ESTABLISHING MORINGA BASED ECONOMIC DEVELOPMENT PROGRAM TO IMPROVE THE LIVELIHOOD OF RURAL WOMEN OF ETHIOPIA

INCEPTION REPORT

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ACRONYMS:

AICS	Italian Agency for Development Cooperation
BMZ	Federal Ministry for Economic Cooperation & Development
BoANR	Bureau of Agriculture and Natural Resources
BoH	Bureau of Health; SNNPR
BoT	Bureau of Trade and Industry
BoWCA	Head of the Bureau of Women and Children Affairs
CA	Cooperatives Agency
CPRW	Convention on the Political Rights of Women
DEM	Digital elevation model
EDGE-	Business Certification Standard for Gender Equality
EFAP	Emergency Food Assistance Program
EPFA	Environmental Protection and Forestry Authority
EPHI	Ethiopian Public Health Institute
ESA	Ethiopian Standards Authority
EU	European Union
F&NRD	Food and Nutrition Research Directorate
FMHACA	Food Medicine Health Administration Control Agency
GAP	Good Agricultural Practise
GDI	Gender and Development Index
GMP	Good Manufacturing Practise
GPS	Global Position System
GTP	Global Transformation Plan
ISID	Inclusive and Sustainable Industrial Development
JICA	Japan International Cooperation Agency
MoWCA	Ministry of Women and Children Affairs
MSEDA	Micro & Small Enterprises Development Agency
NAP-GE	National Action Plan for Gender Equality
NNS	National Nutrition Strategy (NNS)
NSAP-HTPs	National Strategy and Action Plan on Harmful Traditional Practices
OVOP	One Village One Product
PEM	Protein Energy Malnutrition
PMU	Project Management Unit
PLW	Pregnant and Lactating Women
RJOCDA	Rural Job Opportunity Creation and Development Agency
SARI	Southern Agricultural Research Institute (SARI),

SBCC	Social Behaviour Change Communication (SBCC)
SDG	Sustainable Development Goal
SNNPRS	Southern Nationals and Nationalities People Regional State
STI	Science, technology and innovation (STI),
UNIDO	United Nations Industrial Development Organization
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
WASH	Water Sanitation and Hygiene
WHO	World Health Organization

PART I: OVERVIEW OF THE MORINGA VALUE CHAIN

EXECUTIVE SUMMARY

Women in Ethiopia represent approximately 50% of the total population and account for 70% of the household food production. The rural women share in the total agricultural labor force is considerably high. Women make up almost 50% of the agricultural labor force in sub-Saharan Africa, an increase from about 45% in 1980. The averages in Africa range from just over 40% in Southern Africa to just over 50% in Eastern Africa[1].

Since the subsistence economy cannot meet the households' basic needs, the participation of rural women in generating additional income is relevant. This is quite significant given the tendency of underestimating the contribution of women to production, food and nutrition security. In the Ethiopian context, the links between agriculture, agro-industry development and gender have important implications on poverty reduction, biodiversity conservation, environmental sustainability and fight against malnutrition. Therefore rural women's role is critical and necessary in all development agendas.

The objective of the project is, therefore, to contribute to food and nutrition security, through creation of jobs, protection of the environment and biodiversity, as well as strengthening the consumption of a diverse diet that comprises moringa based products. This is envisaged to be achieved through the development and promotion of the value chain of Moringa that includes: (i.) production; (ii.) processing and value addition; (iii.) Set-up of safety and quality parameters; (iv.) establishment of a regulatory framework; and (v.) development of sustainable marketing outlets

Moringa stenopetala is an endemic tree in the Southern part of Ethiopia and the Northern part of Kenya. It is used as food and as medicinal plant by the communities. It has several nutrition traits and is also an important industrial crop.

The Project counterpart is the Southern Nations Nationalities and Peoples Regional State (SNNPRS)-Bureau of Agriculture and Natural Resource (BoANR). The Southern Agriculture Research Institute (SARI) serves as a focal point. The project counts on the support of the Office of the First Lady of the Federal Democratic Republic of Ethiopia. The highest administrative unit of the project, the Project Steering Committee (PSC), consists of representatives of relevant stakeholders from Federal and Regional institutions. The Technical Advisory Group provides technical advice to the PSC.

[1] *http://www.fao.org/docrep/013/am307e/am307e00.pdf*

The project area is defined to be in the SNNPRS, Gamo Gofa Zone, i.e. Arba Minch Zuria woreda. The Regional Government allocated 30 ha irrigable land in Arba Minch Zuria woreda, Wezeka kebele, to be used as demonstration plot and committed to allocate the processing unit. In addition, office facilities, temporary shade and nursery for the propagation of planting materials have been provided.

Production and processing unit will be established to promote technology transfer and training. In addition, institutional capacity will be developed at the Ethiopian Public Health Institute (EPHI) to facilitate the nutrition profiling, setting of standard and conformity assessment and ensure the establishment of the regulatory framework for moringa-based products.

The main project outcomes will be an increase of the income and the improvement in the nutritional status of the targeted beneficiaries, through the development of moringa value chain and the use of the Moringa based products.

This Pilot Initiative, financially supported by the Italian Agency for Development Cooperation (AICS) covers 12 months. This initiative lays strong foundation to achieve the final goal of the project designed for 5 years.

1. CONTEXT

1.1. INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT (ISID) AND GENDER EQUALITY

UNIDO is promoting inclusive and sustainable industrial development (ISID)[2], to eradicate poverty within the next generation and the aim is that "*No one is left behind in benefiting from industrial growth, and prosperity is shared among women and men in all countries".* In this context, it recognizes that gender equality and the empowerment of women have significant positive impacts on sustained economic growth and inclusive and sustainable industrial development, which are drivers of poverty reduction and social integration.

Economically strengthening women is not only a means by which to spur and sustain inclusive industrial development, but also a matter of advancing women's human rights. The World Economic Forum's Global Gender Gap Report, 2014 finds a positive correlation between gender equality and per capita gross domestic product, the level of competitiveness, and human development indicators[3].

The importance of gender equality and women's empowerment, particularly women's economic empowerment, is at the core of UNIDO's mandate[4]. Enhancing the role of women as driver of poverty reduction, promoting food and nutrition security, and recognizing the link between gender equality and safeguarding the environment promote inclusive and sustainable industrialization, and directly contribute to SDG.

Regardless of the international commitment to empower women, still there is a long way to go to secure the women economic empowerment in Ethiopia in general and the rural women in particular. This initiative is aimed at identifying appropriate resource and technology to empower rural women. The MVC development project targeted the women in the SNNPRS, through identifying appropriate technology to improve the production of local relevant crops for increasing food and nutrition security.

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[2] *ISID. UNIDO, February 2014, Inclusive and Sustainable Industrial Development, creating shared prosperity | Safeguarding the environment*

[3] *http://reports.weforum.org/global-gender-gap-report-2014/part-1/the-case-for-gender-equality/*

[4] *https://www.unido.org/fileadmin/user_media/PMO/GC.16/GC.16_8_E_Gender_Equality_and_Empowerment_of_Women_Strategy__2016-2019.pdf*

Demand for value-added agricultural products in developing countries is set to rise in the coming decades. This will create an opportunity for new sustainable jobs in agro-processing, especially for women.

1.2.GROWTH AND TRANSFORMATION PLAN (I &II)

The objectives of the Growth and Transformation Plan (GTP)[5] is "*building an economy which has a modern and productive agricultural sector with enhanced technology and an industrial sector that plays a leading role in the economy, sustaining economic development and securing social justice and increasing per capita income of the citizens so as to reach the level of those in middle income countries".* To achieve the targeted objectives the strategic pillars are: i) maintaining agriculture as major source of economic growth; ii) creating a conducive environment for industry to pay a key role in the economy, and iii) promoting gender and youth empowerment and equality. These strategic pillars are relevant in relation to the proposed project.

The GTP sector development plan stipulates that the plan cannot be achieved without empowering women and youth and ensuring that they benefit from the policy. To address the multi-dimensional problems faced by women and youth, the Government is committed to ensuring equitable socio-economics and political participation by unleashing the potential contribution of women to national development. As the most vulnerable part of the society, the women development strategy agenda core and central aim is the empowerment of women, especially the rural women. This will have profound effects on the speed, equality and sustainability of economic development and on the country's overall growth and prosperity.

Despite the progress made in the national economy development of Ethiopia under the period of GTP I (2010-2015), employment generation and poverty eradication still remain as number one development agenda of the Government, therefore, it remains committed to sustaining inclusive and pro-poor development strategy over the coming years to further address the poverty and employment generation challenges.

The 2011 Gender and Development Index (GDI) placed Ethiopia in the 174th position out of 187 countries. Men are favored over women with regards to food, health care, education, and formal sector employment. Agriculture is a livelihood source for the majority of rural

[5] *The Federal Democratic Republic of Ethiopia: Poverty Reduction Strategy Paper: Growth and Transformation Plan 2015/16–2020/21- II*

women and men. While women farmers perform up to 75% of farm labor, they only hold 18.7% of agricultural land. Though women possess equal rights to access bank loans, mortgages, and other forms of financial credit, they could not to use them effectively.

Supporting the development of micro and small development enterprises is critical in generating employment, it serves as practical tool to develop entrepreneurship capacity and to create domestic private sector. The MVC project will have a role in achieving the national development strategy articulated above through economically empowering rural women in Gamo Gofa zone, through creating micro and small enterprises working in the value chain of Moringa.

1.3.NATIONAL NUTRITION STRATEGY

Optimal nutrition is fundamental to achieving the overall objective of the national strategy Growth and Transformation Plan (GTP II) of becoming a lower middle-income country by 2025. The Government launched a National Nutrition Strategy (NNS)[6] in 2008 thereby achieving a major step forward in its efforts to tackle persistent malnutrition in the country. Chronic malnutrition among children in Ethiopia remains very high 38[7]% and at periods during the year, prevalence of acute malnutrition escalates to emergency levels. Micronutrient deficiencies are rife, nearly one third of women are undernourished and approximately 35 million people in the country are undernourished.

The NNS is now being operationalized through the multisector National Nutrition Program II (NNP II) with 13 stakeholder Ministries. The overall goal of the NNPII is to ensure that all Ethiopians are able to achieve an adequate nutritional status in a sustainable manner. The strategy is focused on reducing malnutrition among the most vulnerable groups, particularly young children, pregnant/lactating women, individuals with HIV and households affected by food and nutrition insecurity. It also includes components to help promote healthy diets and lifestyles. Crucially, a specific objective of the NNPII is to improve coordination of nutrition related activities implemented by the Government. The implementation of the NNPII is reaffirmed by the '*Seqota*' Declaration Implementation Plan[8] as a commitment to nutrition as a foundation for economic development. The Plan's multisector approach addresses the immediate, basic and underlying causes of malnutrition, with a focus on development programming to build resilience to shocks in vulnerable communities.

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[6] *http://www.fao.org/fileadmin/user_upload/drought/docs/Ethiopia_National_Nutrition_Strategy_Final_Report.pdf*
[7] *https://dhsprogram.com/pubs/pdf/PR81/PR81.pdf*

[8] *Seqota Declaration Implementation Plan (2016-2030), Federal Democratic Republic of Ethiopia*

The '*Seqota'* Declaration Implementation Plan leverages pre-existing policies, strategies and programs in place to maximize lessons learned and apply best practices at scale in a targeted approach. It is hoped that through the effective roll-out of this implementation plan, Ethiopia will experience a paradigm shift towards the elimination of child undernutrition by 2030. Informed by a conceptual framework built around three pathways of change, the '*Seqota'* Declaration Implementation Plan will focus on delivering high impact nutrition specific and nutrition sensitive interventions across multiple sectors including health, agriculture, water and sanitation, education and social protection. Furthermore, the Government has made strong commitments to mainstream nutrition into its main flagship programs of Productive Safety Net Program and Agriculture Growth Program II (AGPII), and into all MoANR programs by developing the Nutrition Sensitive Agriculture Strategic plan. All of these interventions will be driven by social behavior change communication (SBCC) strategies with special consideration for cross-cutting issues such as gender mainstreaming, multisector coordination and integrated community development approaches for nutrition.

The Moringa leaves and fruits are eaten as vegetables and are rich in proteins, calcium, and iron, phosphorous as well as vitamins A and C[9]. One tablespoon (5 grams) of dried moringa leaf powder and 1 cup (20 grams) of fresh leaves to the nutrient needs of 1–3 year old children. Both dried and fresh leaves appear to contain a substantial amount of the magnesium, iron, folate, and vitamins B-6, A, C, and E young children need. [10]

MVC project took into consideration the priorities of the government and the aforementioned international strategy documents, to contribute to poverty alleviation and combating malnutrition by providing access to nutritious food supplements.

1.4.ORIGIN OF THE PROJECT

In July 2014 UNIDO received an official letter from the First Lady of the Federal Government of Ethiopia requesting UNIDO's support in developing a project that could foster rural women development in terms of technical assistance through skill development, particularly, in the organization of women farmers clusters, introduction of value-adding rural agro-processing units, packaging and quality assurances for domestic, regional and international markets.

UNIDO responded to the request of the Ethiopian First Lady and instructed the relevant Division to proceed with the preparation of a technical assistance project. The project has

[9] *http://www.worldagroforestry.org/treedb/AFTPDFS/Moringa_stenopetala.PDF*
[10] *http://miracletrees.org/moringa-doc/nutrient-content-of-moringa-oleifera-leaves.pdf*

been designed in line with the pillars of UNIDO's strategy, focusing on Inclusive and Sustainable Industrial Development (ISID) in which "*no one is left behind*" in benefiting from industrial growth, and prosperity is equally shared among women and men all over the world. In this context, it is essential to better integrate women and youth in the process of creating an industrial workforce, especially in the rural communities.

It is crucial to mobilize the potential productivity of rural people, and particularly women, in order to achieve a resilient economic growth that will bring the targeted population out of poverty. The primary focus of UNIDO's activities in this area is addressed to upgrade knowledge, skills, technologies and business support services in order to enable women and youth to be engaged in productive activities, generate income, and thereby reduce poverty.

It has been acknowledged that industrial development increases productivity as well as employment and generates income, thereby contributing to poverty eradication, while providing opportunities for social inclusion (i.e. gender equality, empowering women and youth and creating decent employment for the youth). As industry develops, it drives an increase in value addition and enhances the application of science, technology and innovation (STI), encouraging greater investment in skills and education, and thus providing the resources to meet broader, inclusive and sustainable development objectives.

The project is also addressing the objectives of SDG (2, 5 and 8) that states: End hunger, achieve food security and improved nutrition and promote sustainable agriculture; Achieve gender equality and empower all women and girls; and Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

The "*Project for the development of Moringa Value Chain (MVC) in rural communities in Ethiopia"* is a pilot initiative of 12 months, financed by the Italian Agency for Development Cooperation (AICS), of the *"Establishing Moringa based economic development program to improve the livelihood of rural women of Ethiopia"* presented by UNIDO upon request of the SNNP Region (Southern Nationals Nationalities and People) and the First Lady of the Federal Government of Ethiopia. The entire program aims at fostering rural women development in terms of technical assistance through skills development, particularly through the organization of women farmer clusters, introduction of value-adding rural agro-processing units, packaging and quality assurances for domestic, regional and international markets. In light of the above, the current initiative represents a pilot phase aimed at developing the Ethiopian Moringa Value Chain for the improvement of the livelihood of rural producers, with a particular focus on the nutritional and gender aspects.

The preparatory assessment mission has been conducted, and, based on the field visit, discussions have been held with local relevant stakeholders both at federal and regional levels.

UNIDO and the Regional Government of the SNNP in collaboration with the Ethiopian Public Health Institute have prepared the project proposal through an extensive assessment undertaken by UNIDO international and national experts, in strict collaboration with both Regional and Federal Authorities, in particular with the Southern Agricultural Research Institute (SARI), and the Ethiopian Public Health Institute (EPHI).

The current initiative is also based on successful former UNIDO experiences in other countries (i.e. Sudan, Burkina Faso) aimed at developing the Moringa utilization for nutritional purposes. The program has been designed for 5 years, and it is divided in two phases 2 and 3 years respectively. The current intervention, Pilot Initiative, will have a duration of 12 months.

This pilot initiative project intends to contribute to the nutrition security and to the women economic empowerment in the rural areas of the SNNP Region State. Furthermore, the project is complementary and coherent with the EU development and cooperation policies, focusing on strengthening nutrition and gender socio-economic empowerment, two of the priority sectors of the 2011 Agenda for Change.

In Ethiopia a virtuous cycle among agriculture, agro-industrial development and active gender participation, can have a significant impact in nutritional improvements, in poverty reduction, in biodiversity conservation and in environmental sustainability. In this framework, this project aims at developing the moringa value chain (production, processing, product diversification, and commercialization) by the strengthening of the market linkages and by the involvement of the Institutions involved in the Moringa value chain, also for a quality control process, as well as at improving the utilization of certified Moringa products to combat malnutrition

In detail, the activities foreseen in the project are aimed at reaching the following results:

a) Organizing and strengthening of domestic market linkages of targeted groups involved in the moringa value chain;

b) Set up of a pilot plant for Moringa and derived products (e.g. oil, tea, nutraceuticals);

c) Strengthening the Ethiopian Public Health Institute, to facilitate the nutrition profiling, setting of Standards and conformity assessment and putting in place the regulatory

framework in collaboration with the FMHACA, Standards Authorities and Conformity Assessment Agency. UNIDO shall support EPHI to have the capacity to develop/implement the aforementioned activities in order to have national Moringa quality certification/s;

d) Improvement of the local communities', especially infant children, pregnant and lactating women, nutritional level, directly benefiting of moringa utilization in their daily diet.

The project beneficiaries will be mainly represented by local institutions, women and rural communities in SNNPR. Nevertheless it is expected an involvement of no less than 3000 people (50% women) active in the moringa value chain, corresponding to at least 15000 households' members.

The budget available for this project corresponds to 984,230 € and UNIDO will be accountable for the whole project implementation.

The overall project monitoring body will be represented by the Project Steering Committee (PSC) composed by representatives of: Italian Agency for Development Cooperation (AICS), UNIDO, Local Institutions and all the stakeholders active in the Moringa value chain sector.

1.5. MORINGA VALUE CHAIN (MVC) RELEVANCE TO CROSS SECTOR STRATEGIES

In the last 15 years, Ethiopia has witnessed high and steady economic growth rates, amongst the highest in the world, mainly thanks to the public investment in the agricultural sector and in economic infrastructures despite the above facts, the Government of Ethiopia has several challenges ahead to reduce poverty and improve the livelihood of rural communities. Ethiopia actually remains one of the poorest countries in the world; it is prone to weather-related shocks and experiences high levels of food and nutrition insecurity, particularly among rural populations and smallholder farmers. Women farmers perform up to 75 % of farm labor, representing 70 % of household food production in Ethiopia. But they typically produce up to 35 % less than male farmers because they have lower levels of access to resources[11]. UNDP *Human Development Report* (UNDP, 2014)[12], the Human Development Index of the Country is still very low and puts Ethiopia at the 173rd place on 186 worldwide.

Agriculture still deploys the 78% of the Ethiopian workforce, contributing to the 40% of the GDP and to the 80% of the export revenues of the Country. It is estimated that almost 12.7

[11] *http://www.fao.org/docrep/013/am307e/am307e00.pdf*
[12] *http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf*

million of farmers owning less than 1 ha, therefore the backbone of the national agricultural supply (about 95%) is represented by family agriculture. The equal participation of women to formal agricultural group is indeed fundamental for a sustainable development, considering that it is possible for this groups to experience decision making processes, having so a direct impact on their social and economic empowerment both at community and family levels.

The Ministry of Women's Affairs also developed and launched the National Action Plan for Gender Equality (NAP-GE), 2006-10 to promote the implementation of Ethiopia's commitment to the Beijing Platform for Action. The NAP-GE was later included in the Plan for Accelerated and Sustained Development to End Poverty (PASDEP), the governments five year development program. The Ministry also introduced the Women's Change and Development Package in 2007, a principal strategy for the empowerment of women. 2010 the Ministry restructuring resulted in the establishment of the Ministry of Women, Children and Youth Affairs (MoWCYA). The establishment also included an expansion of the mandate which now includes youth and children issues. MoWCYA's new mandate thus required a more holistic approach to address the constraints and opportunities for women, children and youth.

.According to the GTP II the rural development is not only important for improving the living condition of the majority of the Ethiopian population, but also because it can represent the base for agribusiness initiatives able to transform raw material in added value processed products.

An additional critical issue affecting Ethiopian rural areas is the relevant malnutrition level both in terms of lack of calories and micronutrients (iron, vitamin A, zinc, iodine etc.).

Malnutrition causes are several: inadequate nutrition (due to poor level of substance production and/or income, due to lack of nutritional information, due to scarce diet diversification), an inadequate care of the children (due to lack of basic hygienic and medical knowledge), and harsh environment (with insufficient access to drinkable water, to sanitation and to basic medical care).

