dominant group (e.g. wealthy households or older men) discuss and formulate clear advantages from the inclusion of disadvantaged groups, such as greater gains in useful knowledge, skills and innovative perspectives that would be missed otherwise. Such discussions can facilitate the improved participation of excluded groups in management and decision making. However, participation for the purpose of just achieving the agreed quota number does often not lead to real empowerment. Discussing social inclusion as a stand-alone topic could be a sensitive topic; discussing instead the matter along a practical issue at hand (assessing traditional knowledge or selecting the board members of the cooperative), would help to lesser tensions and facilitate a conducive discussion on social and gender inclusion.

To improve participation of women it is important to understand their limitations to participate in activities such as their limitations to leave the households as they have to take care of children, cooking, household chores or not being allowed to travel alone at night. When organizing activities one need to take extra measures such as providing child care options or ensure appropriate timing or transportation services to overcome such social-cultural barriers limiting their participation in the NUS value chains. Worth stressing here, is that the facilitator should refrain from providing his/her own opinions about norms and values of the community, but facilitate the discussion between villagers themselves and support the process of social learning. And of course, such an advice of behaviour is even more relevant when norms and values of the facilitator are inappropriate or not compatible with local cultural or religious norms and values.

- ➔ The inclusive focus group set-up as explained in this poster³⁰ and as further described in this paper⁹ might help to facilitate more inclusive discussions and programs.
- ➔ More on gender in agricultural value chains³¹

To ensure that the ownership and exchange of traditional knowledge, seeds and land or harvesting rights of indigenous peoples are respected, a Free and Prior Informed Consent (FPIC) agreement should be used to determine the terms of sharing information and seed materials within the project, between beneficiaries (indigenous communities) and other project partners. This can be in the form of minutes of a meeting with representatives of the indigenous community or in the form of a written and signed FPIC contract. This is discussed with beneficiaries at the start of the project after explaining the focus, objective and type of activities that are foreseen in the project. Such an agreement can also include terms about the sharing of seed materials of NUS with researchers (breeders) or seed companies and the ownership rights of indigenous communities over these varieties or natural resources. This discussion and contract ensures that indigenous communities are involved and can make well informed decisions related to the sharing of their knowledge and seeds based on their own defined and mutually agreed terms.

- ➔ More information on FPIC can be found in the How To Do Note on FPIC of IFAD³²

³⁰ <https://www.biodiversityinternational.org/e-library/publications/detail/how-to-make-participatory-research-gender-responsive-experiences-from-the-western-ghats-india/>

³¹ <https://gender.cgiar.org/gender-in-value-chains/>

³² <https://www.cbd.int/doc/meetings/tk/wg8j-09/other/wg8j-09-ifap-en.pdf>

7. Key problems and solutions for domestic NUS value chains

The case studies in section 5 have highlighted a number of issues that need to be tackled when working on domestic NUS value chains. We have listed these problems per key issue and offered possible solutions to be considered when designing and implementing a NUS value chain program. We have first listed them following the typical ‘farm to fork’ representation of value chain activities, but later on, we shall discuss them following a project flow order. Based on ample experience, first and foremost, we should make clear the greater objective of *why we want to work on the NUS value chain* (possible answers may include: increase sales and income generation of farmers or improve resilience of the farming system) and then discuss all required elements that need to fall in place to achieve that.

The point is that *NUS are not an objective on itself*, but a means to achieve several other objectives.

Key issues in domestic NUS value chains include:

1. Selection of NUS for greater impact
2. Conservation of genetic diversity both in situ and on farm
3. Crop improvement, production of good quality seeds, seeds networks
4. Collective action and aggregation of supply
5. Drudgery in cultivation and processing operations
6. Lack of market knowledge and beneficial market linkages
7. Lack of entrepreneurial skills and business support services
8. Marketing; changing the image of a poor man’s crop into a superfood
9. Promote recipes and diet diversity for home consumption
10. Policies hindering the domestic market of NUS

Figure 3. Simplified value chain for domestic markets



1. Selection of NUS for greater impact

Nus is a very broad category including many species, in the order to hundreds in each country. How to make informed decisions on which NUS has greater market potential or does contribute to the sustainability of the local farm system? Should we focus on just one species or more? Who should be involved in making these decisions? Not all NUS have great market potential and it requires a careful evaluation which NUS have immediate market value and which NUS has predominantly home use values, and which NUS doesn't have strong market or use values and should be targeted for a conservation strategy¹⁰.