Furthermore the GTP II is foreseeing to improve the nutritional status of the population: the current *"National Nutrition Programme – NNP II" (2016-2020)* aims at strategically solving the malnutrition problem in the Country, taking into account the multi-dimensional aspect of the nutrition. The document, endorsed by 9 Ethiopian Ministries, focuses on the development of nutrition specific activities such as: micronutrient and protein supply to

strengthen the pregnant women diet, promotion of breast feeding, supply of Vitamin A and Zinc for children diet, measures to tackle acute malnutrition.

The *Moringa Stenopetala* represents solution to the above mentioned problems, considering the rich nutritional properties such as protein and micronutrients like iron and Vitamin. Lack of proteins is one of the main causes of the *Protein Energy Malnutrition (PEM)* chronically affecting children under 5 years old.

2. MORINGA VALUE CHAIN ROLE IN ECONOMIC DEVELOPMENT

From the thirteen species of *Moringaceae* family, *M. oleifera* and *M. stenopetala* are widely cultivated in the tropics. It is a perennial softwood tree with timber of low quality, but which for centuries has been advocated for traditional medicinal and industrial uses[13]. It is already an important crop in India, Ethiopia, the Philippines and the Sudan, and is being grown in West, East and South Africa, tropical Asia, Latin America, the Caribbean, Florida and the Pacific Islands. All parts of the Moringa tree are edible and have long been consumed by humans[14].

The moringa plant is known worldwide for its nutritional and medicinal benefits and industrial uses. Almost every part of the moringa plant has nutritional value. The pod is cooked as a vegetable, fresh or canned. The root can be used as substitute for horseradish. Foliage is eaten as greens, boiled, fried, in soups or for seasoning. Dried leaf powder can be added to any kind of meal as a nutritional supplement. The seed can be roasted and eaten like a peanut. The seeds can be used as a flocculent to clarify water and as a source of non-drying and very stable oil, known as Ben oil. This oil, which was once used for lubricating watches and other delicate machinery, is clear, sweet and odourless, almost never going rancid. It is edible and it is becoming increasingly popular in the cosmetics industry. Leaves and young branches are used as almost all parts of the moringa tree are used for food, oil, fiber, and/or medicine, fodder, water purifying agent.[15] Moringa may also be used in fish and poultry feeds[16].

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[13] *Padayachee & H. Baijnath (2012), An overview of the medicinal importance of Moringaceae, School of Life Sciences, University of KwaZulu-Natal, Private Bag X 54001, Durban, South Africa.Journal of Medicinal Plants Research Vol. 6(48), pp. 5831-5839*

[14] *L.J. Fuglie (Ed.), The Miracle Tree: The Multiple Attributes of Moringa (pp. 45-76). Dakar, Senegal: Church World Service, 2001. Fuglie, L. J. (2001). COMBATING MALNUTRITION WITH MORINGA*

[15] *J.Schneemann (2011), Moringa (stenopelata) production and use for water purification in Ethiopia FINAL REPORT, Commissioned by, ICCO Fair*

[16] *(BMZ, 2013) BMZ, 2013 Moringa Products: Opportunities and Challenges for Mozambique, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Maputo.*

It is a versatile tree where the leaves seeds, flowers, meal, roots, flowers and barks are used for different purposes. Even though the meal, or the so-called "press-cake", which is the byproduct of the seed after the oil extraction, can be used for water purification, animal feed and fertilizer, young pods for human consumption, roots for human consumption as spices and medicine, the back and flowers for medicinal values, the economic importance of moringa are mainly attached the leaves and the seeds for oil production. Moringa was introduced in different parts of Africa to combat malnutrition, and in recent years the commercial value of both the leaves as food supplement and the oil as industrial row material is picking up. Good example is the development of True moringa products from Ghana[17]:

[18]

Figure 1. True Moringa products of Ghana

2.1.POTENTIAL OF MORINGA DEVELOPMENT IN ETHIOPIA

Moringa stenopetala is endemic to Southern Ethiopia, Northern Kenya and Eastern Somalia. It is an agro-forestry tree in the fields; homestead in the rural areas and in small towns, and also growing naturally in riverine and *Acacia-Commiphora* woodland and on rocky ground. The major areas of distribution are in Ethiopia and especially in the SNNPRS region, the plant can be found in the lowlands of the regional state, but the dominant areas are Gamogofa, Derashe valley, Konso, etc.

In Ethiopia the plant is known with different vernacular name: Aleko (Welayeta), Aluko, Halaco, Halako (Gamu), Kallanki (Benninya), Telahu (Tsemay), Haleko, Shelchada (Konso),

[18] *http://wellsummit.org/an-interview-with-emily-cunningham-of-moringa-connect*

Wuame, Mawe (Somale) and as Sheferaw[19](in some part of the country as Amharic reference).

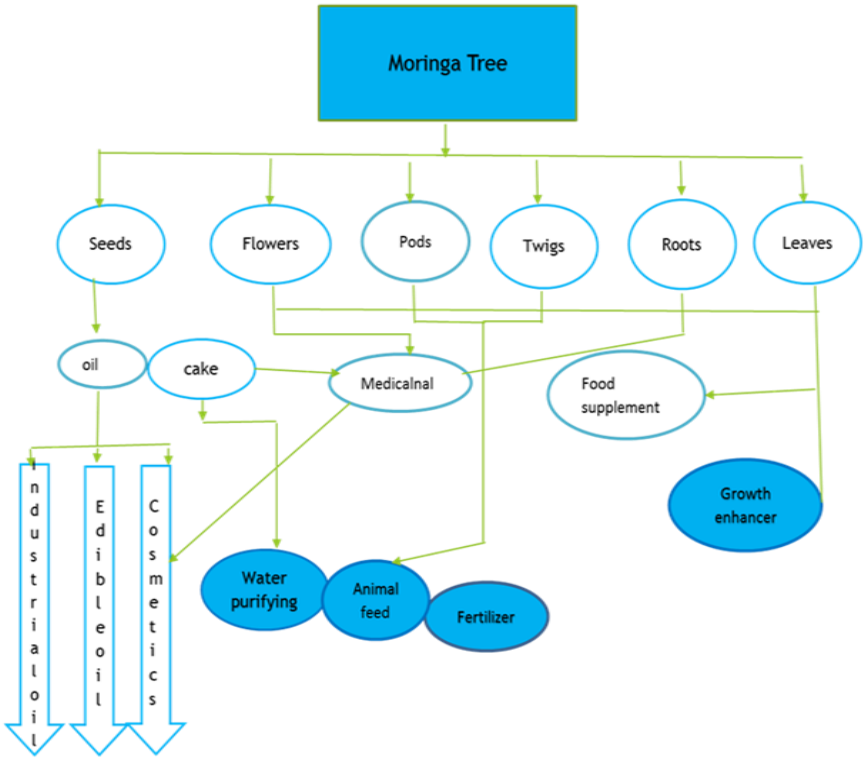

Figure 2. Use of different parts of Moringa Tree

Moringa stenopetala is staple food for millions of people living in the southern part of Ethiopia. Very little commercial production is recorded, farmers are planting moringa tree on the farm and in homestead garden to harvest the leaves for regular family consumption and to supply the local village market. The production can be characterized as informal and scattered, by small farmers and very limited private growers.

The primary production and consumption of moringa in Ethiopia is informal and very little attention is given to the production system and marketing structure and as such it is not even recorded as an important crop/plant/tree in the production and livelihood system of the community.

The recently developed demand of moringa leaves in the urban areas, big cities, of the country is primarily for medicinal purposes. There is a strong believe that moringa tea, moringa leave flex and/ or powder helps to control high blood pressure and blood sugar

[19] *Mekonnen, Y. The multi–purpose Moringa tree: Ethiopia. Examples of the development of pharmaceutical products from medicinal plants. UN Development Program, New York, 2005;(10): 111-115*

level, even though the studies related to this are limited. The demand and consumption in Addis Ababa and other big cities is not studied or recoded, however the products are available with small traditional food vender and bigger supermarkets. Over the last decade, a growing middle class population in Ethiopia, primarily in semi-urban and rural areas has brought about changes in food consumption habit, tastes and lifestyle. Parallel to exotic and imported foods, health and organic traditional products, the demand of moringa products is increasing, and it became one of the products popular with this segment of the society. This current development created business opportunity for the rural farmers, but still the marketing structure is rather small and fragmented. The traders collect from the farmers, dry pack and distribute through different channels.

Individuals from major moringa growing areas are organized in Micro and small enterprises collect leaves and seeds, dry, pack and distribute through different distribution channels. The products are labeled with different benefits and contain, but is has no third party verification of official certification The effort of these entrepreneurs is encouraging and has a potential to create market opportunities to the rural communities if the links are well organized.

The growing population of Ethiopia is recorded to be more that 90 Million, the second highest in Africa next to Nigeria. It is not exaggeration to state that moringa has a big potential to feed millions of people, especially for small children, pregnant and lactating women in the rural areas. The demand of moringa by the urban communities as food supplement and/or medical purposes creates gap between the demand and supply, which will have an impact on the availability of moringa for the homebased food and nutrition security. To avoid the conflict of interest it is appropriate to identify technologies, and production systems that support the improvement of the biomass volume taking into consideration Good Agricultural Practices (GAP). The leaves processing technics should be in line with the sanitation, food safety and quality parameters.

The commercialization of Moringa products in Ethiopia is still very informal and makes it difficult to get reliable information of production volumes and prices. To effectively exploit the existing market potential, the commercialization should become more structured and formalized. Thus, the coordination between producers, wholesalers and retailers should be improved in vertically

Picture 1. Products of Hidase Moringa

Hidase moringa is an association of four young men and women, who has been organized and supported by the Zonal administration to collect, process and market moringa, The group market both moringa tea, cooked moringa food in a small shop in Arba Minch and process the leaves in the unit provided by the Government. The General Manager Ato Asrat reported that there is an international demand for the products, the volume of production is a challenge to penetrate a market link and supply sustainably. Tsehai Moringa is a group of two women, born and grown up in Arba Minch area; they grew up using moringa as staple food and medicinal plant based on the traditional knowledge of the community. Considering the raising demand in the urban areas, they started their small business by collecting the leaves from the farmers' dry, pack and distribute in Addis Ababa in their small shop in Kera and on the bazaars organized by MSEDA even abroad through the informal channel, to the Ethiopian diaspora community.

Picture 2. Products of Tsehai Moringa, trading on Bazars in Addis Ababa.

Picture 3. Products of the Lante Horticulture Marketing Associations

Lante farmers have been supported by the JICA/OVOP project, where 25 farmers organized to process, Mango jam and moringa.

Picture 4. Products of private grower from K Moringa Tea

K. A Plc. is a horticulture development farm where the moringa plantation has been established more than 8 years ago. The promoter introduced both *M.olifera* and *M.stenopetala* with supplementary irrigation. The products are processed on the farm and marketed in Addis in the place called Moringa House.

The use of moringa by the communities, the traditional knowledge and information about the medicinal value of moringa that has been disseminated in an informal way, coupled with the international interest of moringa products, created an opportunity for the development of crop. The current production system of moringa in the regional state is scatted on farm planting and, homestead, garden planting basically for own consumption. Moringa tree is considered the back up the family food supply as green vegetable and supplement for other cereal based food, such as KURKUFA, POSESE etc.

Picture 5. Agro-forestry tree in Derashe Valley

Picture 6. Demonstration of commercial production system/ Arba Minch University

Picture 7. Homestead Tree

For all the uses of the moringa tree discussed in this document,, the importance to the communities day to day consumption, the opportunity of the product development to generate income, the potential of value addition as nutrition supplement and oil processing, there is an urge of the introduction of an intensive production system and development of an integrated value chain to benefit many more stakeholders in the process, as well as the need of a deeper knowledge on the nutritional properties of moringa products. The commercial

production system is almost none existing, except very few such as K moringa tea, and Ethio-agriseft plc. that are distributing moringa tea in different distribution lines in Addis Ababa.

The project intervention area, Gamo Gofa Zone, Arba Minch Wereda, has the potential to demonstrate the intensive production system and processing that can be linked to the existing horticulture producing and marketing cooperatives (e.g. Banana, mango). The different uses, intensification of the production system, processing leaves and moringa seed oil, and entire value chain development will have a significant impact on the rural women and the surrounding communities. The pilot project shall be used as nuclease to demonstrate the value chain beyond the project site, and will have a benefit for the neighboring farmers.

Figure 3. *Current moringa production and processing status process*

2.2. INTERNATIONAL DEMAND OF MORINGA AND MORINGA BASED PRODUCTS

Moringa leaf powder is demanded in the international market as healthy nutritional supplement and falls into the same market category as "green superfoods", such as spirulina, green barley, wheat and alfalfa sprouts. The global nutritional supplement industry has enjoyed a high growth rate in recent years; a trend, which is expected to continue. The largest market for nutritional supplements is the United States of America (USA), followed by Western Europe and Japan, with an affluent middle class willing to invest more in alternative healthy food products.

The market of nutritional supplements in the European Union (EU) is divided into the following three segments: vitamins and minerals; food supplements (sport nutrition, herbs and botanicals); and speciality supplements. Moringa Leaf Powder falls into the category of herbs and botanicals that contain more than 400 substances (BMZ, 2013[20]).

Consumers in developed countries increasingly prefer cosmetics that are from extracts of plants rather than from mineral oils. Therefore, the cosmetics industry started to differentiate its products by using more vegetable oils in the production. This trend triggered a growing international demand, and thereby higher prices, for oils obtained from exotic plants like the moringa tree. Even though the market for exotic oils and fats is still very small, moringa oil is one of the exotic oil identified to have plenty of potential, it is growing at a faster rate than that of traditional vegetable oils. The EU market for moringa oil is heavily influenced by the patent of a US company on cosmetic compositions containing moringa oil. Therefore EU companies are reserved in using moringa oil. Nevertheless, industry sources indicate there is great potential for moringa oil (CBI).[21]

Cosmetics industry uses moringa oil as a very valuable ingredient for face and body cream because of its anti-aging characteristics. Moringa contains 46 antioxidants, by developing obligatory and volunteer quality and standards to indemnify food safety parameters through conformity assessments international niche market can be accesses. International labels, such as Fairtrade, GAP, GMP, organic certification, EDGE certification with secured high quality packaging will be part of the marketing strategy. The promotion of moringa benefits and safety parameters to be developed will create an opportunity for the local farmers and

[20] *BMZ, 2013 Moringa Products: Opportunities and Challenges for Mozambique, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Maputo.*

[21] *CBI, September 2009, Natural ingredients for cosmetics, The EU market for exotic vegetable oils for cosmetics.*

entrepreneurs in the value chain to create businesses. Several African countries, namely: Ghana, Senegal, Sudan, Mozambique, Nigeria, Uganda etc., has number of on-going projects. The production and processing of moringa, in the rural areas are considered to be tools to combat malnutrition, water purification, animal feed and environmental degradation. Initiatives where were at the small farmers level demonstrated potential for to further processing and value addition. University of Pretoria and Cap town, South Africa, is undertaking initiative on moringa as source of biofuel. The current volume of moringa sold internationally is not sufficient to qualify it as a commodity on the global market, and hence the trade statistics for moringa products are only available in an aggregated form. The global market for moringa products is considered substantial, however, with current estimates of over US$4 billion a year[22]

While moringa is used for a wide variety of purposes, two moringa products in particular stand out in terms of their commercial potential: moringa leaf powder and moringa oil as an ingredient for cosmetic products. Following an overall trend on the international market, where natural products have experienced strong market growth over the last decade, demand for these two natural products is strongly growing. Over the past few years, an increasingly large variety of moringa products have spread into many markets and are now available on most health food websites and in many health stores worldwide. Moringa leaf powder is being discovered as a green 'super food' by consumers and is increasingly sold as a dietary supplement, often at premium prices. Interest in and demand for the product is further increased due to a growing number of international organizations that use it as a powerful tool in their global fight against malnutrition. This demand is mainly driven by consumers in developed and emerging economies (particularly the US, Canada and the EU), who are increasingly seeking out dietary supplements and cosmetics derived from natural sources. This segment of the market is especially interested in healthy and nutritious products derived from plants such as moringa. Mainstream cosmetic companies like The L'Oréal Group and its subsidiary brands like The Body Shop, Garnier, and Redken meanwhile, have discovered moringa oil as one of best exotic vegetable oils currently available on the market and have launched various products lines with moringa oil as a key ingredient.[23]

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[22] *Y. Saavedra & E. van der Maden (2015): Opportunities for development of the Moringa sector in Bangladesh Desk-based review of the Moringa value chains in developing countries and end-markets in Europe Yeray Saavedra 1 Edwin van der Maden 1 1 Centre for Development innovation, Wageningen UR*

[23] *Moringa Export Market Potential for Smallholder Farmers In Haiti, Published by Smallholder Farmers Alliance, February, 2015*

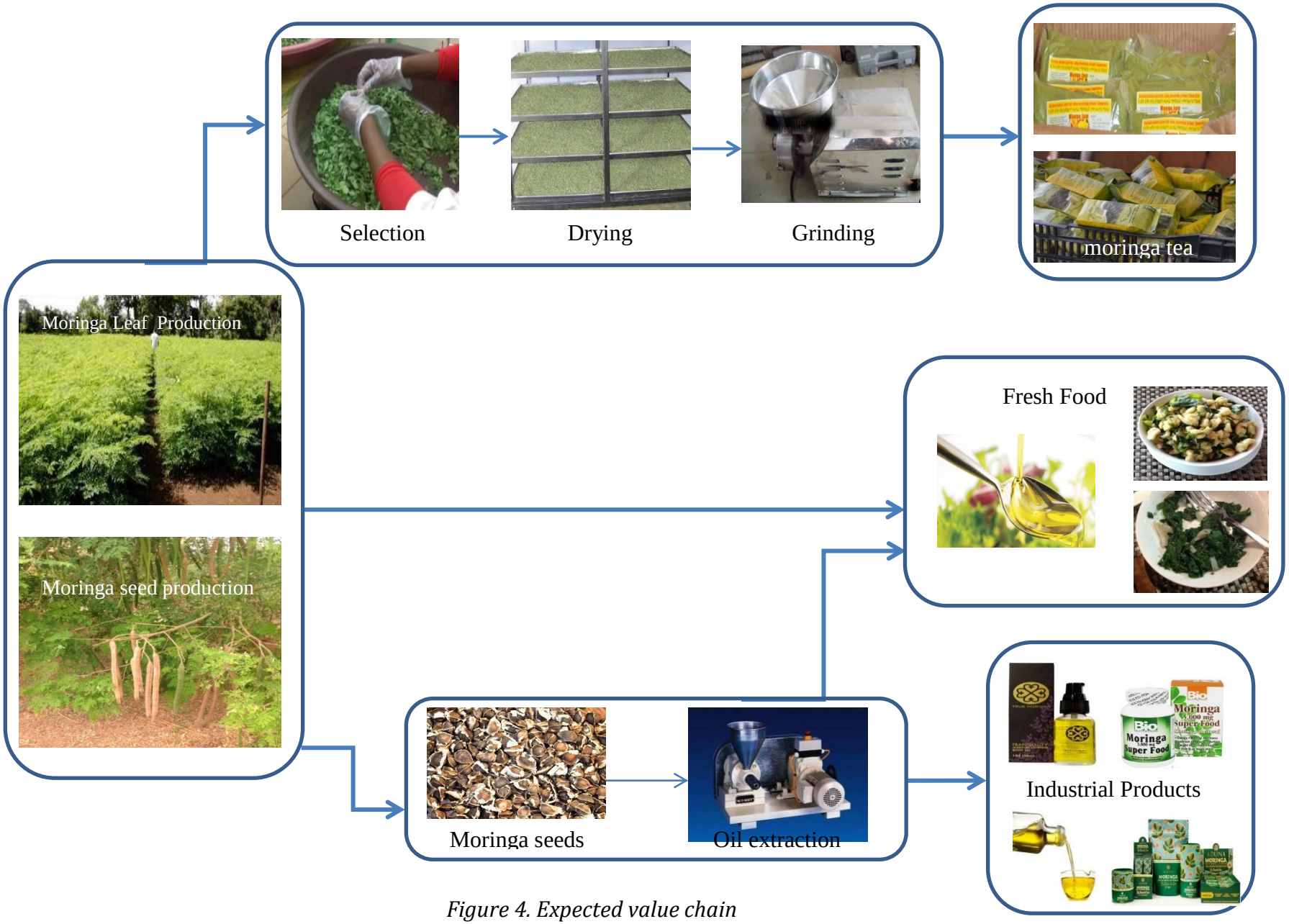


Figure 4. Expected value chain

3. MORINGA DEVELOPMENT OPPORTUNITIES AND CHALLENGES

During this preparatory assessment the following opportunities and challenges were identified:

3.1.OPPORTUNITIES

Moringa Stenopetala is a tree endemic to the southern part of Ethiopia and over 5 million people are using it as staple food and medicinal plant, based on traditional knowledge.[24] The potential of Moringa as multipurpose tree allows expanding its use significantly as it is:

- drought resistant, fast growing tree that grows in marginal area;
- source of food supplement, feed, fodder, edible oil, biofuel and industrial raw material;
- prospective crop to ensure food security and environmental management in arid and semi-arid pastoral or agro-pastoral areas;
- endemic plant that offers international market opportunities and recognition for the community;
- water purifying agent that helps rural people to clean water;
- potential plant to mitigate the issue of climate change- carbon sequestration, carbon trade that contributes to green development.