Marketing means taking economic risks and thus a value chain development program should help farmers to take calculated risks by making informed decisions. As it is the farmer, cooperative or entrepreneur who takes the risk, it is important that they are themselves involved in taking such basic decision. As said earlier, putting all eggs in one basket is often risky and thus when working on NUS, it is often advantageous to work on more than 1 species at the same time. This makes a lot of sense from a nutritional, resilience and income generation point of view as discussed also in the companion HTD Notes no 2 and 4.

In general, agrobiodiversity projects aiming at reinforcing NUS focus on several nutritionally-complementary species as a way to leverage multiple nutrition benefits and other intimately related benefits related to resilience of the agroecosystem, income generation options and other livelihood aspects. Diversity is fundamental for healthy production and food systems and this even more important when dealing with NUS where multiple untapped synergies and benefits can be harnessed.

As we are covering in this note the development of domestic markets for NUS, we would thus talk of developing a multi-chain approach, possibly involving 3-5 NUS or combining a cash crop value chain with 2 or 3 NUS value chains, a combination of priority species that has been recommended by the stakeholders. On the other end, it may happen also that we have a clear idea about a particular NUS having a great market potential whose development may require substantial resources, leaving no chance to include more species in our project.

Ideally, when tackling the market development of these 3-5 species, we should work simultaneously to target different markets and purposes as a way to reduce risks (e.g. work simultaneous on a NUS or commodity crop with market potential for distant urban markets, a NUS that is important as ingredient for processing industry, one or two NUS that are important for rural home nutrition a diet diversity and a NUS that strongly enhances the farm system, crop rotation and is used as animal feed).



Impact filter is a participatory tool that can help to facilitate such a participatory selection process^(22,10)

2. Conservation of genetic diversity both in situ and on farm

A common problem of NUS value chains is that often limited information exists about the genetic diversity of the target species (i.e. range of distinct varieties, peculiar traits and evenness of their presence within the population). Furthermore, NUS are often scarcely included in *ex-situ* gene bank collections and needless to say lack of a conservation strategy for their genetic resources. These factors play a critical role in securing the survival of the species and are very important to researchers, breeders and farmers alike to support their variety selection efforts. Basic on-farm and in-situ conservation activities to consider here include the identification of custodian farmers and lending support to their invaluable conservation activities, help establishing community seed banks, support the documentation of varietal passports in a register of landraces (with traits and associated traditional knowledge) or help the creation of crop diversity gardens in school yards or communal forests and biodiversity sanctuaries. Such networks of custodian farmers, community seed banks or diversity gardens function as a treasure box for farmers to explore new superfoods and market opportunities and as a source of genetic material for better seed development.



More on custodian farmers^(11,12)

- ➔ More on community seed banks (^{13, 33})
- ➔ More on plant biodiversity register (^{14, 34, 35})
- ➔ More on community biodiversity management (¹⁵)

3. Crop improvement, production of good quality seed, seed networks

A major problem of NUS is the lack of uniform or high quality seed or saplings. Landraces or selections using wild plants still have negative traits associated with them such as a bitter aftertaste, low yield or unstable performance. An advantage of most NUS is that in short time and with limited investments, significant improvement can be made by improving yields or removing negative traits in genotypes by simple breeding methods. To that regard, farmer field schools aimed at building farmers' skills in participatory plant breeding and variety selection would be very helpful efforts in a NUS project. It is often beneficial to develop such breeding activities together with commercial activities such as the multiplication and sales of disease-free and uniform seeds of the most promising varieties during diversity seed fairs. Such activities can be organized together with private seed companies, nurseries or as a commercial activity of community seed banks.