3.2.CHALLENGES

- non-existent of quality standards and regulatory framework for moringa products;
- lack of capacity with respect to safety, GAP, GMP and regulatory frameworks;
- use of inappropriate technical for production, processing and marketing;
- promoting moringa as medicine without sufficient information and verification;
- disorganized information disseminating infrastructure;
- insufficient knowledge on the values of moringa.

The action plan of the current project initiative is ongoing research and development efforts, including strategies relevant to Moringa Value Chain (MVC). In this regard, one of the challenges identified is the lack of quality and standards parameters of different moringa-based products, with reference to customer protection regulation framework and execution capacity.

[24] *Proceeding of Consultative Workshop on Moringa stenopetala to Maximize Its Potential Uses, (Bishoftu, Ethiopia 2014)*

PART II: THE INCEPTION ANALYSIS OF MORINGA VALUE CHAIN AND PROPOSED ACTIONS

4. THE INCEPTION ANALYSIS of MORINGA VALUE CHAIN and PROPOSED ACTIONS

The Project for the development of Moringa Value Chain (MVC) in rural communities in Ethiopia is the initial pilot (12months) part of the full-fledged project document developed under the title "Establishing Moringa based economic development program to improve the livelihood of rural women of Ethiopia" The objective of this project is to improve the income level of the targeted rural women/communities and their nutritional status in Southern Nations and Nationalities Peoples Regional State (SNNPRS) through the development of the Moringa Value Chain (MVC).

The project has a strong capacity building component for the rural and agrarian communities that will receive training on Moringa production and processing of moringa leaves for food supplement, seeds for oil production and water purifying agent, as well as feed and fodder for animals. These activities will create income generation capacity and business opportunities of rural women farmers, as well as an improved knowledge on the use of the moringa products. As a result of the capacity building process, technical capacity development, training and institutional support programs for the Ethiopia Public Health Institute, SARI and other relevant stakeholders will be encompassed. Furthermore the project will support the entrepreneurs' capacity to market the value added products and to create marketing infrastructures that will develop the private sector.

The project document indicated that the following outputs to be delivered in the initial pilot phase of the project.

1. *A Project Coordination Unit is put in place for a better management of the project initiative in order to achieve the expected results;*
2. *The groups active in the moringa value chain are organized, empowered and linked to the local and regional market;*
3. *A pilot processing line for moringa and moringa based products (i.e. oil, tea and nutraceuticals) is put in place;*
4. *The Ethiopian Public Health Institute is strengthened for undertaking quality certification activities on Moringa based products;*
5. *The nutritional status and income level of the targeted households is improved.*

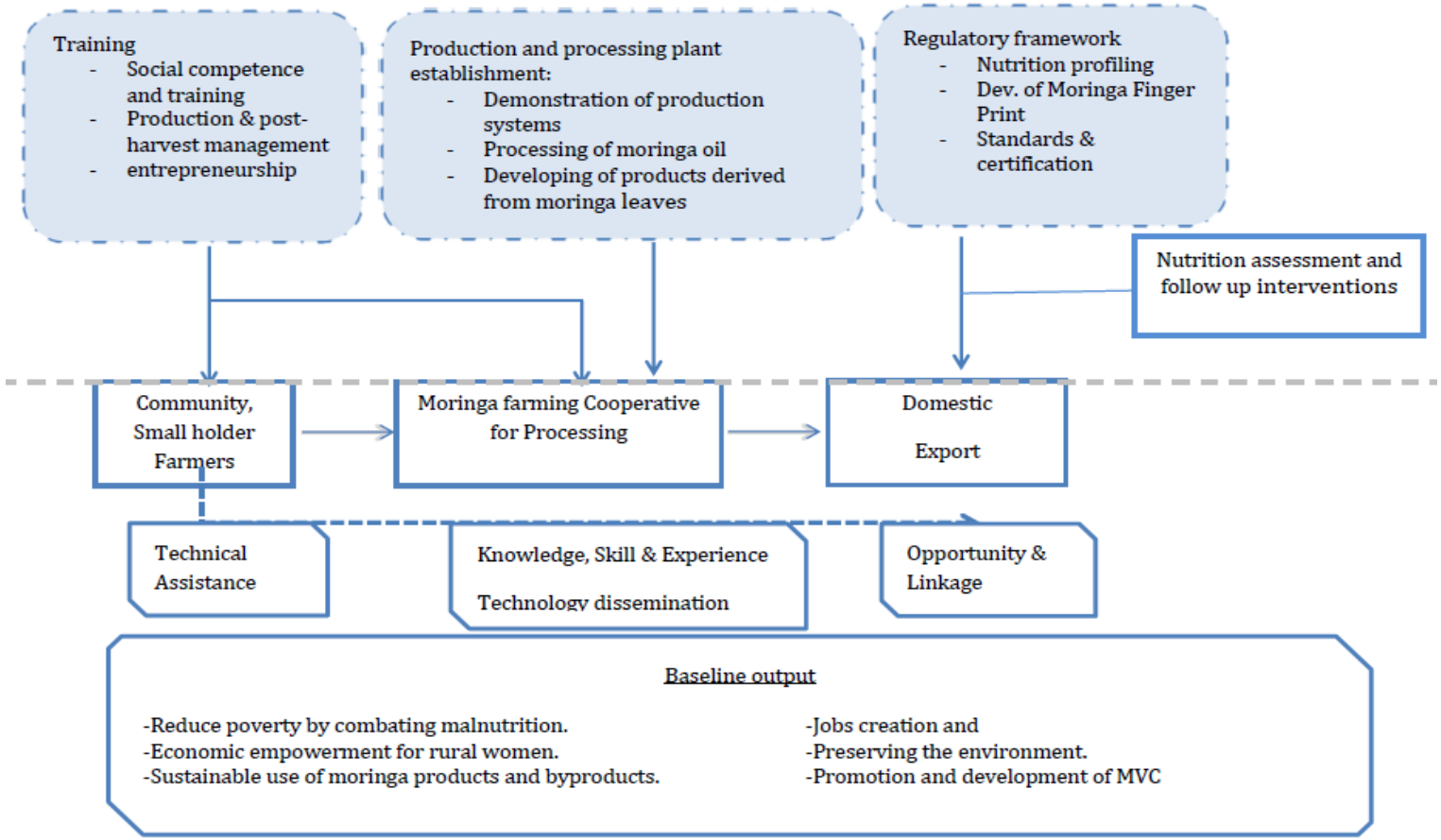


***Figure 5**. Project Planned Outcomes*

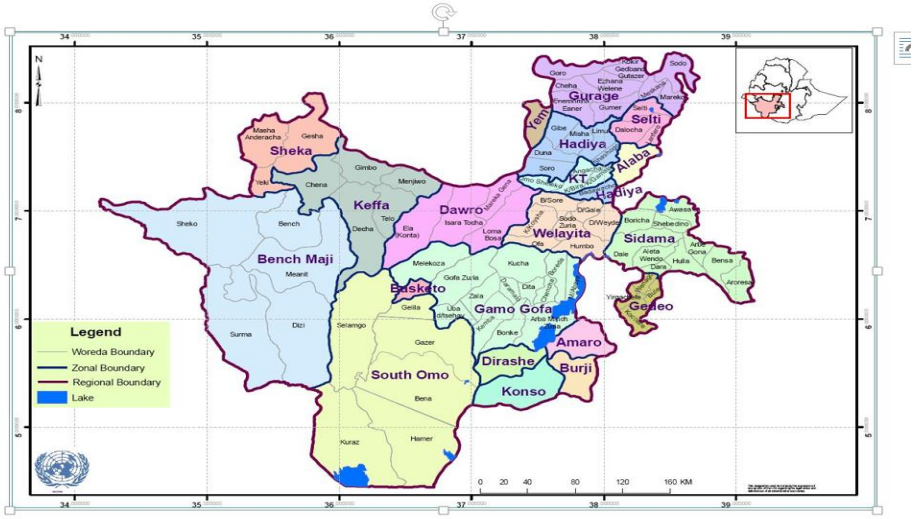
4.1.OBJECTIVE OF THE INCEPTION PHASE

- Profiling the associations, cooperatives, if any, or any other social forms in moringa distribution areas, in order to identify the opportunities and challenges related to the value chain and to prepare an appropriate action plan to mitigate the challenges;
- Surveying on potential project site, taking into account production potential, communities' awareness and status of the women group that can be involved in moringa production and processing in order to create economic empowerment;
- Identifying the project site, selecting the appropriate technology and infrastructure in order to develop the value chain and quality assurance;
- Identifying the area of intervention regarding the nutrient analysis, nutrition profiling, of different moringa products, to ensure quality and certification;

4.2.METHODOLOGY AND ACTIVITIES

Baseline Data of the Moringa Value Chain at Federal and Regional level Southern Nations Nationalities and People Regional State (SNNPRS)

Map of Southern Nations Nationaliteis and Peoples Reginal State



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Map of SNNPRS

[25] *https://www.google.at/search?q=SNNPRS+Map*

The scope of the project is to develop the capacity of the rural communities in the SNNPRs and the Ethiopian Public Health Institute and associated institutes relevant for the assurance of moringa products quality, safety, standards and regulatory framework. In this regards, discussions were held with the Director of Food and Nutrition Research Directorate of the EPHI, experts of the Laboratory, nutrition advisor to the Office of the First Lady and members of the Moringa Task Force.

In the SNNPRS, the stakeholders are represented by SARI as a focal institute for the MVC project. The road map has been prepared with the representative of SARI in order to conduct the assessments at Zone, Woreda and Kebele level.

The data collection information sheet and questioner has been developed with the involvement of the experts involved and the focal person of SARI in order to capture the wider scope of the information relevant to the distribution of resources, community participation and understanding, community development structure, women role in the moringa value chain in the areas of distribution and relevant for the intervention of the project.

To achieve the above objectives the following activities have been planned:

- conduct a detailed baseline studies, assessing the current policy framework and relevant stakeholders' role and participation framework;
- identify specific beneficiaries of the project with due attention to gender equality and empowerment of women;
- develop a monitoring and evaluation system with sex-disaggregated indicators;
- conduct a gender analysis to assess possible opportunities to address gender inequalities identified in the project, as well as to establish a baseline and appropriate sex disaggregated data, to set up an M&E system for the project activities;
- identify the project sites for production and the beneficiary farmers taking into account the economy of scale for the processing unit;
- identify the pilot project site for production and processing initiatives and the target groups training;
- identify the appropriate location for the construction of processing facilities, such as moringa leaves drying, processing and oil extraction units;

- identify the potential of partner institutes, EPHI, FMHACA ESA, to conduct nutrient analysis, nutrition profiling, of different moringa products, to ensure quality and certification.

4.3.PROJECT LOCATION

Gamo Gofa administrative zone is selected as a general project intervention area, considering the distribution of the resource, use and knowledge of moringa by the community. The selection criterion with in the Administrative Zone has been developed with the involvement of the relevant stakeholders at the regional and zonal level.

The criteria considered were:

- *natural distribution of moringa in the area;*
- *potential for improved production system;*
- *communities use and knowledge related to the resource;*
- *proximity to various market outlets;*
- *availability of pilot project site.*

Four woredas were suggested with in Gamo Gofa Zone namely: Arba Minch Zuria, Mirab Abaya, Deramalo and Zala. Extensive field visits were conducted in the above mentioned woredas except Zala. The inception phase has been conducted by a team of experts, socio-economist, GIS and horticulture value chain experts. The team took into consideration the resource availability, interest of the community, understanding of the values and availability of pilot project site.

The team traveled to the three woredas, visited 6 kebeles, for basic ground level assessment, collection of secondary data based on the discussions held with the woreda administrations, kebele leadership and development agents and experts. Sample individual farmers were questioned to elaborate the information related to moringa use, production system and associated traditional knowledge, with in the respective kebeles.

4.4.DATA COLLECTION

4.4.1. Socio-Economic Status of the Selected Project Area

Secondary data collection was undertaken in Zonal, District and Kebele level, government institutions followed by group discussion and individual interview sessions. Secondary data among others comprised of demography and socioeconomic data, crop diversity and relative coverage. Group discussion was also held within community members including high school graduate female and male youths, women and men farmers and agricultural experts. The purpose of the group discussion was to set up the type of beneficiary, set selection criterion,

organization and institutionalization of the beneficiary to ensure the project have the right target or beneficiaries and they are organized in such a way that they have implemented in successful and sustainable mode. Individual Interview session was also held with the intention to characterize the farming communities and their farming system and moringa production, processing and utilization pattern along the value chain. Sex disaggregated data has been collected from 40 small holder farmers in various age, sex and literacy levels.

4.4.2. Nutrition component of the intervention area

4.4.2.1. Nutritional Assessments

Anthropometric measurements, that is weight, height & mid-upper arm circumference, of children under 5 & women 15-49 years of age will be conducted before implementation starts (at baseline) as well as at the end of year one. These assessments would enable us, based on international standards (WHO 2006), to determine the levels of under-nutrition in children, including wasting, stunting, underweight, stature and thinness amongst women aged 15 – 49 years.

While conducting anthropometric measurements, children U5 and women will also undergo clinical assessments, to particularly determine signs & symptoms of (micronutrient) deficiencies such as Goitre (iodine def.), Bitot's spots/ night blindness (vitamin A def.) and pallor (indicating anemia – iron def.).

Finally, biomedical tests will also be performed to determine status of major micronutrients amongst children under 5 & women 15-49 years of age. The major micronutrients (deficiencies) of public health significance in Ethiopia are iodine, iron, vitamin A, and zinc. These biomedical tests would be conducted on a sub-sample of the study population.

All the three assessments above, to determine nutritional status, would be done at baseline and at the end of year one as well as using control groups for comparison.

4.4.2.2. Nutrition interventions in Study area(s)

Most interventions that would be implemented in study areas will be aligned to those in the National Nutrition Program II (NNP II). These interventions, shown below, would be modified based on indigenous knowledge and local wisdom, particularly related to the availability of moringa (& additional income). Furthermore, additional interventions or innovations will be tried and tested using moringa products.

Intervention(s):

- *Social Behaviour Change Communication* (SBCC) – targeting children under 5 and women 15-49 years old. These SBCC messages would focus on adolescent, maternal and infant and young children nutrition, focussing on the use and diversification of moringa and moringa based products, as well as water, sanitation and hygiene (WASH). Guidelines and training materials developed by MOH, customized to the purpose of the project and local context.

- Focus on *the first 1000 days*: For **pregnant & lactating mother** –including monitoring weight gain; iron folic acid supplementation with moringa based products; de-worming; counselling; and WASH.

- For the **child**: Breast feeding promotions and support; complementary food preparation, using moringa in the recipes and demonstration; monthly Growth Monitoring & Promotion.

- *School Health and Nutrition* interventions: nutrition education; de-worming; home grown school feeding program and school gardens promoting moringa planting.

Innovation(s):

- Development of alternative food recipe and food supplements from moringa in different forms (powder, capsule, baby food etc.);

- Alternative recipe development for children and mothers [PLW] – including moringa as part of diversified diet as well as a '*fortificant*' mixed in other staple foods. Clinical trials, randomized control trial, are also needed to determine the minimum/max levels to achieve optimal requirements for children/PLW and avoid potential toxicity;

- Moringa oil can be used as both food and value addition in one's diet. In addition, women could use the oil as raw material for cosmetic purposes – therefore generating (more) income and wealth, which in turn improves women's access to a variety of food sources that improves their nutritional status. For this purpose, use of moringa oil, mentioned above, will be assessed on sub-sample of target women.

a) Assessment of the nutrient content of moringa

Nutrient analysis of different moringa products at different stages of the project is envisaged that, amongst others, the nutritive/ medicinal value following products will be examined using standardized methods:

- Fresh leaves and those cooked as food;
- Fresh leaf extracts;
- Dried leaves – used as tea as well as powder;

- Fresh seeds/ pods – as well as the oil;
- Fresh roots, bark and others as deemed necessary.

The findings from the above analyses will also be compared to nutrient values of commonly consumed local/ national food sources.

Furthermore, as the project progresses, it is intended to use all by-products of moringa (oil cake, etc.) to create improved animal feed and soil improvement.

b) Determining bioavailability of nutrients after consumption

- Several studies have shown that in plant sourced foods, the absorption of different micronutrients are compromised by tannins and phytate, which are also found in these plant foods, including moringa leafs;
- For this purpose, 3-6 months after sustained consumption of moringa products, we will test the bioavailability of micronutrients (particularly iron) in sub-sample of study subjects. Furthermore, methods to minimize the effect of tannins and phytate would be investigated;
- This assessment needs ethical clearance from EPHI/ Ministry of Science & Technology.

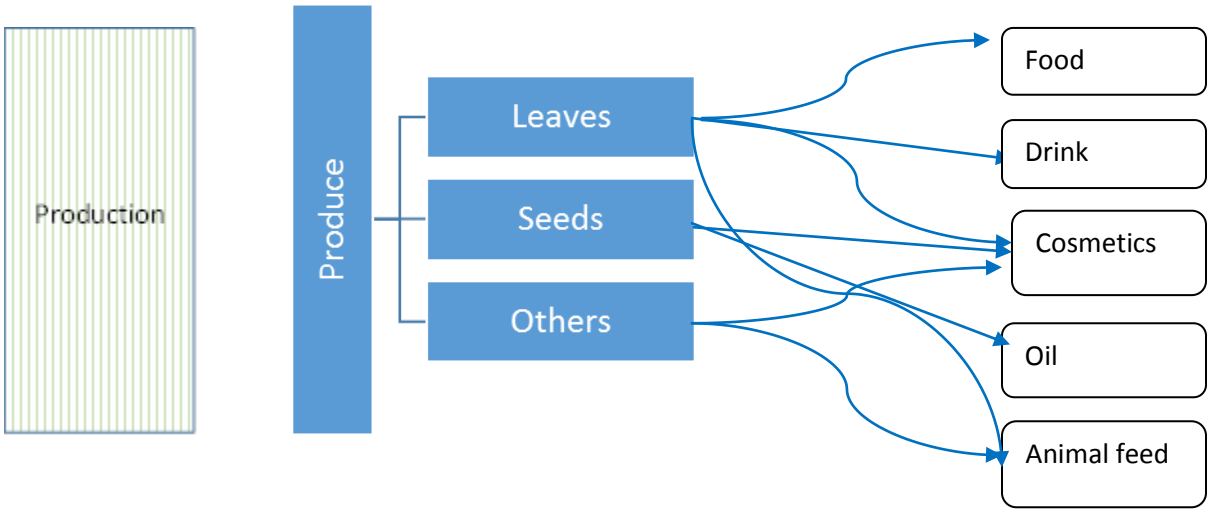
c) Monitoring and evaluation (including process evaluation)

- See assessments above;
- Key Performance Indicators – to be developed after baseline survey is done;
- Process evaluation – what works and why, so as to learn best practices for further scale up. In addition, there are possibilities of undertaking specific focused research as the project unfolds (soliciting external fund).

d) (Potential) Institutions involved in the Moringa Nutrition Partnership

- OFL/MOH – main implementer and overall lead of nutrition component;
- EPHI – National public health and nutrition research institute with in-depth experience;
- Arba-Minch University – locally based, young institution responsible to oversee assessments and implementation;
- Hawassa University – regionally based renowned institution to back-stop Arba-Minch University.

- SNNPR Agriculture Research Institute (SARI)
- Italian National institute of Nutrition
- Other potential partners currently working with the OFL in the area of Nutrition:-
    a. Bill and Melinda Gates Foundation – nutrition & agriculture programs
    b. Children Investment Fund Foundation
    c. University of Wisconsin – already linked/ working with OFLE – to provide technical



4.5.TYPE OF BENEFICIARY AND MEANS OF SELECTION

Identifying the right beneficiary in the very beginning of the project period is an indispensable act for smooth project implementation process, effectiveness and sustainability. Members of the group discussion suggested the type of beneficiaries to be women/ high school graduates and this was substantiated by the fact that these segments of the community face cultural, social and economic marginalization and consequently, they are vulnerable to unemployment, migration, extreme poverty and diseases. Furthermore they have added that some women farmers shall also be engaged with specific and pre stated terms and conditions to add some sort of momentum in terms of management, team spirit and endurance during the project implementation period.