- ➔ More on evaluation and selection of varieties by farmers (³⁶)
- ➔ More on participatory plant breeding (¹⁶)
- ➔ More on technical issues related to seedbanks (¹⁷)
- ➔ More on seed diversity fairs or exchange of seeds and saplings (³⁷)

4. Collective action and aggregation of supply

NUS value chains involve often many smallholder farmers which are not organized in cooperatives or associations that may provide services tailored to the crops they are growing. On the contrary, such supporting services are typically well established for commodity value chains. In the case of wild collected NUS, lack of such services is even stronger, as harvesters usually prefer to work in isolation. Households involved in collecting NUS from the wild are often vulnerable social groups like illegal settlers, landless farmers or impoverished agricultural labourers and NUS harvesting is often the work of women, as these species are mostly used for home consumption. Aggregation of supply enables sorting and grading or other pre-processing steps that would result in a more uniform and higher quality produce which is a first step towards improved market linkages. It is crucial to have farmers organized in collector groups or farmer groups at ground level to aggregate supply and create shared labour, investment and learning platforms. These groups also enable an administration and self-monitoring system to enforce compliance towards agreed and peer-reviewed sustainable harvesting or farming practices that improve quality of produce or that enhance the local agro-ecosystem. The evolution of such farmer groups into cooperatives, producer companies or as out-grower systems connected to a company, will be a crucial next step for strengthening NUS value chains. This will enable the recruitment of full-time staff that can collect market intelligence, build linkages with more distant buyers and coordinate more effectively the sales of improved products. Provision of need-based training through these institutions is crucial to build capacities with a strong emphasis on the inclusion of vulnerable groups in those organizations such as indigenous communities, illegal settlers, landless labourers or youth and women in general.

- ➔ More on social and gender inclusion (See chapter 6 and ³⁸)

³³ <https://www.biodiversityinternational.org/seedbanks/>

³⁴ https://www.researchgate.net/publication/267635711_Community_biodiversity_registers_in_Nepal

³⁵ <https://cgspace.cgiar.org/handle/10568/78415>

³⁶ <https://www.biodiversityinternational.org/innovations/seeds-for-needs/crowdsourcing/>

³⁷ <http://www.fao.org/3/aq387e/aq387e00.htm#Contents>

- ➔ More on starting a farmer cooperative or producer company (¹⁸ and ¹⁹)
- ➔ More on participatory guarantee systems (PGS) for organic practices (³⁹)

5. Drudgery in cultivation and processing operations

A common problem for most NUS is the need for suitable machinery to process the raw harvested product before it can be commercialized. These operations often include de-husking, decorticating, milling, washing, drying or other crucial processing steps. Often such machineries do not exist and need to be developed or adapted from commodity crops' technologies and tailored for the needs of the target NUS. Such operation should be carried out in close collaboration with research centres or experienced local manufacturers. Important is to also assess whether these processing activities are best conducted at household or cooperative/company level in order to make them economically profitable, effective (i.e. create a uniform higher quality product) and socially desirable, especially for vulnerable groups. Obviously, solutions here may vary greatly per case and type of NUS.

- ➔ More on drudgery reduction (^{20,21})

6. Lack of market knowledge and beneficial market linkages

Farmers in general, but especially farmers growing NUS, often lack market knowledge and business skills. Farmers are knowledgeable about home uses and recipes of NUS, but have very limited knowledge of the value chain and what happen after they have sold their harvest to the collecting trader. Besides, farmers and traders can have limited trust in each other. Farmers complain about the low prices given by the traders and the traders complain about the low quality produce of farmers. To tackle common bottlenecks within the value chain, such as low prices, perishability, short shelf life, quality problems, poor transportation means, lack of price information, it is required that farmers increase their market knowledge and work together with companies, traders or entrepreneurs. Actions that improve your market position such as by-passing traders and direct sales to retailers or consumers are called market improvements. Such actions can result into friction as you increase your share of the added value in the value chain at the cost of other value chain actors. This is often referred to as a zero-sum game (i.e. redistribute the slices of the same cake). Alternatively, Value Chain Development means interventions that are beneficial for all value chain actors as the interventions increase the added value for all actors from farmers to retailers (ensure to grow the cake larger). Working together with all actors in a NUS market channel from farm to fork, help to better understand and interpretate specific demands and preferences of consumers. It is crucial therefore to build trust among farmers and traders or companies, and to work closely together to achieve collective benefits. This is what we would describe as a value chain upgrading strategy. Specific activities can be considered in such upgrading strategy. Value Chain Mapping helps to improve the understanding of stakeholders of how the value chain is organized, who are the various actors and what are their roles. Value chain assessment and rapid market appraisal are helpful activities to improve market knowledge and intelligence. The Participatory Market Chain Approach and stakeholder platforms are approaches used in many VCD programs, which help building trust among farmers, cooperatives and companies and guide joint upgrading activities. Among those activities, for example a short theatre play has shown to be a simple but very powerful tool to bring smallholder farmers or value chain actors together to explain them about key value chain concepts, discuss value chain problems and potential solutions for specific NUS value chains.