They have suggested that the nomination process shall be very participatory and should be put in effect with the existing government public structure such as '*YeLemat budin & 1-5*[26]' to ensure the participation of the majority of the community. They have added that working collectively or in group is a less practiced scenario in the locality and prior related efforts were less effective. Henceforth, they suggested that a series of training might augment the situation coupled with engaging most appropriate beneficiary mixes in establishing groups or cooperative those are expected to be the future moringa baron. The participants were also seriously considering some compromises in free labor contribution Vs contribution on payment bases in the start of the project period. They tried to rationalize the premises by noting that the proposed target beneficiaries are under extreme poverty and other economic and cultural barriers and this might hinder their full participation.

The beneficiaries 'selection criteria strictly takes into consideration the economic, family status and vulnerability of the women in the area of intervention. It is not always the case that the female household heads are most economically deprived, so all different criteria will be taken into considered.

5. OVERVIEW OF PROJECT LOCATION

5.1.INTRODUCTION

Resource distribution mapping has become a useful tool for storing *spatio*-temporal data for development monitoring and impact evaluation. This assessment was conducted with the intention to understand the environmental settings of the area so as to plan site development propagate collection for nursery activities and seed acquisition potentials for oil extraction, in case it is required to do so in due course of the intervention. Furthermore, the data can also be used to evaluate the short-term and long-term impacts of the project on people's motivation to grow the plant in their private and communal land holdings.

5.2.METHODS OF DATA COLLECTION AND ANALYSIS

Satellite image analysis was coupled with field observation using hand-held Global Positioning System (GPS) to gather spatial data of land use patterns and moringa distribution in selected woredas of Gamo- gofa Zone. In addition, site boundary demarcation was carried out by experts

[26] In Amharic language: Development team of 1team leader and 5 members

of the Investment Department of Gamo Gofa Zone Administration. Furthermore, the boundary demarcation was verified in the field for ensuring that the site doesn't fall on a water logged area or an area that is not accessible for irrigation from the available water sources. Digital elevation model (DEM) data was downloaded from the USGS web portal (http://glovis.usgs.gov/). Slope and other topographic details of the area were generated from the DEM data using ArcGIS software. Attribute data collected during the field observation like number of density of moringa trees were analyzed in MS excel to estimate average value. On the other hand, all the spatial data were set to the spatial reference system of Universal Transverse Mercator (UTM) projection with Zone 37N grid and Adindan datum. Image classification was performed using ERDAS imagine version 2010 software while spatial analysis and mapping were done in ArcGIS version 9.3 application software.

5.3.SITE DESCRIPTION

5.3.1. DESCRIPTION OF ARBA MINCH ZURIA WOREDA

Arba Minch Zuria woreda is one of the resource-rich sites in the country, which is geographically located in the south western part of Ethiopia surrounding Arba Minch town. It is situated to the west of Lake Abaya (at its south end) and Lake Chamo (see Figure 1). Like in many districts of Gamo Gofa Zone, fruits such as banana, mango and papaya are widely produced in Arba Minch Zuria woreda with small-scale irrigation systems.

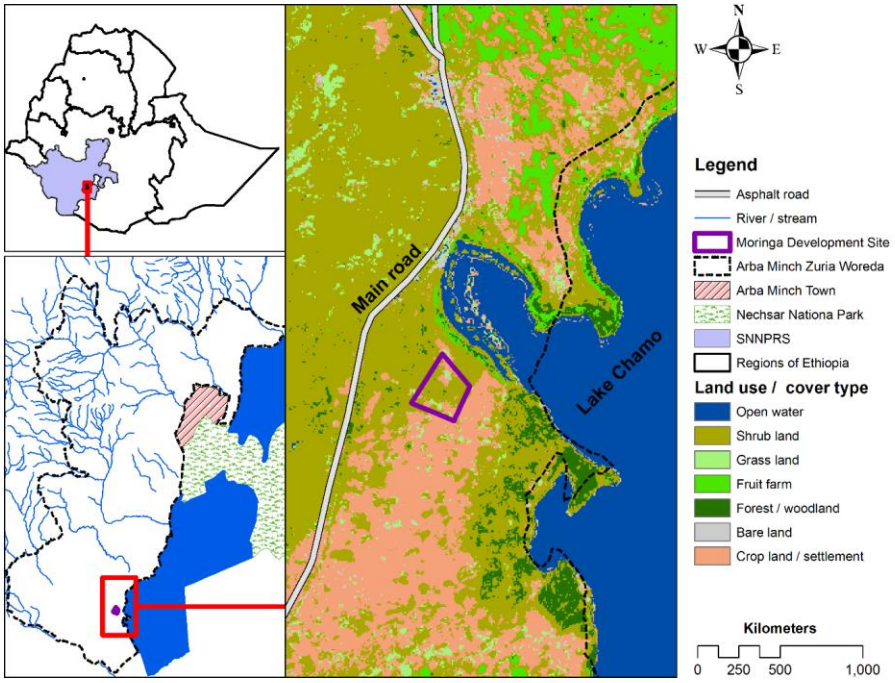


Figure 7: *Location map of the proposed moringa development site*

5.3.2. TERRAIN

The district has undulating topography. The woreda has varied topography as some 20% of the landmass is high steep hills, 60% are medium steep slopes and the remaining 20% are flat plains (Figure 2).

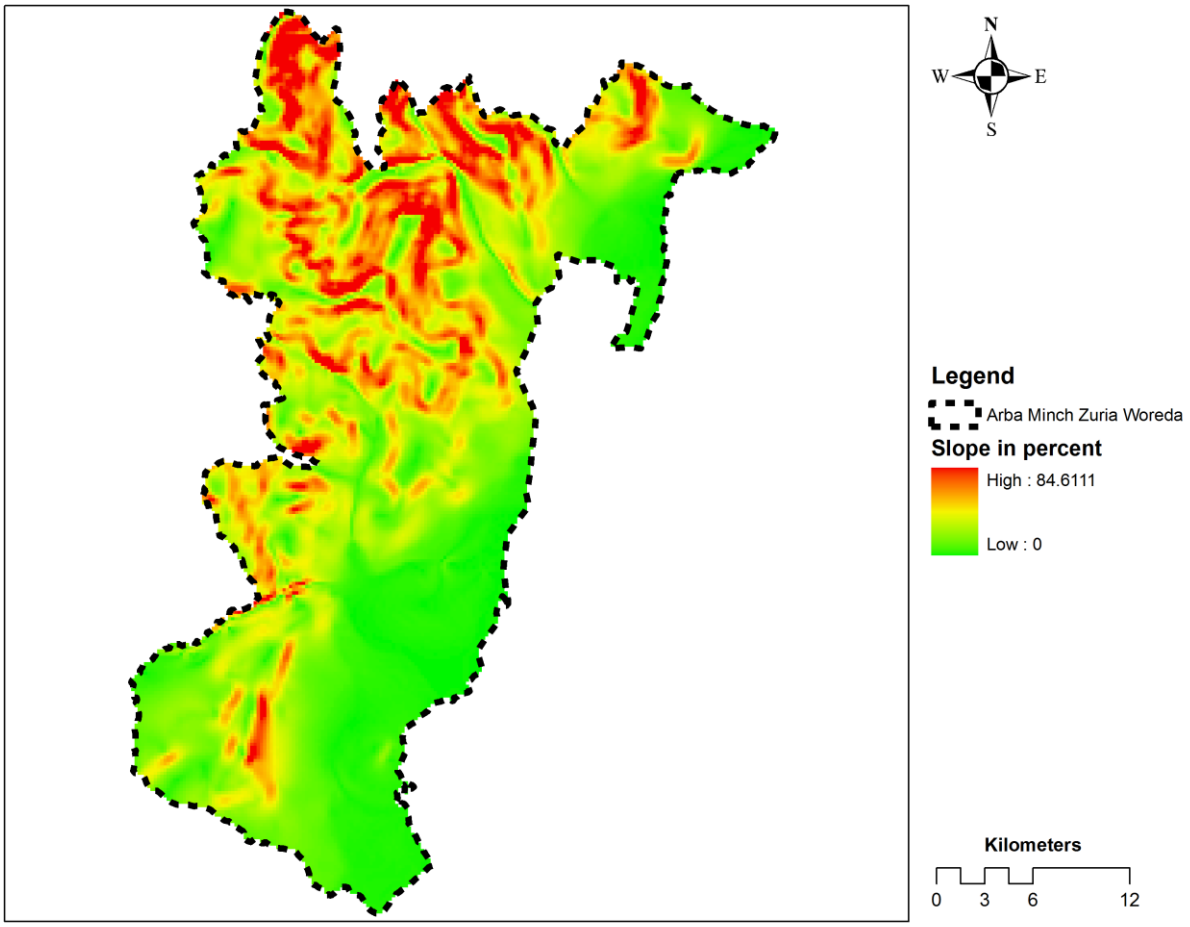


Figure 8: *Terrain configuration of Arba Minch Zuria woreda expressed in terms of slope (%)*

5.3.3. LAND USE/COVER MAPPING

Satellite image analysis shows that a large proportion of the land in Arba Minch Zuria woreda (77.4%) is covered with shrub land and woodland (including forests). These land cover types are dominant on the sloppy hills, which protected the landscape from erosion and other related problems. Field observation revealed that thorny plant species like *Balanites aegyptiaca*, acacia and *Terminalia* species are dominant in the forest landscape.

Furthermore, fruit production is the dominant production use in the woreda, which account for about 10% of the land cover in the district. Annual crop production is practiced at foots of the hills on lands that are not allocated for banana and mango production.

During the field visit, it has been identified some forest-related cooperatives in the woreda that are engaged in collection and processing fruits, moringa powder and tree seeds. Leaves of moringa tree comprise of a major component of the staple food items in the woreda. In addition, some people earn small amount from selling the leaves in local markets.

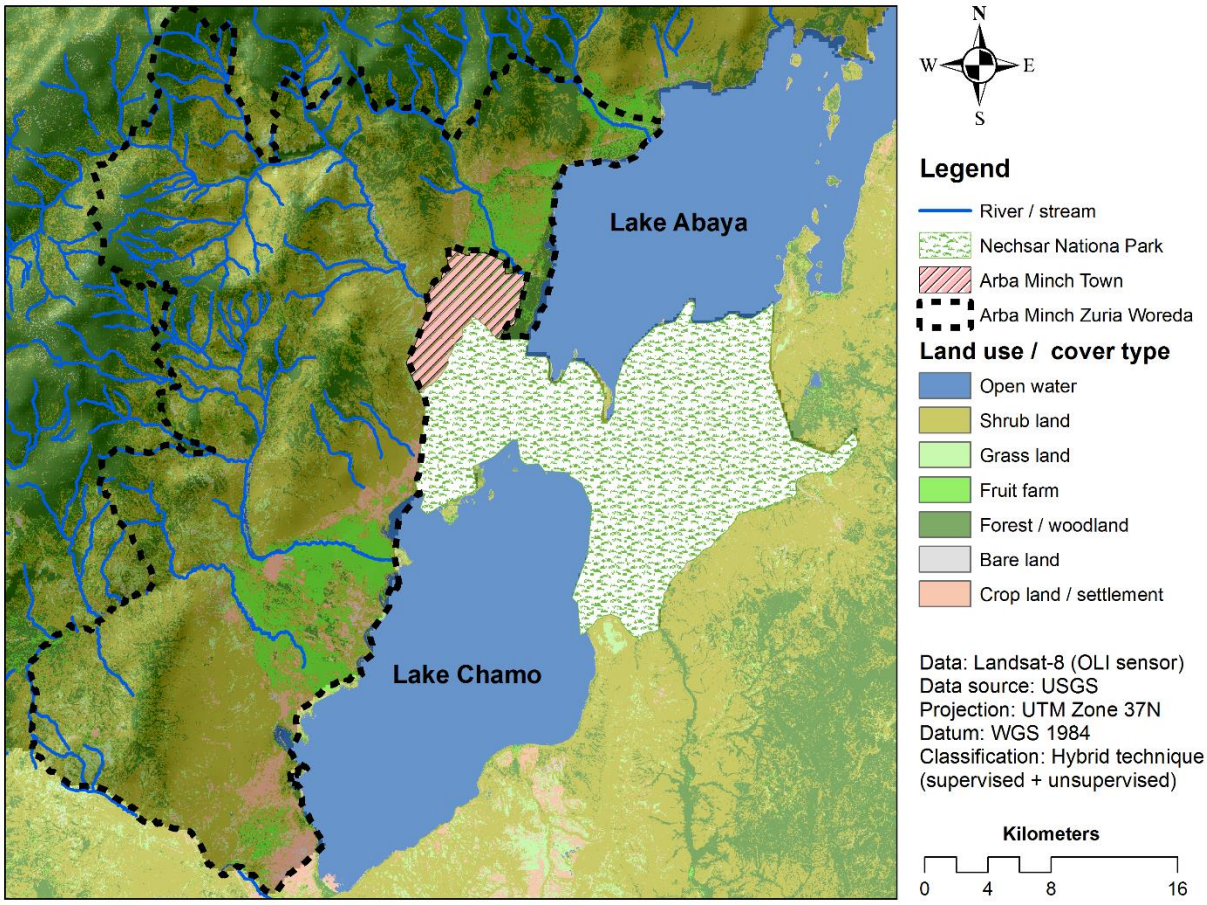


Figure 9. *- Land use / cover map of Arba Minch Zuria Woreda (October 14, 2016)*

Moringa tree is grown on farm lands and within home gardens that are accessible for the female family members to harvest the leaves on daily basis.

Table 1: *Proportion of major land use / cover types in Arba Minch Zuria Woreda (November 2016)*

No.	Land use / cover type	Area in hectare	Proportion (%)
1	Crop land / settlement	4001.5	4.1
2	Bare land	1415.0	1.5
3	Forest / woodland	22577.9	23.3
4	Fruit production	9388.5	9.7
5	Grass land	5909.3	6.1
6	Shrub land	52324.5	54.1
7	Open water	1152.7	1.2
	TOTAL	**96,769.4**	**100%**

A general assessment of the resource base was conducted in three woredas of the zone; namely, Arba Minch Zuria, Merab (West) Abaya and Daramalo woredas. The assessment conducted in Daramalo woreda focused on home garden, limited observation was carried out around farmlands. Hence, the estimate seems on the high side compared to detailed comprehensive data collected from Arba Minch Zuria woreda. The data of Merab (west) Abaya woreda has been limited to the information gathered from local woreda and kebele experts' local experts' guesses, which again overestimated the value.

From remote sensing data analysis, it was found that an estimated 4001.5 hectares of land are under intensive annual crop production and sedentary settlement in Arba Minch Zuria woreda. From the field observation, it was found that the average plant density on agricultural fields was 14.3 plants per hectare. Therefore, the estimated moringa plant population in Arba Minch Zuria woreda was 57,221 trees. About the same amount of plant population is estimated to be found in the other two visited woredas; namely, west Abaya and Daramalo woredas of Gamo Gofa zone.

The existing plant population can serve as source to propagation for the proposed project activities. In addition, it can serve as a field laboratory to demonstrate the diverse benefits of the plant as a component of the agro-forestry system.

***Table 2**: Moringa plant density in studied woredas of Gamo Gofa Zone, Ethiopia*

No.	Place name where estimate was made	Woreda	Plant density (plant
1	Wezeka / Holie	Arba Minch Zuria	14
			12
			13
			6
2	Wezeka / Bikesa		18
			23
	Wezeka average		**14**
3	Daramalo on farm plots / Tilale Kebele	Daramalo	4
4	Daramalo on residential plots / Tilale Kebele		75
5	Daramalo / Dachume [village]		60
	Daramalo average		**46**
6	**West Abaya (average)**	West Abaya	**5**
	Overall average		**22**

Source: Field observation (November 2016)

5.3.4. DESCRIPTION OF THE SELECTED INTERVENTION AREAS

The basic parameters to be taken into account while selecting the pilot project site are; accessibility, proximity to the major road, transport and labor availability, proximity to water sources and history of moringa production and use patterns, and most of all availability of plot of land that will be nucleus, for demonstration the different production and processing technics for the farming communities, and might also have the potential to be future agro-processing training center. The suggested woredas namely; Daramalo, Merab (west) Abaya and Arba Minch Zuria were evaluated by the project expert team and zonal and woreda administration officers and experts taking into account the aforementioned parameters and available data at hand to select the potential site.

With the instruction of the Gamo Gofa Zone Chief Administrator and the involvement and facilitation of the Arba Minch Zuria woreda Administrator, experts at woreda and the land

availability in the suggested areas were evaluated. Taking into account all the above a sites has been suggested and visited for further inspection. Two kebeles, Lante and Wezeka has been identified as suitable area of intervention for MVC project.

5.3.5. LANTE KEBELE

Lante kebele is located 22 km form Arba Minch town at 1267 meters above sea level. The kebele covers about 1600 ha out of which 917 ha is irrigable. The major crops produced are maize, teff, sweet potato, cotton, beans and vegetables form annual crops and the dominant perennial crops are banana and mango. Horticulture production and marketing has important economic value for the area.

The population of Lante kebele is 7479 with the distribution of 3635 male and 3844. 967 house hold, 713 male and 254 female head of house hold with an average of 7,66 head /household. Farmers in Lante kebele, organized under Ochole Lante Kurshato mango jam processing basic cooperatives society has been working in moringa processing and marketing with the support of One Village One Product (OVOP)/ Japan International Cooperation Agency (JICA). One of the potential area identified, for the intervention of the Moring Value Chain project, is Lante kebele. The intervention of OVOP/JICA, benefited 25 members of the cooperative out of which 3 members are women.

In Lante areas considered suitable for the development of the project are all occupied by the farmers or private horticulture developers, the opportunity to find a plot of land r the demonstration pilot was limited. The second option was Wezeka kebele is located about 30 km form Arba Minch close to the main road going from Arba Minch to Konso, accessible, with dry season road, close to Lake Chamo that insures the water availability. It is verified, through the field visit, that the site is not affected by waterlogging. However, absence of settlements close to the specific site may be an issue of future discussion with the project beneficiaries and local administrators.

Map of the proposed project site is shown in the figure below. The site is covered with thorny shrub species of acacias and other plant varieties. It requires human labor and small machinery to clear the site, prepare for proposed development activities.

The water source is accessible from the Lake Chamo at a reasonable distance. Furthermore, key informants, local communities expressed that digging to a depth of less than four meters is sufficient to get enough water for irrigating the site, but this has to be verified be hydrological assessment (Figure 10).

5.3.6. WEZEKA KEBELE

Wezeka Kebele was selected and it is the only location that made 30 hectare of land available for the project. The Kebele has about 7340 total population with 750 households that are male headed and 275 female headed families and average family size of about 7.2 persons per household.

Table 1, presents various crop species cultivated and their relative importance in terms of areal coverage in Wezeka Kebele. The most widely cultivated crops in order of importance in the Kebele among others include: banana, maize, mango, common bean, sesame, papaya, sorghum and avocado.