- ➔ More on theatre play for value chain development (⁴⁰)

³⁸ <https://ccafs.cgiar.org/gender-and-inclusion-toolbox#.XNw0UKRS82w>

³⁹ <https://www.ifoam.bio/en/organic-policy-guarantee/participatory-guarantee-systems-pgs>

⁴⁰ <https://www.biodiversityinternational.org/news/detail/research-through-theatre-using-participatory-methods-to-spark-discussion-and-empower-local-communi/>

- ➔ More on Participatory Market Chain Approach and innovation platforms ^(22 and 41)
- ➔ More on participatory tools for value chain development of NUS ⁽¹⁰⁾

7. Lack of entrepreneurial skills and business support services

Farmers, especially smallholder farmers, often have no time and resources to dedicate time to develop their skills for market and business development, managing the farm is already difficult enough. Improving their situation is only feasible through cooperatives or producer companies that can hire dedicated staff for market development. It is important to find staffs and farmers that have natural skills and interest in entrepreneurship or to find promising traders and companies that can be linked to the farmer groups. Often youth are interested in this type of activities and business oriented capacity building activities enables you to orient your program on youth or vulnerable groups such as women. Interventions include capacity building for business plan development, entrepreneurship, collecting market intelligence, financial administration, food safety, marketing or trade fair participation. Other important actions also include providing start-up capital or investment funding to enable crucial investments for farm-based entrepreneurs and cooperatives. When working with many smallholder farmers it can be beneficial to organize business plan competitions or create so-called rural business incubators, which provides farmers and entrepreneurs with services and a coaching trajectory to start-up businesses and commercial activities. This can help allocating investment budget more effectively and efficiently to the most promising or impactful entrepreneurs instead of granting the whole budget to one pre-defined cooperatives or entrepreneur. Exposure visits to companies, processors, trade fairs or other successful cooperatives or farmer groups that work on NUS is another important way how to familiarize your beneficiaries with successful business cases and to generate ideas for market development.

- ➔ More on business plan competition and incubators ^(42 and 43 and 23)
- ➔ More on value chain tools of CGIAR ⁽⁴⁴⁾

8. Changing image from poor-mans' crop to novel superfood

Another common problem faced by NUS is that consumers are generally unaware of the species or that the crop has a negative connotation. Often they are referred to as the crops or the foods of the poor, despite their nutritional qualities. Wealthier households, often an interesting market segment, do not find these food items attractive or are unaware of their benefits, and thus marketing these species is a major challenge. Changing this image takes time and great commitment, especially in terms of developing innovative promotional campaigns and advertisements. Targeted activities such as working with celebrities, famous chefs, restaurants or hotel chains on improved or novel recipes is important as highlighted in the HTD Note no. 2 (promotion of chaya in Guatemala). It is often also advantageous to integrate the crop as ingredient into retail products that are already popular among wealthier households instead of promoting the food in the format as it was originally used by poor households. For example, the market for chapatis from 100% finger millet flour or '*ragi balls*' which are the traditional way of consuming finger millet in rural India is still difficult, but the market for finger millet induced *momo*'s or *samosa*'s that makes them more nutritious as promoted by food blogs, famous chefs and restaurants, picks-up much faster. Similarly, the market for acai, a fruit harvested from the Amazon rainforest, in the format of powder or frozen pulp that is used in smoothies or ice-cream as consumed in popular juice bars and fitness clubs in Brazil is much higher than its traditional fresh consumption. Also, the sales of African leafy vegetables in Kenya picked-up when few supermarket chains, which are frequented by higher-end consumers compared with street markets, started to promote the nutritional and healthy benefits.

- ➔ More on recipe development and working with chefs ^(45 and 46)

⁴¹ <https://cgspace.cgiar.org/handle/10568/34160>

⁴² www.bidnetwork.org

⁴³ <https://start-life.nl/>

⁴⁴ <http://tools4valuechains.org>

➔ More on the impact of market development of minor millets ⁽²⁴⁾

9. Promote recipes and diet diversity for home consumption

Often the focus of projects is on improving nutrition and diet diversity of rural populations. Such a work calls for a specific focus on studying home consumption patterns of children, male and female household members within the focus population. Activities needed to this regard include nutritional gap analysis differentiated for children, men and women, identification of suitable NUS with the right nutritional profile, awareness raising and the promotion of recipes through focus group discussions and cooking clubs.

➔ More on nutrition sensitive value chain development ^(25 and 26)

10. Policies hindering the domestic market of NUS

Policies play an important role in hindering or favouring the development of NUS. Hindering policies are for instance those that limit the inclusion of NUS as mandate crops in public research centres or those that do not consider these species in farmers' extension programs, school feeding programs or subsidized food distribution. Some policies may also affect directly the marketing of NUS by requesting specific quality standards for the produce that might be hard to be implemented by poor value chain actors due to lack of financial resources, infrastructure or adequate skills. On the contrary, supportive policies include those that would recognize the value of NUS for society and create an enabling environment for their use enhancement, by encouraging research in critical areas such as conservation, breeding, nutrition, agronomy, processing or marketing or those providing subsidies to farmers to encourage their cultivation, or for the establishment of collectives or to strengthen their fair trading.

Changing policies requires advocacy work and engagement of influencing policy makers, both long-term commitments as better articulated in the companion HTD Note on NUS policy and mainstreaming (*in press*).

➔ More on school feeding and distribution programs ⁽⁴⁷⁾

➔ More on effective advocacy for NUS ^[48]

⁴⁵ <https://www.biodiversityinternational.org/news/detail/uniting-efforts-to-enhance-the-use-of-neglected-mayan-superfood-chaya/>

⁴⁶ <http://www.nuscommunity.org/resources/our-publications/publication/embracing-millet-back-to-life-compilation-of-millet-recipes-of-tribals-of-mandla-district-in-madhy/>

⁴⁷ <https://www.wfp.org/home-grown-school-feeding>

⁴⁸ <https://india.mongabay.com/2020/07/indias-millets-policy-is-it-headed-in-the-right-direction/>

8. Methods & tools to support NUS value chains

In principle, the same methods and tools can be used irrespectively for value chains of commodity crops or for those related to NUS. For instance, the article of Donovan et al. 2013⁴⁹ compares several value chain approaches and provides a good overview and evaluation of the most prominent value chain guidelines and methods that are used in the agricultural development sector²⁷, and represents thus a good basis to start with to deepen our knowledge on value chains. Some approaches have proven to be however better adapted to the situation faced by NUS value chains or for the promotion of markets for agricultural biodiversity in general. This book chapter of Lamers et al. 2016⁵⁰ provides a good historical overview of value chain approaches that focuses specifically on crop diversity and NUS, lists several participatory value chain tools and describes 14 interesting market case studies (with a focus on tropical fruit trees)¹⁰.

Three approaches typically used for NUS are the [Participatory Market Chain Approach or PMCA](#), the guideline for [Promoting Value Chains of NUS for pro-poor Growth and Biodiversity Conservation or PVC-NUS](#) and the [Holistic Value Chain Approach or HVCA](#). The HVCA provides a good framework for analysis of a NUS value chain while PMCA and PVC-NUS describe an operational framework to guide interventions.

Links to major approaches and frameworks for NUS value chains:

- Holistic Value Chain approach for NUS (Bioversity International)²⁸ – <https://www.mdpi.com/2071-1050/6/3/1283/htm>
- Promoting Value Chains of NUS for pro-poor growth and biodiversity conservation (Global Facility Unit for NUS)²⁹ - <https://cgspace.cgiar.org/handle/10568/104850>
- Participatory Market Chain Approach (CIP)²² – <http://cipotato.org/wp-content/uploads/2014/09/003296.pdf>
- Stakeholder platforms (CIP)³⁰ – https://www.researchgate.net/publication/223665159_Collective_action_for_market_chain_innovation_in_the_Andes
- Nutrition Sensitive Value Chains (IFAD)²⁵ – <https://www.ifad.org/en/web/knowledge/publication/asset/40805038>
- Valuelinks (GIZ)³¹ – <http://valuelinks.org>

Market development for smallholder farmers means taking risks and thus a value chain development program should help farmers and other stakeholders to take calculated risks by making informed and joint decisions. Such decision making processes are often facilitated through meetings and focus group discussions while making use of specific tools. A range of participatory tools for value chain development that are often used when working with smallholders are also mentioned in the companion HTDN 2.