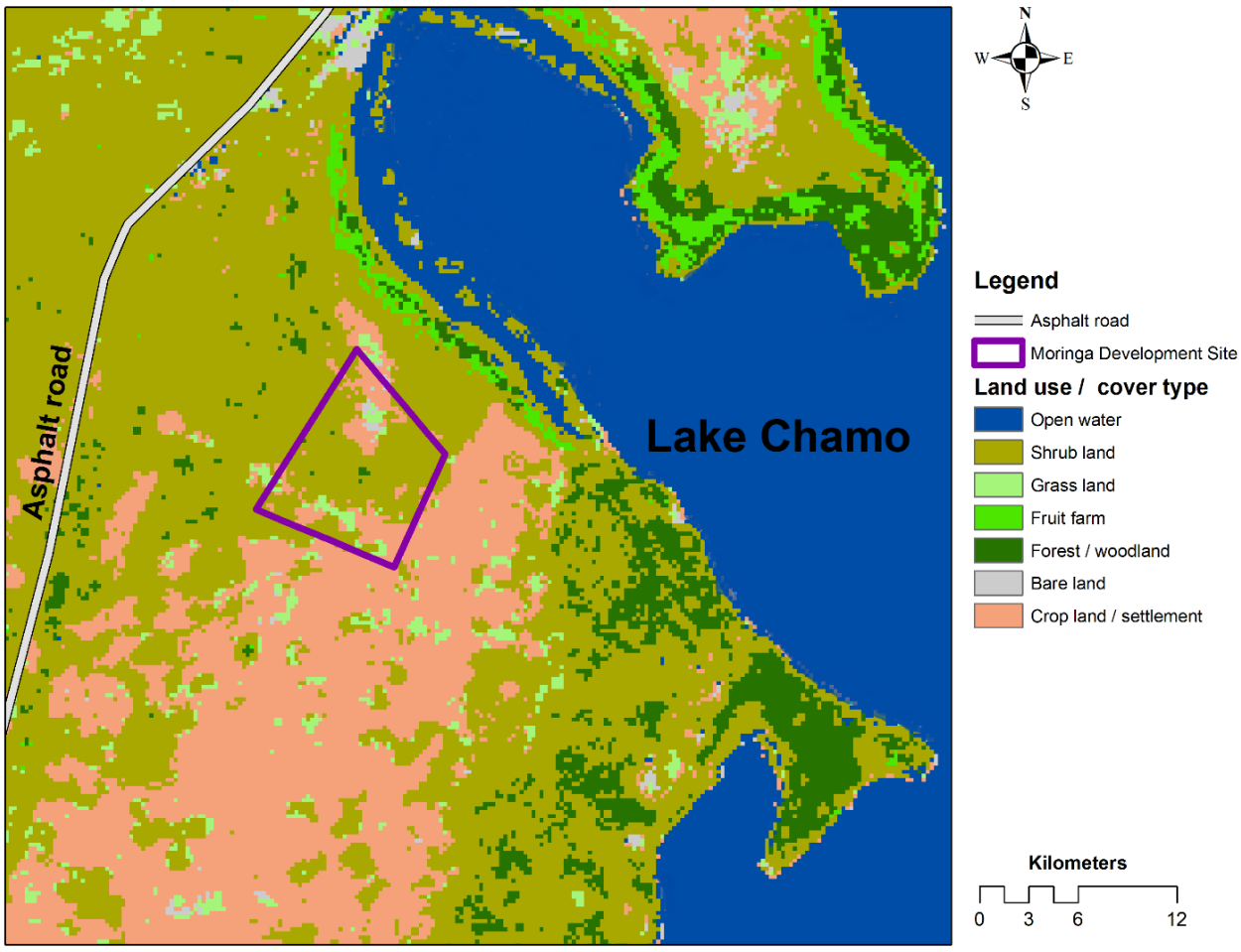


Figure 10: *Detail map of the moringa development site*

Table 3. Species diversity and areal coverage

No	Crop type	Area (ha) covered	Remark
1	Moringa	8.39	
2	Maize	365.75	
3	Sorghum	24	
4	Common bean	78	
5	Mung bean	2.5	
6	Chickpea	2	
7	Sesame	36.5	
8	Banana	1198	
9	Mango	83.5	
10	Avocado	21.5	
11	Papaya	30.5	
12	Orange	16	
13	Lemon	14	
13	Root and tuber	27.5	

6. LOG-FRAME[27]

6.1.LOGFRAME AND AREAS OF THE INTERVENTION

	INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION
General objectives	Contribute to the national poverty reduction and food security strategy as stated in the Growth and Transformation Plan II (GTP II).		Reports from the Kebeles and follow up interviews with farmers and household
Specific objectives	To improve the nutrition and income of the targeted rural women/communities in Southern Nationals and Nationalities and People Regional State (SNNPRS) through the development of the Moringa value chain (MVC).	- Improved nutrition status of the beneficiary, especially children under 5 and pregnant and lactating women by % (Number of families using moringa products specially PLW and children U5 years); - Increase of the income level of the communities.	- Reports of the Kebeles and woreda administration (i.e. Arba Minch Zuria) - Interviews with farmers and household members
Outputs	1. The groups active in the moringa value chain are organized, empowered and linked to the local and regional market; 2. A pilot processing line for moringa and moringa based products is put in place; a) Pilot production and processing unit has been established at the selected project site (Wezeka kebele, ArbaMinch Zuria wereda); b) Moringa based products has been developed (i.e. oil, tea and; nutraceuticals) to improve the nutrition status and income level of the targeted communities. 3. The Ethiopian Public Health Institute, FMHACA and ESA are strengthened to	- Number of cooperatives involved in the MVC activities; - Number of jobs created; - Physical infrastructure established at the project site (production unit and processing plant). - Number (diversity) of products developed; - The infrastructural capacity of the EPHI and associated institutes; - National Standards developed; - One Regulatory Framework.	- Registration document of the Cooperatives. - Designs approved by the Authorities and registration doc. - Reports of the Authorities and UNIDO Office - Published standards and registration manual - Monitoring and evaluation report

[27] *Although in the project document there were 5 outputs, as Output 1 has been completed (Inception Phase and establishement of a PMU), it has been omitted from the LOGframe*

	undertake nutrition profiling, certification, standards development activities on Moringa based products; 4. Food, nutrition and economic status at a targeted household level has been improved.		
Output 1: The groups active in the moringa value chain are organized, empowered and linked to the local and regional market			
Activities	• Organization of the group active in the moringa value chain with particular attention to women component • Implementation of training modules related to moringa value chain • Development of food safety and quality protocol as part of the training module • Development of improved production and demonstration system replicable by the community in Wezeka pilot project site • Selection of suitable technologies for production, harvest, post-harvest and processing of moringa and moringa – based products • Development of beneficiaries' capacity to insure the appropriate use the pilot project site and operation of processing plant • Identification of the appropriate operation frame-work, registration and legalization the modality for the benefit of the communities with regard to the Pilot project infrastructures (out growers scheme, cooperatives etc.) • Registration and legalize the out growers scheme operational modality • Development of feasibility study and business plan to link the beneficiaries with micro-financing institute to establish sustainable businesses		
Output 2: A pilot project unit for moringa and moringa based products is put in place			
a) Pilot production and processing unit has been established at the selected project site (Wezeka kebele, Arba Minch Zuria woreda)			
Activities	• Facilitation of the designing and construction of the processing plant • Selection of suitable technologies for production, harvest, post-harvest handling and processing of moringa • Establishment of the moringa oil processing plant • Designing and setting up moringa leaves post-harvest handling unit, considering the necessary quality and safety parameters, washing, sorting, drying and grinding infrastructures and equipment • Preparing feasibility study on the use of the production unit and the processing plant • Procuring, installation and commissioning of the machineries of the pilot processing plant for the processing and packaging of moringa and moringa based products • Development of food safety and quality protocol as part of the training module • Training selecting beneficiaries on operation and maintenance of the processing line		

b) Moringa and moringa based products (i.e. oil, tea ,powder and; nutraceuticals) has been developed	
Activities	• Development of moringa based food and food supplements with special emphasis on PLW and children under 5 • Development of moringa recipes to diversify food • Capacity development training on moringa oil processing and product development • Development of moringa based food and food supplements with special emphasis on PLW and children under 5
3. The Ethiopian Public Health Institute and other partner (FMHACA, ESA) are strengthened for undertaking quality certification activities on Moringa based products	
Activities	• Preparation of moringa quality control manuals based on international recognized standards; • Strengthening the capacity of EPHI & FMHACA, and its laboratory to be able to conduct nutrition profiling of moringa leaves, develop its finger print and quality analysis of the oil. • Establishment of moringa based products standards. • Establishment of regulatory framework following the national Food, Medicine and Health Administration and Control rules and regulations. • Development of quality and certification mechanize linkage between the regulatory institutes and the beneficiaries • Development of moringa regulatory and inspection manual; • Conducting nutritional assessments using anthropometric measurements; • Determination of minimum/ max levels of moringa consumption to achieve optimal requirements for children/ PLW and avoid potential toxicity
4. Food security of the targeted households is improved	
Activities	• Production of produce derived from moringa leaves, seeds and oil. • Development of moringa recipes to be used as food and nutritious supplement and alternative recipes for pregnant & lactating women and children under 5 years old as well as determine the dosage to meet daily requirements. • Promotion of moringa utilization in household nutrition habits in local communities. • Preparation of promotion material and communication toolkit about moringa value and utilization • Introduction of moringa as animal fodder for the agro pastoralist of the targeted area. • Production of produce derived from moringa leaves, seeds and oil • Development of marketing strategy and introduction of moringa to other suitable areas of the country • Development of moringa recipes to be used as food and nutritious supplement and alternative recipes for pregnant & lactating women and children under 5 years old as well as determine the dosage to meet daily requirements

6.2.Activities and Time frame

THE GROUPS ACTIVE IN THE MORINGA VALUE CHAIN ARE ORGANIZED, EMPOWERED AND LINKED TO THE LOCAL AND REGIONAL MARKET												
	Time Frame											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1. Organization of the group active in the moringa value chain with particular attention to women component.												
Organization of the group active in the moringa value chain with particular attention to women component												
Implementation of training modules related to moringa value chain												
Development of food safety and quality protocol as part of the training module.												
Development of improved production and demonstration system replicable by the community in Wezeka pilot project site												
Selection of suitable technologies for production, harvest, post-harvest and processing of moringa and moringa –based products												
Development of beneficiaries' capacity to insure the appropriate use the pilot project site and operation of processing plant												
Identification of the appropriate operation frame-work, registration and legalization the modality for the benefit of the communities with regard to the Pilot project infrastructures (out growers scheme, cooperatives etc.)												
Development of feasibility study and business plan to link the beneficiaries with micro-												

financing institute to establish sustainable businesses.												
Preparation of a market study to let moringa and moringa based products penetrate the local and domestic markets.												
Output 2: A pilot project unit for moringa and moringa based products is put in place												
a) Pilot production and processing unit has been established at the selected project site (Wezeka kebele, Arba Minch Zuria woreda)												
Selection of suitable technologies for production, harvest, post-harvest handling and processing of moringa												
Designing and setting up moringa leaves post-harvest handling unit, considering the necessary quality and safety parameters, washing, sorting, drying and grinding infrastructures and equipment												
Establishment of the moringa oil processing plant.												
Procuring, installation and commissioning of the machineries of the pilot processing plant for the processing and packaging of moringa and moringa based products												
Development of food safety and quality protocol as part of the training module												
Training selecting beneficiaries on operation and maintenance of the processing line												
b) Moringa and moringa based products (i.e. oil, tea , leaf powder, nutraceuticals) has been developed												
Development of moringa based food and food supplements with special emphasis on PLW and children under 5												
Development of moringa recipes to diversify food												
Capacity development training on moringa oil processing and product development												
Output 3: The Ethiopian Public Health Institute and other partner (FMHACA, ESA) are strengthened for undertaking quality certification activities on Moringa based products												

Strengthening the capacity of EPHI & FMHACA, and its laboratory to be able to conduct nutrition profiling of moringa leaves, develop its finger print and quality analysis of the oil												
Establishment of moringa based products standards												
Preparation of moringa quality control manuals based on international recognized standards												
Establishment of regulatory framework following the national Food, Medicine and Health Administration and Control rules and regulations												
Development of quality and certification mechanize linkage between the regulatory institutes and the beneficiaries												
Development of moringa regulatory and inspection manual												
Conducting nutritional assessments using anthropometric measurements												
Determination of minimum/ max levels of moringa consumption to achieve optimal requirements for children/ PLW and avoid potential toxicity.												
Output 4: Food security of the targeted households is improved												
Production of produce derived from moringa leaves, seeds and oil												
Development of moringa recipes to be used as food and nutritious supplement and alternative recipes for pregnant & lactating women and children under 5 years old, as well as determine the dosage to meet daily requirements												

Promotion of moringa utilization in household nutrition habits in local communities												
Preparation of promotion material and communication toolkit about moringa value and utilization												
Introduction of moringa as animal fodder for the agro pastoralist of the targeted area												
Production of produce derived from moringa leaves, seeds and oil												
Development of marketing strategy and introduction of moringa to other suitable areas of the country												

7. Project budget

Budget Line	Description	Unit Cost €	Units	Total Costs
11:00	CTA Technical Adviser	14,000	10	140,000
17:00	National Project Coordinator	3,000	12	36,000
17:00	Project Assistant	2,500	12	30,000
13:00	Support Personnel (Secretary – Driver)	1,500	24	36,000
11:00	International Consultant	14,000	4	56,000
	• Nutrition studies	14,000	2	28,000
	• Product development	14,000	2	28,000
	• Gender expert	14,000	2	28,000
17:00	National Consultant (others)	2,500	8	20,000
	• Soil and nutrition analysis	2,500	2	2,500
	• Processing unit design	2,500	2	5,000
	• Nutrition policy expert	2,500	2	5,000
	• Nutrition assessment expert	2,500	2	5,000
	• Food processing & recipe developer			5,000
	• Marketing expert	2,500	2	2,500
	• Non-food products development and marketing	2,500	2	2,500
	• Communication and advocacy	2,500	2	5,000
		2,500	2	2,500
32:00	Project Travel	20,000	1	20,000
16:00	UNIDO staff travel	3,000	3	9,000
33:00	Trainings		-	
	• Production of moringa	25,000	-	25,000
	• Moringa leaf processing and value addition	15,000	-	15,000
	• Moringa oil processing and value addition			
	• Quality control and food safety	10,000	-	10,000
	• Food processing and recipe development			
	• Marketing	10,000	-	10,000
		7.000	-	7,000
		8,000	-	8,000
45:00	Machinaries and equipments including vehicle		-	-
	• Project vehicle	40,000	-	40,000
	• Laboratory equipmets	110,000		110,000
	• Office facilitis and furniturs	9,000	-	9,000
	• Irrigtion and land development equipment	50,000	-	50,000

	• Oil processing equipments • Processing facilites • Packing unit • Products development equipment (moringa soap, cream etc.)	8,000 5,000 5,000 3,000	- - 	8,000 5,000 5,000 3,000
	Communication and Promotion	20,000	-	20,000
	Monitoring and Evaluation	25,000	1	25,000
51:00	Miscellaneous	50,000	-	50,000
	SUB-TOTAL			**871,000**
	Support Cost (13%)			113,230
	TOTAL			**984,230**

The budget indicated above covers the first 12 months of the project. The government of Ethiopia contributed to the project, in kind, taking into account the original projection of 5 year. 30 ha of land is allocating for the implementation of the pilot initiative, 2 offices in Arba Minch and Hawassa and a construction of processing unit in Arba Minch Zuria Woreda. The above contribution is estimated to be about 110,000 Euro.

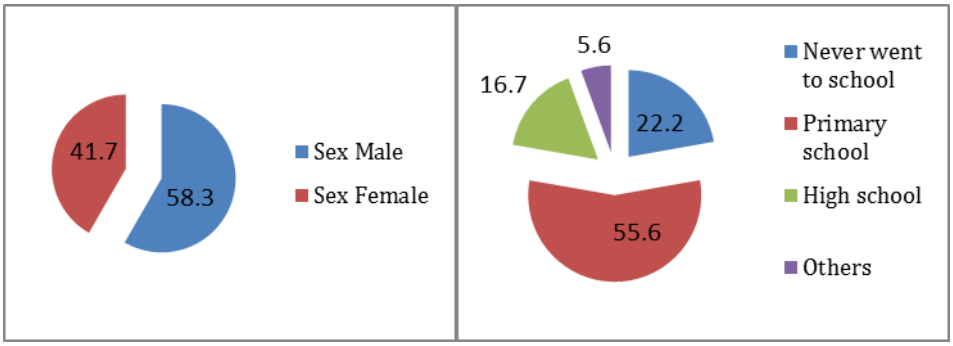
8. ANNEXES

ANNEX I: SOCIO-ECONOMIC STATUS OF THE PILOT PROJECT

a. Distribution of Sample Respondents

Sample respondents that have been inferred for the information contained in this document comprises 58.3 male and 41.7 female. About 22.2 % of sample respondents replied that they have never visited formal education whereas 55.6 and 16.7 % revealed they have attended to a primary and high school level of formal education.

Figure 1. Characteristics of Sample Respondents



Family size characteristics of sample respondents were also assessed and the total family size of sample households were about 7.2 person with about 2.7 adults and 4.5 children within each farm families.

Table 1. Distribution of Sample Respondents by family structure

Family size	Male	Female	Total
Adults living in the household	2.7647	2.6154	2.6901
Children living in the household	4.8824	4.0833	4.4829
Total	7.6471	6.6987	7.173

b. Role of women in income generation and moringa production and marketing

Most of the respondents (77.8%) have confirmed that women have no any contribution in income generation related activities where as 5.6 % respondents reply that they have participated in sale of crops as a means of income generation.

Table 2. Role of women in the family in income generation

	Frequency	Percent
None	28	77.8
Farm activity	3	8.4
Home based work	2	5.6
Marketing of crop	2	5.6

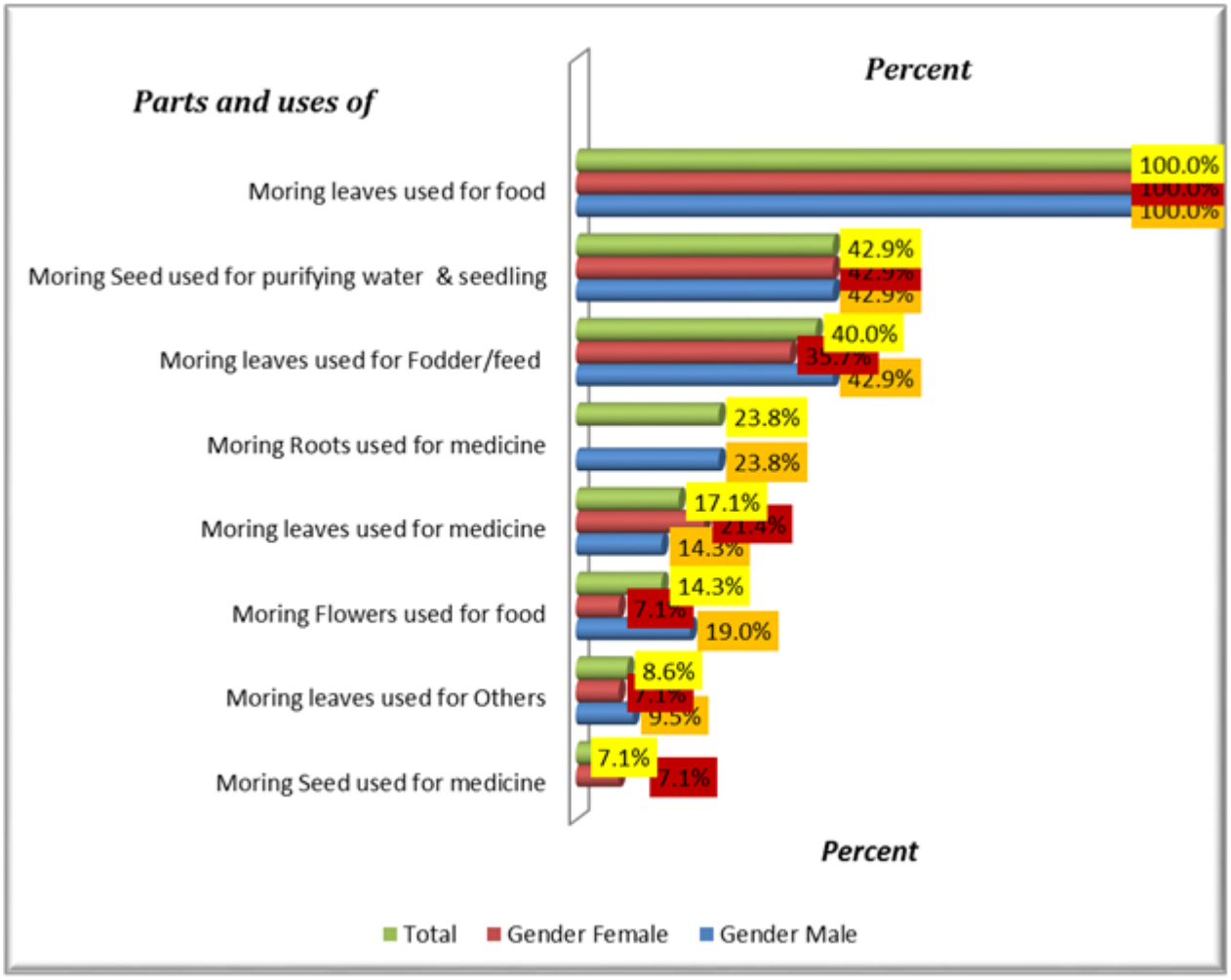
The role of women in moringa production and processing, according to respondents among others comprises of:

- Processing, cooking and moringa related food preparation
- Harvesting
- Moringa management and
- Marketing

c. Farmers uses of Moringa

Sample farmers were asked to reveal uses of different parts of moringa and portrayed in figure 2. According to the results, different parts of moringa are used for various purposes. Moringa Leave is described as it is used for food by 50% respondents. The same proportion of respondents also mentioned moringa leave is being used for medicine. Respondents also described other parts of the plant such as the seed, flower and roots are also being used for medicine, food, feed/fodder, and water purifying purpose (Figure 2).