Key (participatory) methods and tools that can be used for NUS value chains include:

- Four Cell Analysis to assess crop diversity ([link](#) and [link](#))
- Value Chain Pyramid to assess market penetration of crop diversity ([link](#))
- Crop attributes to identify promising NUS or landraces for market development ([link](#))
- Street Theatre Play or Sketch to build trust and explain value chain concepts ([link](#))
- Impact filter to evaluate and select NUS or product formats ([link](#))

⁴⁹ https://www.researchgate.net/publication/309548675_Guides_For_Value_Chain_Development_-_A_Comparative_Review

⁵⁰ https://www.bioversityinternational.org/fileadmin/user_upload/online_library/publications/pdfs/Tropical_Fruit_Tree_Diversity/22_Markets_Conservation_Biodiversity.pdf

- Value Chain Map to understand the value chain ([link](#))
- Value Chain Assessment or Rapid Market Appraisal to collect market intelligence ([link](#))
- Identifying Private Sector partners ([link](#))
- SWOT to develop a market strategy ([link](#))
- Farmer or Food Fair for crop diversity to learn, share and sell seeds & products ([link](#))
- How to do: Mainstreaming NUS in national policy for nutrition outcomes. Nutrition-sensitive Agriculture Note No 5. Rome, Italy. (*in press*).

9. Guidance for project design and implementation

The framework of the Holistic Value Chain approach for NUS (figure 1) provides an overview of all the critical issues that need to be tackled in developing value chains for these species. It emphasizes that before production, the usual starting point of a value chain, there is a need to work on genetic diversity conservation (1) as well as the seed sector for crop improvements (2) before harvesting (3) processing (4), marketing (5) and final consumption or use of the NUS and its derived products (6). For each of the six phases specific critical issues are listed that need to be addressed to ensure the objectives are achieved such as improved incomes, nutrition, resilience or other livelihood benefits. Key aspect of the holistic value chain approach is that it can focus on multiple crops and how their interaction within the farm system can lead to multiple impacts.

The complexity of a NUS value chain development project that strives to achieve multiple economic, social and environmental objectives requires a structured approach for implementation. To that end, useful is the 2008 guideline by Margret Will (⁵¹) which describes a cycle of five steps for guiding NUS value chain development projects as follows:

Step 1: *Bring the stakeholders together and start with the selection of NUS that merit to be promoted for their economic, social and environmental potential*

Step 2: *The VC promotion cycle continues with a sound analysis of the VC system, also referred to as VC mapping and the collection of market intelligence*

Step 3: *That is followed by the identification of entry points: opportunities fostering and/or constraints hampering VCD for the selected NUS.*

Step 4: *Based on agreed-upon priority entry points, stakeholders will then design an upgrading strategy with concrete actions.*

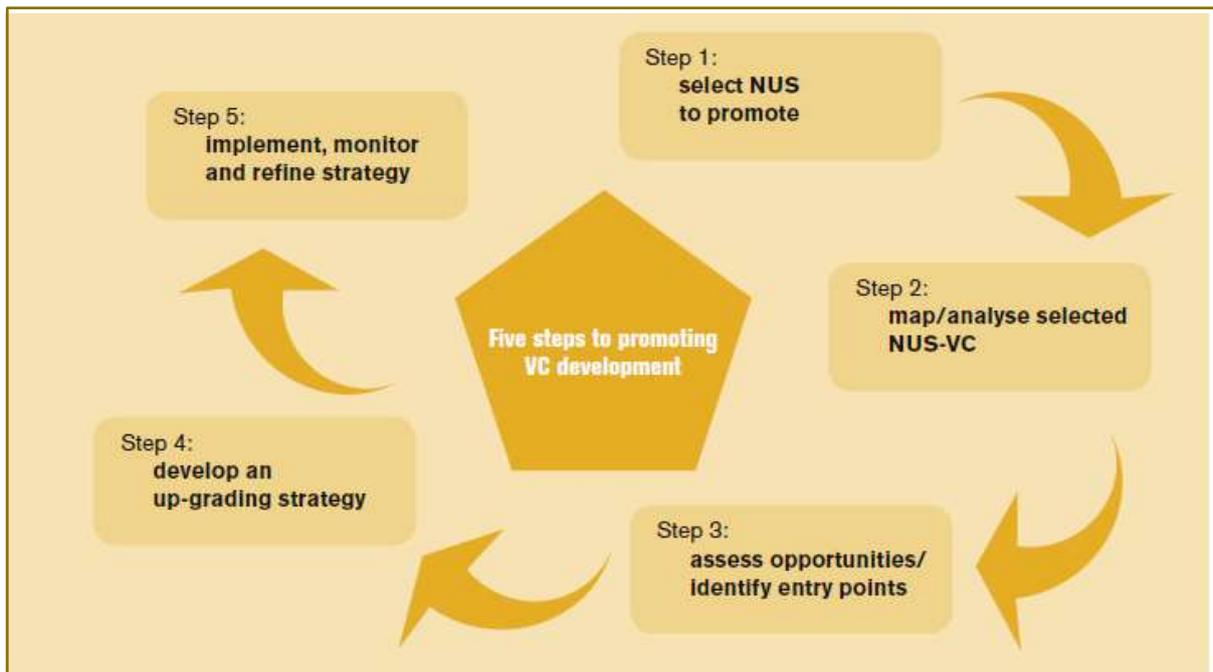
Step 5: *The planning phase is followed by step 5, the implementation cycle that consists of a) implementation of interventions to strengthen VC competitiveness; b) monitoring of progress; and c) if necessary, refinement or revision of the strategy.*

Even if the value chain literature provides some different terminologies for the various steps involved in the VCD, the general procedures and sequencing are very much the same. The cycle of the proposed five steps to promoting VCD is illustrated in figure 4.

The sequence of steps towards VC Development is not static, but needs to be flexibly adapted to the prevailing circumstances. Regardless of whether planning a smaller community-based or a larger national project, following the proposed cycle will assist stakeholders to conceive a viable strategy for sustainable VCD. In any case, deploying the proposed structured approach will help avoid ad hoc and isolated interventions that too often do not lead to viable strategies and sustainable impact. (Margret Will 2008).