Figure 2. Parts and uses of Moringa described by Farmers



d. Land use and ownership

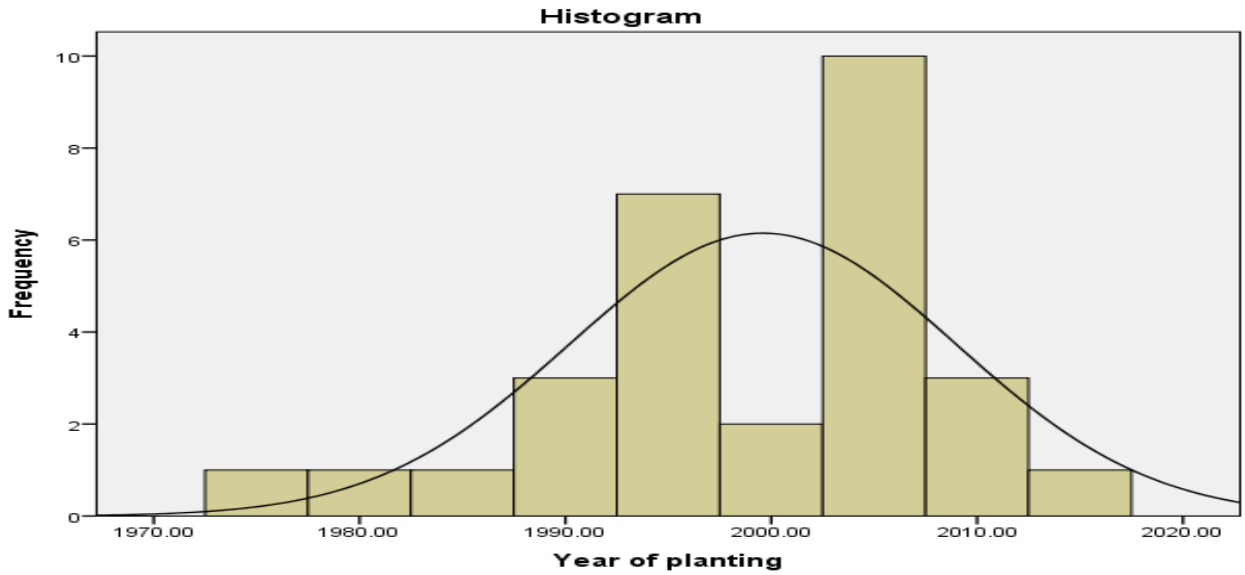
Land tenure status of sample respondents was assessed for both men and women. Results has indicated that more than 97 % of the total respondents confirmed that the type of land ownership is own lands with some disparities within gender differentials (male, 100% and female 87.5%). The total size of the cultivated areas was also estimated about 1.47 hectare (male, 1.60 and female, 1.33) and about an average of 8 moringa plant per household. According to the results, female farmers have less acreage of land and also disfavored in terms of land ownership.

Table 3. Land use and ownership

		Gender		Average total
		Male	Female	
Type of land ownership	Own land	100.0%	85.7%	97.1%
Total size of the cultivated areas (ha)	Mean	1.60	1.33	1.47
Number of Moringa Tree/plants	Mean	8.62	7.50	8.06

Figure 3, Most of the moringa trees counted in the sample respondents' garden are planted between 1990 and 2010 G.C. Some of the trees are as old as 30-40 years of age, as mentioned by respondents.

Figure 3. Years of moringa tree planted



Agricultural inputs used by farm households were assessed and sex disaggregated data on the quantity and values of inputs have been presented in table 4. Results have shown that female farmers tend to use fewer inputs (seed, 0.29 and fertilizer, 1.04) than male farmers (seed, 0.71 and fertilizer, 1.32). The cost of seed and fertilizer has also been quantified and more than 1000 birr for seed and nearly 2000 birr for fertilizer was reportedly expended by small holder farmers.

Table 4. Agricultural inputs

Agricultural inputs used/HHD	Gender	Mean	Std. Dev.
Seeds quantity	Male	.71	.85
	Female	.29	.16
Seeds value	Male	1012.88	741.06
	Female	1011.67	1057.08
Fertilizers quantity	Male	1.32	.54
	Female	1.04	.71
Fertilizers value	Male	2133.50	921.98
	Female	1788.57	371.37
Irrigation Facility (frequency)	Male	40%	
	Female	71.4%	
Irrigation cost/value	Male	290.00	.00
	Female	995.00	814.06

e. Farmers' income level

Producers' monthly net income related to agricultural production (Birr) was estimated for the sample respondents' farm families for women and men headed households. The monthly income of male headed families was calculated as 3212 birr whereas female headed families have been recorded as 2152 birr. Trend of monthly income compared to the past several years also assessed and more than 40 % of respondents confirmed that their monthly income has shown decreasing trend and 37 % pointed out that there is no change related to their income growth. Only 22.2 % regarded their monthly income has shown increasing trend.

Table 5. Producers' income

		Gender		Total
		Male	Female	
Producers monthly net income related to agricultural production (In Birr)	Mean	3212.12	2152.00	3010.19
Trend of this income compared to the last year	Increase	22.7%	20.0%	22.2%
	Stagnation	40.9%	20.0%	37.0%
	Decrease	36.4%	60.0%	40.7%
Have you ever sold moringa	No	100%	100%	100%

f. Producers' role in the value chain and role of moringa in household

According to the results presented in table 5, all respondents revealed they have never been sold any Moringa product. However on average about 9 qt. of Moringa is being produced in sample respondents farm families, more than 2 women family members on average participated in moringa production and processing. All the produce harvested from moringa is being consumed at home. They also added that no one in their villager accustomed to sell moringa and it has been given as gift in any case.

Table 6. Role of moringa in household

	Gender	Mean	Std. Dev.
Yields of moringa produced this year (qt)	Male	9.30	6.12
	Female	8.88	6.35
Yields of moringa produced the last year (qt)	Male	9.74	9.82
	Female	9.90	9.12
Family members under the age of 15 participating in moringa production	Male	1.26	1.81
	Female	1.86	1.07
Family members over the age of 60 participating in moringa production	Male	0.26	0.86
	Female	0.86	1.46
Women family members participating in moringa production	Male	2.04	1.89
	Female	2.29	1.11

g. Agricultural Input access

About 82.4 % of respondents avow they have public access for agricultural input. Nonetheless public agricultural input access for women farmers is still far below the men counterparts. Low access and high price for agricultural input are also mentioned among the prominent bottlenecks for smallholder farmers.

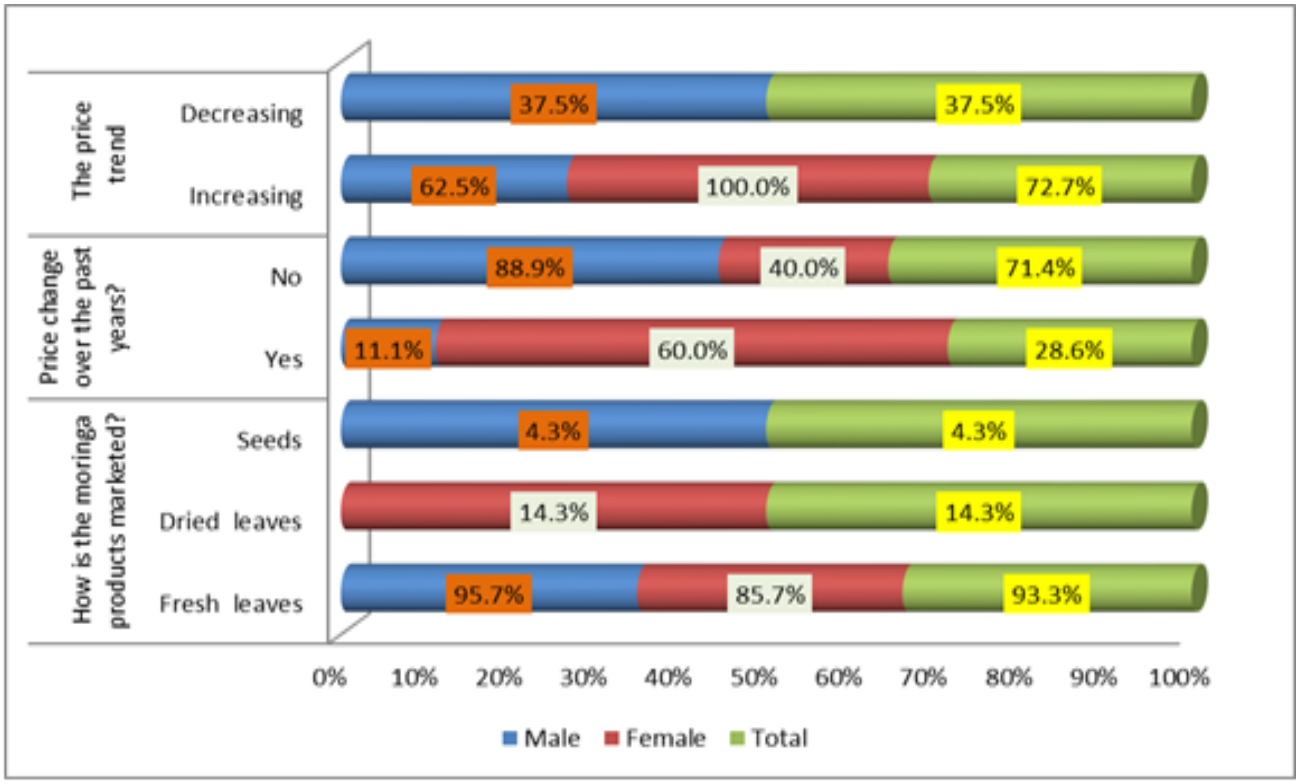
Table 7. Agricultural Input access

		Gender		Total
		Male	Female	
Source of planning material	Own	11.1%	42.9%	17.6%
	Public	88.9%	57.1%	82.4%
Source of agricultural inputs	Own	NA	50.0%	50.0%
	Boa	100.0%	50.0%	88.6%
Difficulties to access supplies	Yes	16.0%	25.0%	17.2%
	No	84.0%	75.0%	82.8%
The main difficulties	Low access	100.0%	87.5%	97.1%
	High price	NA	12.5%	12.5%
How is the moringa products marketed?	Fresh leaves	95.7%	85.7%	93.3%
	Dried leaves	NA	14.3%	14.3%
	Seeds	4.3%	NA	4.3%
Is there price trend over the past years?	Yes	11.1%	60.0%	28.6%
	No	88.9%	40.0%	71.4%

h. Marketing of moringa products

All sample respondents confirmed that they have never been sold any moringa product and they gave as gift and/or some other means. However, 93.3 % of respondents replied that moringa is sold mostly in its fresh leaves, followed by some dried powder (14.3, women respondents) and seeds (4.3%, men respondents) in few instances. Regarding the price of moringa and its trend in the past few years, there is significant difference across women and men respondents. Most women sample respondents (60%) revealed that there has been an increasing price change regarding moringa products. While the proportion of those men respondents to affirm the aforementioned connotation, price change, is far less than reflected by women counterparts.

Figure 4. . Marketing of Moringa products



i. Value of moringa in the household

Moringa tree as accredited by sample respondents (farmers) was cultivated mainly for food value. Moringa tree particularly the fresh leaves plant part is commonly used as food for the family by small holder farmers on average from two to three times each day. Farmers were asked to attribute the various purpose of moringa cultivation and the results have been portrayed in the figure below. Most frequently mentioned (more than 85% respondents) that the crop is important as food supplements, followed by nutrition supplement and medicinal values (Figure 5).

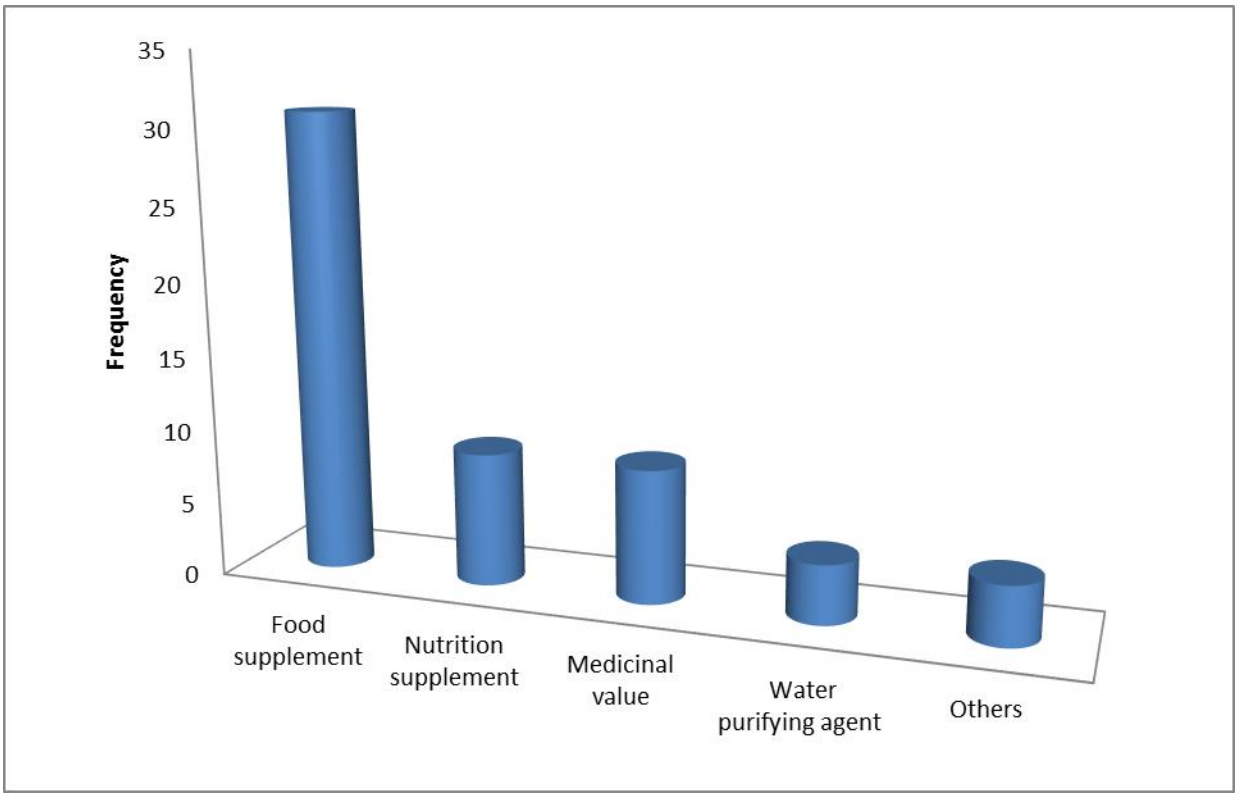


Figure 5. Various uses of moringa plant

Farmers were also asked to elucidate the net income earned and their next plan and aspiration toward moringa cultivation. They noted that they hardly quit cultivating the plant because of its indispensable food and nutritional characteristics. Nonetheless the products have suffered with low price and seasonal demand hampering its production, productivity and supply.

j. Production risks

Sample respondents were asked if there are any production risks such as diseases, pest and climate change observed during the past couple of 3 years. About 58.3 % of the respondent affirmed that there faced diseases and pest problem which has adverse impact and reduced their farm income with an estimated 27.6 % loss on average. The effect of climate change such as Higher temperatures (78.5%) and Rainfall pattern (42.84 %) also posed an impact and negatively affected their agricultural produce with a 32.3 % decline in their gross farm income. Other factors such as conflict and theft also cause negative impact.

Table 9. Production risks

		Gender		Total
		Male	Female	
Occurrence of pest and diseases (during the last 3 years)	Yes	57.9%	60.0%	58.3%
	No	42.1%	40.0%	41.7%
Percentage lost due to diseases	Percent	25.2%	30.0%	27.6%
Impact of climate change: negatively impacting your production this year?	Higher temperatures	65.2%	20.0%	57.1%
	Rainfall pattern	13.0%	60.0%	21.4%
	Both	21.7%	20.0%	21.4%
percentage lost due to natural disasters	Percent	39.6%	25.0%	32.3%
Did you face other losses	Conflicts	25.0%	NA	25.0%
	Thefts	75.0%	100.0%	87.5%

k. Support services

More than 75 % of sample respondents replied that they need technical support for Moringa production (Table 10). Among the more commonly mentioned technical support by sample respondents encompass, processing (100%), crop management (58.4%), harvesting / post-harvest (33.4%) and improving input access and nursery establishment (27.8%).

Table 10. Technical support for Moringa production

		Gender		Total
		Male	Female	
Technical support needed for Moringa production	Yes	76.2%	80.0%	76.9%
	No	23.8%	20.0%	23.1%
Areas of technical support needed technical support	Planting materials	27.8%	NA	27.8%
	Crop management	23.3%	35.1%	58.4%
	Processing	NA	100.0%	100.0%
	Harvesting / post-harvest	33.4%	NA	33.4%
	Crop protection	5.6%	NA	5.6%
	Marketing	5.6%	NA	5.6%

l. Production and marketing structure

During focus group discussion, most farmers reflected that either no or poorly functioning institutions exists in their locality. About 53 % respondents confirmed that one cooperative, mentioned as somehow formal institution, was working toward moringa product processing and marketing. Nonetheless it has been knocked down because of various conflicts among members and poor management set up. Furthermore nearly 76.2 of them replied they are not members due to the fact the process engaged only few members of the kebele(23.7%). Majority of the community members, be it men or women, could not access membership and consequently improve their bargaining power. In the group discussion participants highlighted there are few very limited success stories and benefits of cooperative engagements in their locality, didn't show any interest to be engaged or be a cooperative membership.

Table 11. Memberships to a cooperative & external support

		Gender		Total
		Male	Female	
Is there any formal institution related to moringa?	Yes	44.4%	57.1%	47.1%
	No	55.6%	42.9%	52.9%
If yes, are you a member?	Yes	12.5%	60.0%	23.8%
	No	87.5%	40.0%	76.2%
If no, why?	No access	22.2%	25.0%	23.7%
If you are a member of yes, what are the benefits?	Training programs	100.0%	66.6%	83.3%
	Providing resources (land, water...)	NA	33.3%	33.3%
	Providing an access to markets	NA	33.3%	33.3%

Most of small holder farmers participated in various local institutions. Among them are involved, various producers associations, community servicing and Edir (social security) and Equb (local saving), Table 12. Many respondents also reported that they have participated in various producers and social affaire related community services (Table 12).

Table 12. Local institutions as support services

		Gender		Total
		Male	Female	
Participation in local institutions?	Yes	66.67%	71.43%	68.67%
	No	33.33%	28.60%	31.43%
Type of local institution	'Edir'	53.40%	100%	34.60%
	'Ekub'	28.60%	43.80%	36.20%
	Fishery cooperative member	4.70%	NA	4.70%
	Saving association member	NA	12.20%	12.20%
	Security affairs committee	9%	NA	9%
	Youth and women affairs committee	4.70%	NA	4.70%

According to the information regarded from respondent also involved, they have access to clean water (88.9%), electricity of various sources (83.3%), Annex 4.

Table 13. Agricultural inputs

Agricultural inputs used/HHD	Gender	Mean	Std. Dev.
Seeds quantity	Male	.71	.85
	Female	.29	.16
Seeds value	Male	1012.88	741.06
	Female	1011.67	1057.08
Fertilizers quantity	Male	1.32	.54
	Female	1.04	.71
Fertilizers value	Male	2133.50	921.98
	Female	1788.57	371.37
Irrigation Facility (frequency)	Male	40%	
	Female	71.4%	
Irrigation cost/value	Male	290.00	.00
	Female	995.00	814.06

Table 14. . Agricultural Input access

		Gender		Total
		Male	Female	
Source of planning material	Own	11.1%	42.9%	17.6%
	Public	88.9%	57.1%	82.4%
Source of agricultural inputs	Own	NA	50.0%	50.0%
	Boa	100.0%	50.0%	88.6%
Difficulties to access supplies	Yes	16.0%	25.0%	17.2%
	No	84.0%	75.0%	82.8%
The main difficulties	Low access	100.0%	87.5%	97.1%
	High price	NA	12.5%	12.5%
How is the moringa products marketed?	Fresh leaves	95.7%	85.7%	93.3%
	Dried leaves	NA	14.3%	14.3%
	Seeds	4.3%	NA	4.3%
Is there price trend over the past years?	Yes	11.1%	60.0%	28.6%
	No	88.9%	40.0%	71.4%

Table 15. Access to finance

		Gender		Total
		Male	Female	
Do you have a bank account?	Yes	40.0%	21.4%	32.4%
	No	60.0%	78.6%	67.6%
What are your savings for?	Children education/health	16.7%	42.9%	26.3%
	Household improvements	50.0%	71.4%	57.9%
	Farming investments	75.0%	14.3%	52.6%
	Others (feed)	33.3%	NA	33.3%
Monthly income sufficient to cover all your family's monthly expenses?	Always	5.0%	8.3%	6.3%
	Almost each month	15.0%	16.7%	15.6%
	No	80.0%	75.0%	78.1%
Did you borrow money this year?	Yes	15.0%	30.8%	21.2%

From whom borrowed?	No	85.0%	69.2%	78.8%
	Relative	66.7%	50.0%	57.1%
	Others (micro finance	33.3%	NA	33.3%
	Neighbor	NA	50.0%	50.0%
Purpose of funds borrowed	Consumption	NA	25.0%	25.0%
	Investments	50.0%	25.0%	33.3%
	Health	NA	25.0%	25.0%
	Others	50.0%	25.0%	33.3%
Have you ever faced difficulties to reimburse?	Yes	NA	66.7%	66.7%
	No	100.0%	33.3%	66.7%

Table 16. Access to support services

		Gender		Total
		Male	Female	
Do you have access to clean water?	Yes	95.2%	80.0%	88.9%
	No	4.8%	20.0%	11.1%
Access to electricity in your house?	Yes	85.7%	80.0%	83.3%
Access to various energy source	Yes	85.7%	93.3%	88.9%
Type of energy sources!	Electricity	84.6%	41.7%	64.0%
	Engine generator	NA	16.7%	16.7%
	Solar panels	NA	16.7%	16.7%
	Candle Light	7.7%	NA	7.7%
	Biomass/bio-fuel	7.7%	16.7%	12.0%
	others, specify	NA	8.3%	8.3%

m. Resource ownership and access to financial services

		Gender		Total
		Male	Female	
Do you have your own house?	Yes	100.0%	73.3%	88.9%
	No		26.7%	11.1%
If yes, what type of house?	Corrugated iron sheet	61.9%	36.4%	53.1%
	tukul	38.1%	63.6%	46.9%
Does your household include any of	TV	12.5%		8.3%

the following appliances?	Radio	87.5%	100.0%	91.7%
Do you off-farm income?	Yes	28.6%	6.7%	19.4%
	No	71.4%	93.3%	80.6%

		Gender		Total
		Male	Female	
Do you have a bank account?	Yes	40.0%	21.4%	32.4%
	No	60.0%	78.6%	67.6%
What are your savings for?	Children education/health	16.7%	42.9%	26.3%
	Household improvements	50.0%	71.4%	57.9%
	Farming investments	75.0%	14.3%	52.6%
	Others (feed)	33.3%	NA	33.3%
Monthly income sufficient to cover all your family's monthly expenses?	Always	5.0%	8.3%	6.3%
	Almost each month	15.0%	16.7%	15.6%
	No	80.0%	75.0%	78.1%
Did you borrow money this year?	Yes	15.0%	30.8%	21.2%
	No	85.0%	69.2%	78.8%
From whom borrowed?	Relative	66.7%	50.0%	57.1%
	Others (micro finance	33.3%	NA	33.3%
	Neighbor	NA	50.0%	50.0%
Purpose of funds borrowed	Consumption	NA	25.0%	25.0%
	Investments	50.0%	25.0%	33.3%
	Health	NA	25.0%	25.0%
	Others	50.0%	25.0%	33.3%
Have you ever faced difficulties to reimburse?	Yes	NA	66.7%	66.7%
	No	100.0%	33.3%	66.7%

This report concentrates on defining the Project's detailed action plan of the 1st year of the project implementation, aimed at improving the performance of selected stakeholders active in the Moringa value chain, in order to have a positive impact on development of rural women. Furthermore, the project's action plan is aimed at creating positive and success cases all across the Moringa value chain, to be replicated and up-scaled in the following years. The methodology employed for the study concentrated on the following approaches:

Discussions with stakeholders and field visits in SNNPRS; The extensive field mission has been conducted with the aim of surveying the current status of the moringa in Gamo Gofa Zone, identifying the project site and beneficiaries.