⁵¹ http://www.underutilized-species.org/Documents/PUBLICATIONS/promoting_vc.pdf

Figure 4. Steps top pormoting Valeu chain development for NUS



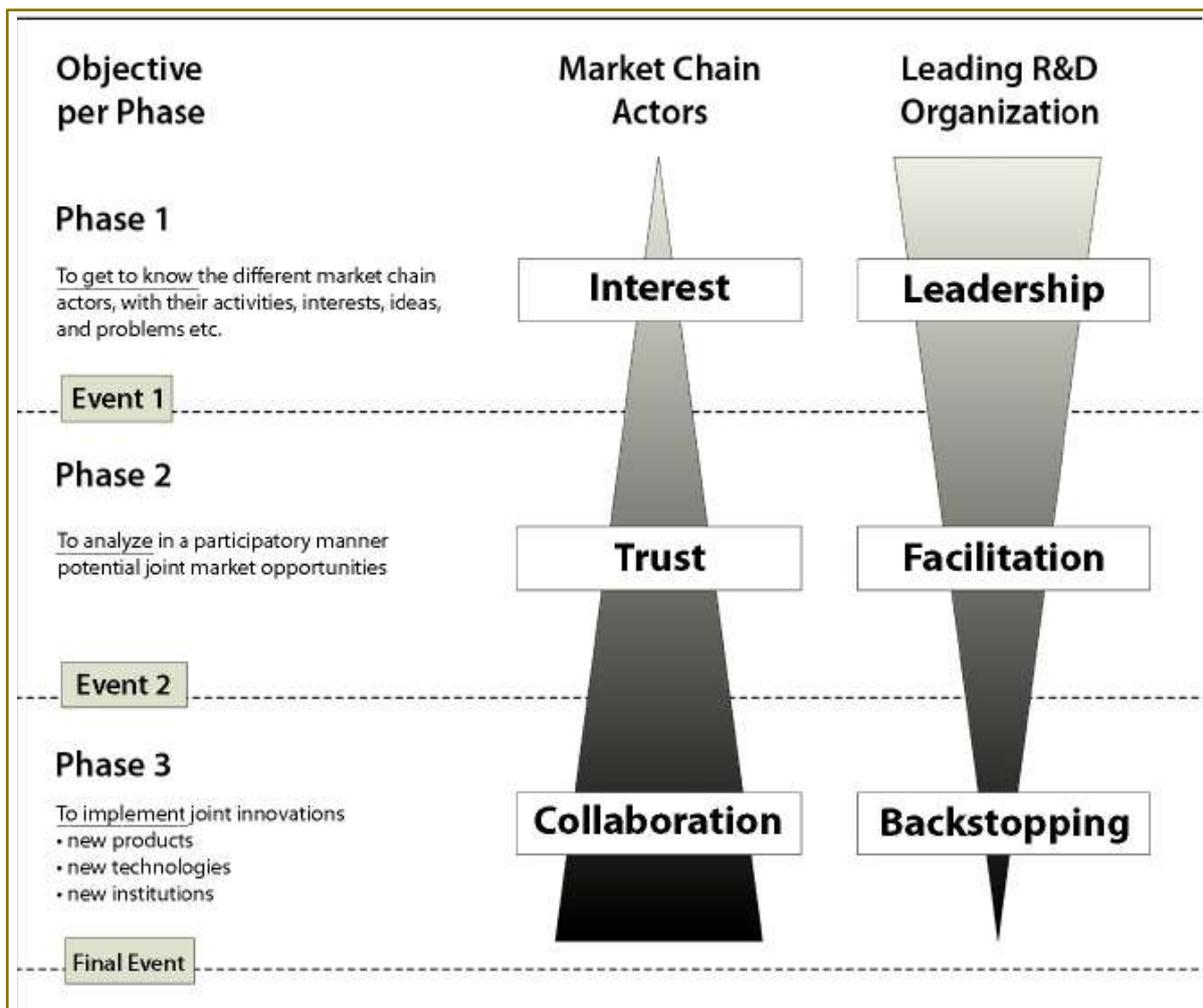
Source: Margret Will 2008

The Participatory Market Chain Approach (PMCA) follows a similar structure but lays more emphasis on the value chain innovations and collective action. This method entails the guidance of all activities through three major workshops where all stakeholders come together (see figure 5). To note that this approach assumes that the NUS to be targeted by the program have been already identified:

- **The first phase** is focused on bringing all stakeholders together to discuss their value chain problems and interests. Stakeholders will evaluate market opportunities and agree on the ideas and market opportunities that will be taken forward.
- **The second phase** is about analysing the value chains of target crops and involves collecting market intelligence related to the identified joint market opportunities. Results are shared in a second joint workshop where an action plan can be developed based on the gathered information.
- **The third phase** is about implementing the joint innovations and market opportunities by making improvements in product design, processing capacities or other activities. A final event is organized to showcase the innovations, proto-type products or improved equipment's to all stakeholders.

The PMCA highlights that at the start a research agency or NGO will lead the activities but slowly will reduce its influence while market actors take control of activities.

Figure 5. Framework of the Participatory Market Chain Approach



Source: PMCA Guide CIP

10. Further reading

Rural Marketing

Most marketing approaches and activities are focusing on urban consumers, however in least developed countries the majority of consumers are often still living in rural areas or small villages and towns. MARTRural from India has developed an interesting book about the specifics of targeting rural consumers. Logistic costs are much more prominent and rural consumers have different preferences, lifestyles and needs compared with urban consumers³².

Gender in value chains

Some interesting guidelines have been developed that focus specific on gender in value chains, including a practical toolkit by AgroProFocus³³. Besides, a gendered version of the Participatory Market Chain Approach was recently published by the Potato Research Institute³⁴

Clearance house for VCD tools and publications

The CGIAR has developed a specific website (www.tools4valuechains.org) for value chain development research with descriptions and evaluations of tools, publications and organizations. The purpose of this portal is to provide a comprehensive, easily accessible repository of research methods and best practices surrounding value chain performance that can be used by all the consortium research programs and partners.

LINK methodology

CIAT developed a methodology specific to build trade relationships between smallholders and companies. The LINK methodology will help you understand the current functioning of the market chain and key business models, design innovations that empower producer groups to engage more effectively and buyers to act in ways more amenable to small holder farmers. At the end of the day, this method seeks to build bridges between the often disparate worlds of small holder farming in the developing world and emerging market opportunities both in the global south as well as developed economies³⁵.

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