ANNEX II: MORINGA VALUE CHAIN

a. Moringa plant character

Growing to a height of almost 10 m, the moringa has grey or pale tanbark that is smooth or slightly coarse. Its trunk reaches a diameter of 20 to 40 cm. Its fruit takes the form of elongated three-sided pods that are 10 to 50 cm in length, which turn brown when ripe and each contain between 12 and 35 round seeds with a semi-permeable brown shell. The shell has three white "wings" that extend from the bottom to the top.

[28]

Figure 6. Edible parts of moringa tree

The two important spp. of *Moringacea* family are *M. Olifera & M. stenopetala.* The two species have morphological, physiological and nutrition contains differences. Never the less both spp. are important sources of nutritious elements, such as vitamins, protein, minerals and antioxidants that are important health factors. Almost all parts of the moringa tree are used for food, oil, fiber, and/or medicine. In the Pacific, the most important products are pods and leaves. Young pods are consumed as a vegetable. Very young pods are fibreless, and can be cooked like string beans. Because the weight is low on very young pods, most commercial production involves larger, more fibrous pods that are used in soups, stews, and curries. The nutritious leaves are eaten in many dishes including soups, stews, and stir fries. In Ethiopia, Moringa is mainly used as food and medicinal plant.[29] The leaves are consumed in different forms[30]. Alike other Asian countries the young pods are not considered for human consumption.

[28] Irénée Modeste Bidima (2016) Production and processing of Moringa, The Pro-Agro Collection is a joint publication by Engineers without Borders, Cameroon (ISF Cameroun) and the Technical Centre for Agricultural and Rural Cooperation (CTA). CTA – P.O. Box 380 – 6700 AJ Wageningen – The Netherlands – www.cta.int EWB Cameroon – P.O. Box 12888 – Yaoundé – Cameroon – www.isf-cameroun.org© CTA and EWB 2016, Cover photo: © Tim Gainey/Alamy, ISBN (CTA): 978-92-9081-599-0

[29] A.Tekle, A. Belay, Kalab Kelem, Meseret W/Yohannes, Behanu Wodajo, Yohannes Tesfaye, Nutritional Profile of *Moringa Stenopetala* Species Samples Collected in Different Places in Ethiopia and their Comparison with *Morniga Oliferea* Species Ethiopian Public Health Institute, Micronutrient Initiative, Ethiopian Institute of Agricultural Research, Addis Ababa, Ethiopia

Moringa Oleifera, "DRUMSTICK TREE, "HORSERADISH TREE" OR THE "MIRACLE TREE"

Most common species grown in many countries, Brown colored seed, with wings, easy to grow in warm weather, grows tall and thin, has evergreen and small and round leaves. Grows very fast *M. Olfeiera* will flower and get seed pod within the first year, 8-12 months. Grows best in warm/tropical weather, Do not perform well in cold weather, but can with stand cold weather better than *Stenopetala*. Leaves fall off and lie dormant when the temperatures drop. Can grow well in bad soil, but glows best in rocky sandy soils, It is drought resistance spp., which the seed cake purifies polluted water.

Moringa stenopetala rare species called as African Moringa which is endemic to Ethiopia. The seeds are long and are cream colored, evergreen larger longer leaves than *m.olifera.* Difficult to grow in a cold environment, prefers dry climate*. M. stenopetala* is part of the bottle tree moringa family, which trunk grows wide like a bottle shape, some say its taste a little better than *M.oleifera,* it grows slower than *m.oleifera* it will take more than a year to flower and set seeds.

Picture 9. Moringa Stenopetal in Gamo Gofa Zone, SNNPRS

b. Moringa Production and Processing

To ensure best results from the production and processing of moringa care should be taken from the selection of site till the end of the value chain. It is fundamental that the production system has to be determined at the beginning, based on the purpose and intention. If the objective is to produce moringa leaves, the intensive biomass production system is the applicable, with dens planting, frequent harvest intensive crop maintains and management. It is fundaments that the seed sources have to be known and certified.

[30] E.Seifu (2014) Actual and Potential Applications of *Moringa stenopetala,* Underutilized Indigenous Vegetable of Southern Ethiopia, Department of Food Science and Technology, Botswana College of Agriculture, Gaborone, Botswana, International Journal of Agricultural and Food Research, ISSN 1929-0969 | Vol. 3 No. 4, pp. 8-19 (2014)

Moringa production

Site selection

Picture 8. Land preparation at Wezeka Nursery

The increased awareness of the multiple uses of moringa leaves for both domestic and industrial purposes is leading to an increased demand for it. This is creating the need to find more efficient ways of producing moringa leaves to meet this demand.

Moringa is basically a tropical crop. It grows best between 25 to 35oC, but will survive up to 48oC. Optimum growing conditions are well drained, sandy and sandy loam soil, it tolerates a pH 5.0-9.0, but the crop performs best in neutral or slightly acidic soil. Moringa does not tolerate prolonged flooding or poorly drained clay soils. Prefers intensive lighting, clear site for better light penetration. Annual precipitation between 250 and 3,000 mm/annum is required; if the precipitation is below 850mm/ annum supplementary irrigation might be required. The suitable altitude is between 500-1900 meters above sea level[31].

Production system, plant population, crop management structure, depends on the final purpose of the production. All parts of moringa are useful; the most economically important parts are the leaves and the seeds. The leaves are the most for the nutrition part used as food, food supplement, feed, fodder etc. The seed oil has very important economic values, used as row material for industries, biofuel and used for human consumption.

- **Intensive monoculture for leaf production**

Intensive monoculture is the best choice for the intensive production of leaves. The plant population can range from 250,000 to 500,000 plats per ha. There are examples that close to 1million plants per ha. The space between the plants must be 20 cm x 20 cm, 15 cm x 15 cm, or 20 cm x 10 cm (i.e. a density of 250,000 to 500,000 plants per ha). Regular paths set 3-4 m to provide access and insure access for crop maintenance and harvest. These intensive systems are suitable for industrial production, although they

[31] *N. A. Kwame, How to Produce Moringa Leaves Efficiently (2006), Workshop, on Moringa et autres végétaux à fort potentiel nutritionnel : Stratégies, normes et marchés pour un meilleur impact sur la nutrition en Afrique. Accra, Ghana, 16-18 novembre 2006, Nkrumah University of Science and Technology, Ghana*

require greater care and more resources for soil management, fertilization and crop protection due to their high density.

- **Semi-intensive monoculture for leaf production**

For small-scale farmers who want to obtain good results with less labor, the suitable production system is semi-intensive production with the spacing between plants between 50 cm and 1 m. This production system provides opportunities to produce both leaves and seeds.

- **Monoculture for seed production**

The spacing between plants is much greater in a monoculture 3 m x 3 m, or 2.5 m x 2.5 m. The seed production system is specialized to produce oil, but it can also be used for others products by intercropping Moringa with other compatible annual crops that are adaptable to alley cropping, such as shade-tolerant leafy vegetables, legumes and herbs. Leaves can also be harvested from the tree crops, however, care should be taken not to jeopardize the growth and development of the tree.

Taking into consideration the objectives of the production system and the capacity of the producer, small holder farmer, commercial producer or farmers cooperatives, and final products it is important to start with the right technic. Moringa requires a well-drained loamy or sandy loam soil for optimal growth, easy and appropriate development and speed of roots, which is necessary for the growth and development of the plant. Land should be slashed where necessary and all unwanted materials removed. If planting density is high, the land must be ploughed and harrowed to a maximum depth of 30 cm. If planting density is low and the plant spacing is greater than 1 m x 1 m, it is better to dig pits and refill them with the soil, ensures good root system penetration without causing too much land erosion, the pits must be 30 to 50 cm deep, 20 to 40 cm wide filled with mix the soil organic fertilizer to insure the best water holding capability of the soil. For the commercial moringa farmers, large scale, it is recommended that soil testing, use of improved seed ensure good returns on investment.

Picture 9. Nursery

For moringa propagate both generative and vegetative propagation technics are applicable (from seeds or mature cuttings (brown wood)

- **Propagation technics**

Purchase or collect seeds from reliable sources, seeds should be viable, clean and disease free. It is advisable not to store the seed for more than a year as risk of losing viability. A kilogram of moringa seeds (with shell) contains about 4000 seeds depending on varieties and seed quality. Seed can be propagated by using plastic containers, on the seedbeds or directly on the field. Direct seeding is advisable for small farmers if the germination rate is high as it is easy to handle. With good quality of seeds, 85% germination is achievable after 12 days of seeding.

Seedbed propagation required serious attention and intensive labor, especially at the time of transplanting the seedlings. Small seedlings of moringa plants are sensitive to transplanting, taproot damage of fragile plants delays the takeoff of the seedlings on the field.

Rinsing of seedlings in containers is expensive as it requires material and labor. With good quality and proportion of soil mixture, well drained, nursery management, good planting material can be established that are easy to transport and less sensitive for transplanting shock. Depending on the temperature seed germinate within 5-12 days.

Direct seeding, care should be taken not to put the seeds very deep (maximum depth of 2 cm), deeper seeding will reduce the germination rate. For small farmers planting as scattered field/agro-forestry planting 2-3 seeds can be placed per pit. If seed sourcing is difficult or expensive single seed can be placed in a pit and wait for two weeks to germinate and replace if fails.

Vegetative propagation using cuttings, matured hardened cuttings of one meter long and at least 4 to 5 cm in diameter can be used for propagation, one third of the stem should be buried in the soil. Plants produced with cuttings will not have a deep root system and will be more sensitive to wind and drought. Cuttings are also more sensitive to termite attacks.

- **Crop management and cultural practices:**

The production system and the purpose defines the plant space and planting density. The intensive planting system ranges from 95,000-1 million plants per ha (Amaglo, 2006)[32]

[32] *(Amaglo, 2006)*

Picture 10. Different production system (intercropping, semi-intensive & intensive leave production)

Seed production: spacing must be much wider for fruit or seed production. Trees must be at least 2.5 m apart. Line and peg; using a 3 x 3 meter triangular pattern for seed-producing farms. This will optimize plant population density.

Shaping the trees: As Moringa tends to produce long branches that grow vertically and produce leaves and fruits only at their extremity, yields will be low if the trees are left to grow naturally. The tree can grow to heights of about 3 to 4 meters in the first year and continue to about 10-12 m thereafter. It is therefore essential to give the trees a good shape when they are young, by enhancing lateral branching thus creating bushy growth.

Picture 11. Pruning and training

Pinching the terminal bud on the central stem is necessary when the tree attains a height of 50 cm to 1 m. This will trigger the growth of lateral branches which must be pinched too. This will promote the growth of many lateral branches, increase yields and reduce the height of the tree. In addition, pinching reduces damage due to heavy winds and makes harvesting much easier.

Pinching can be done with the finger nails as the stems are tender. If the trees are older and pinching was not carried out early enough, the terminal stem can be cut with a sharp tool, just above a node. Cutting in the internodes will cause the rotting of the stem all the way down to the node below the cut, and will give way to diseases and parasites.

Irrigation: Moringa can germinate and grow without irrigation if it is sown/planted during the rainy season. Its tuberous root develops in twenty days and allows young plants to endure drought. However, for optimal growth, it is advisable to irrigate regularly during the first 3 months after seeding. Irrigation is necessary to produce leaves all year round.

Another option is to stop producing during these periods: the trees will shed their leaves but will not die. At the onset of the rains, a good pruning and adding some organic manure will ensure that the trees start producing many new branches and leaves. Any suitable irrigation system can be used e.g. rubber hose, watering can, sprinkler or drippers. Ideally, irrigation should be done in the early morning, night or evening, to reduce evaporation. If water is scarce, mulching or a very superficial weeding will also decrease evaporation.

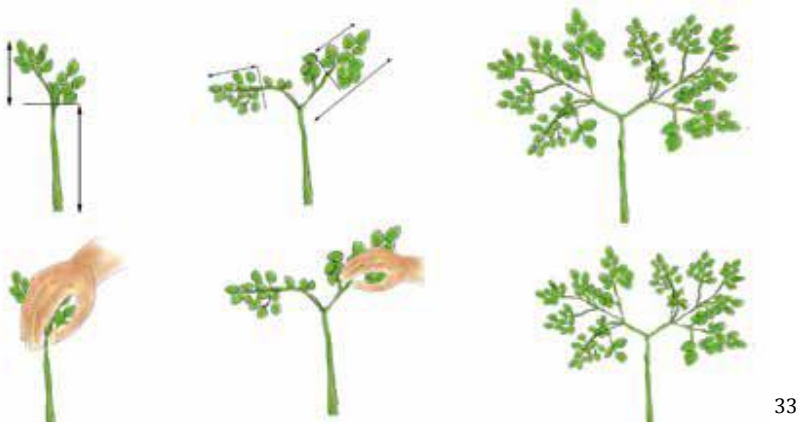
Weeding: must be done regularly to avoid competition for nutrients, especially for nitrogen. If not weeded properly, the trees produce fewer leaves and the leaves at the base of the plant begin to yellow. Weeding must be more frequent when the plantation is young and the trees are small, allowing light to reach the soil. It is advisable to weed an adult plantation at least 4 times a year, with a higher frequency during rain seasons. A good option is to leave the weeds on the soil as a mulch to reduce evaporation and enrich the soil. Burying them is not necessary as tropical soils have a very low capacity to retain minerals over time. It is better to let the weeds progressively enrich the soil as they decompose. Burying plant residues must be especially avoided on sloping terrain, to limit soil erosion. Weeding must be done early enough so that no seeds develop on the weeds. If fruits and seeds are present, weeds must be removed from the field.

Mulching: consists in covering the soil with crop or weed residue to reduce the loss of soil moisture and to minimize irrigation needs during the dry months. This also reduces weed growth.

Fertilizing: Moringa can produce large quantities of leaves, but only if it receives enough organic supplements. Its leaves are rich in proteins and minerals, which means that the soil needs to provide enough nitrogen and minerals to the plants. Instead of chemical fertilizer, farmyard manure (animal dung mixed with plant residue) or compost (plant residue left to decompose on a heap) can provide the necessary nutrients as well as improve the soil structure. The best fertilization is ensured by mixing fast decomposing residue (animal dung, green and soft plant residue) with slow decomposing residue (straw, dry plant residue and thin branches). Fertilization must be

done during land preparation, before seeding. After it is important to apply manure or compost at least once a year, for instance before the rainy season, when the trees are about to start an intense growth period (pruning can also be done at this time). If there are two rainy seasons, two applications are advised.

Pruning: is applicable for semi-intensive, leaf production, mixed leaf and seed producing and seed production system. It helps to reduce the apical dominance, shape the tree to be manageable to maintain, harvest, and insure ventilation and pest control. After the initial pruning to shape the tree maintenance pruning is required, it can be done at each harvest. Unharvested trees during the dry season lose its shape and productivity, before the rains appropriate pruning should take place to insure the biomass production in the season. If the main stem is too thick, terminal branches can be cut down as in the initial pruning. For seed-producing farms, pruning helps induce more fruits, as well as larger fruits. Break the terminal bud when the plant is about one meter high to stimulate branching.



[33]

Figure 7. Formation pruning

Crop protection

Against Insects: the most common pests are grasshoppers, crickets and caterpillars. These insects bite and chew parts of the plant, causing the destruction of leaves, buds, flowers, shoots, fruits and seeds. These outbreaks are frequent in dry zones where moringa leaves strongly attract insects. It seems that these outbreaks occur at the beginning of the dry season when insects cannot find other tender, green material to feed on. The best solution, in this case, is to cut back the trees, leaving no green part apparent. The following growth is very vigorous if conditions permit (sufficient water

[33] *Irénée Modeste Bidima (2016) Production and processing of Moringa, The Pro-Agro Collection is a joint publication by Engineers without Borders, Cameroon (ISF Cameroun) and the Technical Centre for Agricultural and Rural Cooperation (CTA). CTA – P.O. Box 380 – 6700 AJ Wageningen – The Netherlands – www.cta.int EWB Cameroon – P.O. Box 12888 – Yaoundé – Cameroon – www.isf-cameroun.org© CTA and EWB 2016, Cover photo: © Tim Gainey/Alamy, ISBN (CTA): 978-92-9081-599-0*

supply). Concerning the Lepidoptera caterpillar, it is imperative to detect the outbreak at the beginning, at the shoot center, in order to act before it is too late. Spraying must be aimed at the center and the extremity of the shoots to reach the young caterpillars.

In organic farming, Bacillus thuringiensis can be used as biological control system (brand name Batik), it is an insecticide composed of bacteria specific to Lepidoptera larvae, it doesn't have health hazardous effect on humans, wildlife or pollinators. The waiting period before harvesting is only three days. This insecticide is a good alternative to chemical products, is authorized in organic farming and has the advantage of a being a guaranteed preparation. Neem extract can also be used against insects, if it is sprayed in time

Fungal diseases: Disease caused by funguses *Cercospora* spp. *Septoria Lycopersica* are the once economically important on moringa farming, the symptoms are brown spots on the leaves that spread to cover entirely leaf , turning the leaves yellow in savior cases. *Alternaria solani* courses angular, dark-brown spots with concentric circles appear on the leaves, black or brown marks appear on the branches as well. Hard to detect, once the spots have appeared it is often too late to treat and defoliation is inevitable. It is therefore important to remember the periods when the symptoms appeared to be able to act earlier the following season.

The area around the trees, in organic farming, should be kept clear of weeds which are often hosts to diseases. The leaves and young shoots should be checked regularly for symptoms of fungal attacks. An early detection will save a lot of young plants from destruction. Neem leaf or seed extract can be sprayed on the plants to control pest and fungal attacks. This treatment is not as effective as using chemical products. The neem extract should be used as early as possible and sprayed repeatedly. Neem products can be produced locally and are not toxic for humans. The leaf extract is not as effective as the seed extract, but it can be used as well.

c. Harvest and post-harvest handling

Harvesting of shoots and leaves: Moringa leaf is compounded, one leaf comprises of multiple leaf lets. Manual harvesting of shoots and leaves with a pair of shears, a sickle or a sharp knife is recommended. All shoots should be cut at the desired height, i.e. 30 cm to 1 m above ground. Mechanical harvesters could also be used for large-scale, intensive leaf production. It can also be harvested by picking the leaves direct from the tree, the leaves are easily removed at the base of the petiole. With this technic the harvesting is quicker, but not advisable as it jeopardizes the development of biomass benefiting from the appropriate pruning. Produce should be harvested at the coolest time of the day: early morning or late afternoon or evening, with the high level of hygienic consideration, especially if the leaves are used for dried leaves food

supplement. Dew residue of the morning harvests can affect the quality as it can develop mold during transport.

Transportation: is a very critical step in ensuring high quality and safety. Freshly harvested material should be transported to the processing center as quickly as possible to avoid deterioration. Fresh moringa leaves, transported loosely, should be well ventilated. For shorter distances aerated baskets or perforated plastic containers should be used to transport the fresh leaves. Avoid open vehicles. Under no circumstances should people or goods be placed on top of leaves. Transportation should be during the cooler parts of the day: early morning, evening or night. Leaves being transported over long distances should be in air-conditioned or refrigerated vans to keep them cool until delivery at the processing center.

Harvesting of seeds: In seed farms, pods should be harvested as early as possible when they reach maturity, i.e. when they turn brown and dry. Fruits should open easily. Seeds are extracted, bagged, and stored in a dry place. Moringa branches break easily; it is not recommended to climb up the tree to harvest the fruits.

Picture 12. Selecting and sorting

Processing should start immediately after harvesting and transporting the leaves to the processing point.

Stripping the leaflets: Strip all the leaflets from the leaf petiole can be done directly from the branches either directs on the field or after transported to the processing unit. At this stage, diseased and damaged leaves are discarded.

Washing: The striped leaves has to be washed with clean and potable water to remove dirt in order to secure, Wash leaves again in 1% saline solution for 3-5 minutes to remove microbes. Finally wash again in clean water. Leaves are now ready for drying. Drain each trough after each wash: fresh leaves must always be washed with fresh water.

Draining: Strain water from the leaves in buckets that have been perforated, spread leaflets on trays made with food-grade mesh and leave to drain for 15 minutes before taking them to the dryer.

Drying: The leaves must be dried quickly, but not under direct sunlight, to avoid mould growth and degradation of the vitamins by ultraviolet light (UV). The leaflets has to be spread thinly on mesh on racks in a well-ventilated room, secure the circulation of air, keep dust and other contamination to maximize the food safety and sanitation. The leaves must me turned wit clean hands to avoid over lapping and improve uniform drying. The loading on the drying rack should not exceed 1 kg/m2. Leaves should be completely dry within of 4 days, the moisture content should not exceed 10%.

Solar and electrical dried can be used for maximum production and fast process, but the temperature should not exceed 50 degree centigrade.

 [34]

Picture 13.Leaves drying process

Picture 14. Grinding

[34] *http://www.moringanews.org/documents/moringawebEN.pdf*

Good quality leaves dried to the required moisture contain can be grinded using stainless steel mill for maximum quality assurance. Final sorting to remove any remaining stem or unwanted material should follow by milling, sieving in different dimensions, (coarse (1.0 mm – 1.5 mm), fine (0.5 mm – 1.0 mm), very fine (0.2 mm – 0.5 mm)) depending on the purpose and the market. To avoid absorption of moisture and quality deterioration the moringa leaf powder must be packed at the level of 7.5 % of moisture[35].

To insure maximum safety, the personnel involved in the whole post-harvest process and especially finally in the packaging must be in the highest possible level of hygiene and sanitation and use Personal protective equipment (PPE) such as head caps, nose masks, gloves, etc. must be used at all times.

The temperature and humidity must be controlled in the packaging room, to avoid dehumidification of the product. Moringa leaf products should be packaged in clean, dry and opaque containers made of materials that do not affect the quality of the product. Each package must be properly sealed to prevent content leakage as well as moisture absorption.

- **Labeling**

Each package should be marked with the following information:
a) Name of product
b) Net content
c) Name and address of producer
d) Country of origin
e) Lot / batch identification number or code
f) Instructions for use
g) Production date
h) Nutritional information (optional)

d. Moringa Seed product description and application

Moringa seed oil is well-known for its physicochemical properties and used in many industrial applications. The functional properties of moringa oil is edible, the oil extracted using cold press method results pale yellow colour liquid oil at room temperature with palatability and nutty flavour. (Janaki, 2015[36]) It has natural antioxidants which keep it stale.Moringa seed oil is used for cooking, soap

[35] *S.P.Mishra , P. Singh & S. Singh (2012) Processing of Moringa oleifera Leaves for Human Consumption, Moringa Biotech, Institute of Forest Productivity, Academy for Environment and Life Sciences, India Bull. Env. Pharmacol. Life Sci.Volume 2 [1] December 2012: 28- 31*

[36] *(Janaki, 2015)*

manufacturing, cosmetic base and as carrier oil known as Ben oil. Oil is clear, sweet and odourless, never become rancid (Bandarkar, 2013)37). Moringa seed-oil contains natural preservatives and antioxidants which avoid the need of addition of synthetic agents for preservation. Perfume manufacturer esteem the oil for its great power of absorbing and retaining even the most fugitive odours and for its stability. The cosmetics industry values moringa oil for skin moisturizing benefits, which are derived from the fact that moringa seed oil is high in vitamin A and C and unsaturated fatty acids. It contains antiseptic and anti-inflammatory properties, which help heal minor skin complaints such as cuts, burns, insect bites, rashes and scrapes quickly. The oil is highly unsaturated and it is liquid at room temperature with low melting point at 20.5.

To extract moringa seed oil, mechanical cold press, solvent extraction with **n-hexane** and ethanol, and chloroform: methanol extraction methods are applicable. For the best use and quality of moringa oil production, depending on the side capacity, the cold press technic is appropriate. The press can be connected to filters and bottling component.

Picture 15. Oil press machine

- Edible oil,
- Oils for cosmetics and soap,
- Oil-cake as animal feed, fertilizer, water purifying and solid fuel

[37] *(Bandarkar, 2013)*

The edible oil is equivalent in every way to Olive oil with similar health benefits affordable for the local population**.**

Cosmetic oils are used in skin care, massage preparations and pure natural soap is also made from *Moringa* oil. The left over cake have a value as fertilizer water purifying agent and feed. Training the beneficiaries to produce moringa soap, shampoo and detergents is one of the activities envisaged to contribute to the economic empowerment of the rural women.

Picture 16. *Locally produced cosmetics product*

The product development activity will be conducted in collaboration with a private company called Ethiopian Skin Beauty Secret Organic Beauty, owned by an Ethiopian young lady, Yordanos Goushe, Yordanos a trained journalist, who stated that her business is single handed and understands very well the challenges of women as entrepreneurs. She develops her products and business using the traditional knowledge of the communities, she grew up with, coupled with formal training she acquired in Ghana, Accra.

Yordanos is currently operating both in Addis Ababa, Ethiopia, and Ghana, Accra, with four and two distribution shops respectively. She offered her services to conduct the training and to be a potential market out late for the producers in the future. In collaboration with the aforementioned company the selected beneficiaries will be trained in four line of products. It is planned to train 75 women on each line of product, form moringa oil and second grade leaves.

ANNEX III: INSTITUTIONAL SET UP OF THE MORINGA VALUE CHAIN PROJECT

Detailed information was collected in two targeted Regional States from the following Organizations and Institutions.

The project approach is need-based and the sustainability will be guaranteed by integrating the technical assistance into the institutional framework and by maximizing the farmers' benefits from value chain development. The major Institutions involved in the implementation phase of the project are the following:

- Regional Government of the SNNP: will secure the project implementation and sustainability by providing the necessary support and infrastructure. The Regional Governor appointed, since the project formulation, Southern Agricultural Research Institute (SARI) as the technical counterpart and focal institute to link the project to the relevant stakeholders in the Regional. The project office is provided by SARI both in Hawassa and Arba Minch centre premises.
- The Office of the First Lady of the Federal Democratic Republic of Ethiopia: provides the necessary political support the promotion both at Federal and Regional level for the project implementation.
- EPHI (Ethiopian Public Health Institute): is the Institution in charge of the coordination and establishment of quality, safety, standard and regulatory framework in close collaboration with FMHACA & ESA. Setting up the necessary laboratory facilities and conducing the relevant analysis to establish the nutrition profile of moringa and moringa based products, developing moringa finger print etc. EPHI work in collaboration with UNIDO with the aim of guaranteeing the Moringa and Moringa based certification for their easier international recognition.
- Moringa Task Force (MTF) a national team is represented by following institutes:

National Level:

- Ethiopian Public Health Institute (EPHI)
- Ethiopian Environment Development Organization
- AAU (Addis Ababa University), Faculty of Life Science, College of Natural and computational Sciences, Addis Ababa
- AAU, Department of Pharmacology, School of Medicine, College of Health Sciences, Addis Ababa
- Ethiopian Biodiversity Institute (EBI)
- Ethiopian Institute of Agricultural Research
- Community elder from Konso
- Ethiopian Food, Medicine & Health Administration and Control Authority (EFMHACA)

- Horn of Africa Regional Environment Centre and Network Addis Ababa University (HoA-REC&N).

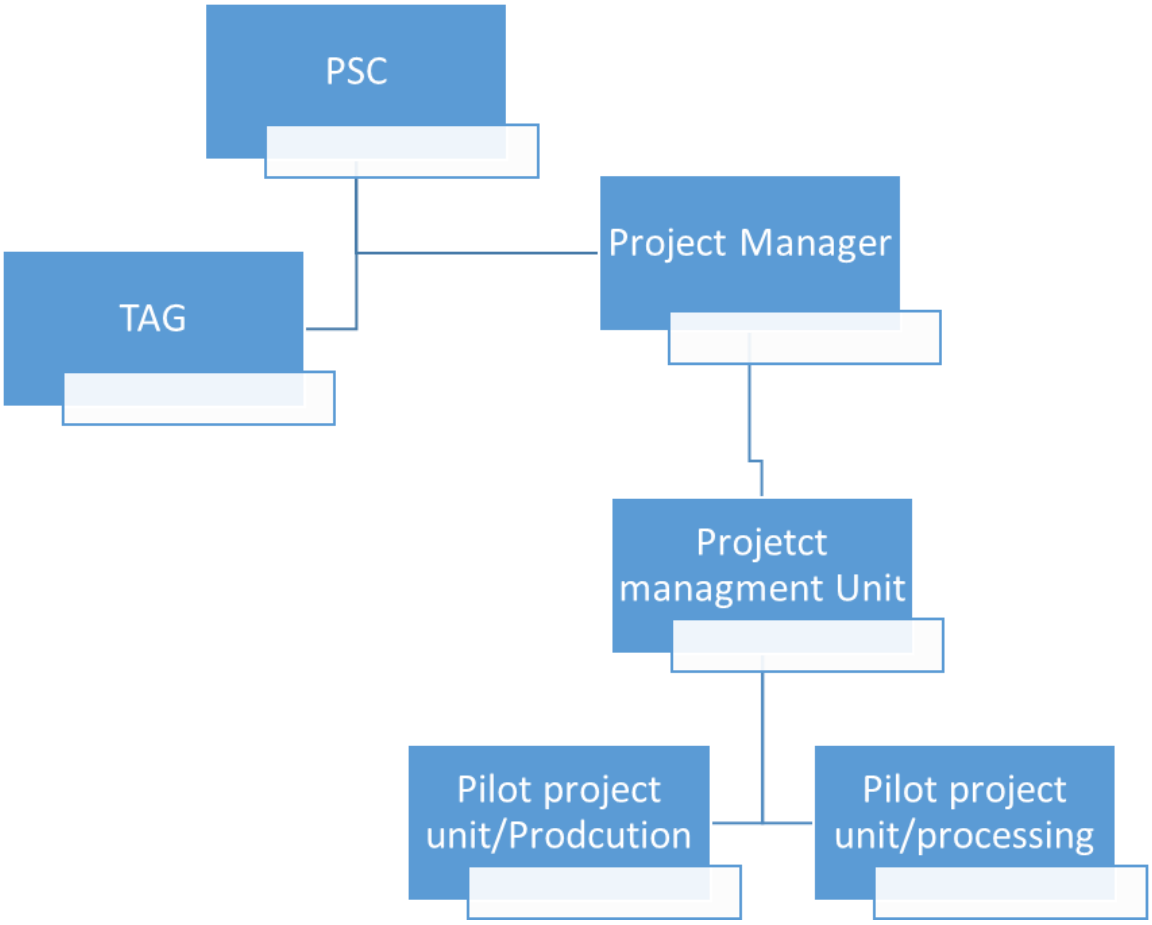
Regional level:

- Arba Minch University (AMU)
- Southern Agricultural Research Institute (SARI)
- Hawassa University
- Natural Resource and Environment Protection Authority (NREPA)
- Agriculture marketing and cooperatives Bureau
- Regional health bureau
- Health and Health related Regulatory Bureau
- Kalehiwot Church
- Global Team for Local Initiatives.

The Task Force is working on a R & D project entitle: "Maximizing the Development and Safe Utilization of *Moringa Stenopetala* (Haleko, Shiferaw) Through Interdisciplinary Investigational Approach". The Task Force is chaired by the EPHI, and the project fund is secured from the Ethiopian Science and Technology Ministry, National Research Grant Fund. The Major stakeholders of the aforementioned projects are partners/stakeholder in the MVC project, it is considered beneficial that the research results and outcomes shall be used as an input to insure the sustainability of the MVC project. As EPHI is the chair institute for the MTF, it is considered beneficial that the activities paned to be conducted the Institute will have synergy with the activities of the MTF and support the mutual efforts.

"Establishing Moringa based economic development program to improve the livelihood of rural women of Ethiopia"

Project management structure and stakeholders



A. TERMS OF REFERENCE FOR THE STEERING COMMITTEE

Background Information

In Ethiopia, the links between agriculture, agro-industry development, active involvement of women, have important implications on fight against malnutrition, poverty reduction, biodiversity conservation and environmental sustainability. In this regard, the aim of this project is to develop the value chain of Moringa, through the strengthening and the connection to the local market of targeted groups (with focus on women) and training/capacity building of key Institutions.

Purpose of Establishing the Steering Committee

The Project Steering Committee is considered to be the highest level of the Project governance structure composed of relevant federal and regional research & development institutes, Italian Agency for Development Cooperation (the donor) and UNIDO etc. It will be chaired by the BOANR of SNNPRS. The purpose of establishing the Steering Committee is to review the progress and obstacles encountered and ultimately suggest solutions. The main functions and responsibilities of the SC will be to:

Overseeing the overall project activities:

a) Provide the project with strategic direction in terms of implementation of the activities;
b) Ensure the effective coordination and cooperation between relevant stakeholders;
c) Monitor the progress towards achieving the planned outputs as well as to review and approve the annual work plans;
d) Guide and direct to resolve problems that might arise at the different level of Project structure during its implementation;
e) Provide policy direction as deemed necessary for the sustainability of the Project;
f) Ensure that the available resources are used to achieve outcomes and output defined in the Project document;
g) Monitor the application of the approved annual action plan of the Project.
h) The SC will hold quarterly meetings: the Project Management Unit (PMU) will act as the secretariat of the SC

Specific Activities of the SC

The SC will receive a detailed progress report of the Project every 3 months, depending on the intensity of implementation as well as on a need to discuss urgent matters, which could affect the Project's life. The UNIDO project team (PMU), in cooperation with the Project Manager, will prepare the report.

This report will include:

a) A description of the activities planned to take place in the reporting period, and results achieved;
b) Explanations on any deviations or delays of activities, which were planned and could not take place, or had to be postponed;

c) A description of all activities planned for the following 3 months, including a projection of results to be achieved, as well as their effect on the overall implementation of the project;
d) Presentation of challenges or obstacles, which need to be brought to the attention of the donor country and the Government of Ethiopia.

The PCU secretariat will distribute an agenda of the meeting prior to the scheduled meeting, (at least 15 days before), as well as other relevant documentation.

Composition of the Steering Committee

It is proposed that the Steering Committee be composed of representative of the following institutions and organizations:

• Ato Tilahun Kebede	Head of the Bureau of Agriculture and Natural Resources
• Ato Anesa Melko	Special Advisor to the President of SNNPR
• Wro Hikma Hayredin	Head of the Bureau of Women and Children Affairs (BOWCA); SNNPR
• Dr. Nigussie Dana	Head of Southern Agricultural Research Institute (SARI)
• Ato Eyob Wate	Head of SNNPR Cooperatives Agency
• Ato Issayas Endrias	Chief Administrator of Arba Minch Zuria woreda
• Ato Ezedin Misbah	Head of Rural Job Opportunity Creation and Development Agency (RJOCDA); SNNPR
• Dr. Tsigereda Kifle	Deputy Director General, Ethiopian Public Health Institute
• TBD	Food Medicine and Health Care Administration and Control Authority (FMHACA)
• Dr. Abrham Olana	Head of the Bureau of Health; SNNPR
• Dr. Getnet Begashaw	Head of the Bureau of Trade and Industry
• Ato Samuel Kekebo	Head of the Environmental Protection and Forestry Authority; SNNPR
• Ato Ashebir Demse	Head of the Department of Agriculture and Natural Resource of Gamo Gofa zone
• Ato Mathios Mentamo	Head of Omo Microfinance Institution
• Tsigereda Tafesse	Program and Communication Advisor Office of the First Lady of the Federal democratic Republic of Ethiopia
• Ginevra Letizia	Director, Italian Agency for Development Cooperation
• Aurelia Calabro/Lemlem Sissay FETENE	Project Manager (and Division Chief PTC/AGR/AIT) and CTA from UNIDO

The Chairperson of the Steering Committee will be Head of the BoANR of SNNPRG. The Steering Committee will have one secretary, i.e. National Project Coordinator of the project.

Meeting Schedule of the Steering Committee

The Steering Committee will meet every 3 months in Hawassa at the premises of BOANR upon availability of its members. The duration of the meeting will depend on the volume of matters to be discussed, but for a maximum of 3 hours.

Financial and administrative arrangements

For participants coming from Addis Ababa and Arba Minch, financial and administrative arrangements will be made in accordance with UNIDO's rules and regulations: a Daily Subsistence Allowance (DSA) at the prevailing UN rate of Birr per day will be paid to the participants from Addis Ababa and Arba Minch. The DSA will cover taxi rent, lodging, and incidentals for the period of attendance, thus for a maximum of two days. If the SC meeting is conducted at the project site the above arrangement shall prevail for members coming from Hawassa.

UNIDO will not assume responsibility for the following expenditures:

a) Cost incurred by the participants with respect to travel insurance, accidental insurance, medical bills and hospitalization fees in connection with their attendance of the meeting,

b) Compensation in the event of illness of the participants in connection with their attendance of the meeting,

c) Loss or damage of personal property of the participants while attending the meeting,

d) Purchase of personal belongings and compensations in the event of damage caused by them, by climatic or other conditions,

e) Travel and any other costs incurred by dependents who might accompany the participants.

f) Participants coming from AA are free to make their own hotel reservation

Language:

The working language of the Meeting will be English.

B. TERMS OF REFERENCE - PROJECT TECHNICAL ADVISORY GROUP

Background:

The "*Moringa based economic development program to improve the livelihood of rural women of Ethiopia*" project is the initiative of UNIDO to fulfil the request of the First Lady of the Federal Democratic Republic of Ethiopia, to support the most vulnerable, rural women, members of the community. The objective of this project is to improve the livelihood of the targeted rural communities/women in Southern Nations and Nationalities Peoples Regional State (SNNPRS) through the development of the Moringa Value Chain (MVC). The project has a strong capacity building component for the rural and agrarian communities that will receive training on Moringa production and processing as food supplement, water purifying agent, as well as feed and fodder for animals and moringa oil. This will improve livestock productivity, income generation capacity and business opportunities of rural women farmers and youth. As a result of the capacity building process, the technical capacity development, as well as the training and institutional support programs for the standardizing the quality product development and consumer protected supply chain. Furthermore the project will support the entrepreneurs' capacity to market the value added products and to create marketing infrastructures to improve the income level of the targeted community members.

Duties:

The composition of the TAG should be multi-disciplinary that contributes to the development of moringa production and processing to improve the livelihood of the rural community, with special emphasis on rural women. The members of the TAG shall cover the agronomy, agro-processing, nutrition, community development, gender mainstreaming, marketing and quality and standards components. The member shall be nominated based on their technical merits and contribution to the Moringa R&D both at national and international level. The nominated TAG members shall volunteer to participate in the TAG.

The role of the TAG is:

- Provide technical support and advice to achieve the project objectives;
- Work closely with the PMU;
- Review the project activities quarterly;
- Advise the Steering Committee on technical issues;
- Guide the project in establishing quality and slandered parameters and structure
- Conduct quarterly meetings in Hawassa, visit the project site as it deems necessary and report to the SC.
- Guide, advise and follow up the sustainability of the project

Composition of Technical Advisory Group (TAG)

- Ato. Getahun Yakob — Southern Agriculture Research Institute
- Ato. Tesfaye Hailu — Ethiopian Public Health Institute (EPHI, MTF)
- Ato. Adamu Belay — Ethiopian Public Health Institute (EPHI)
- Ato. Dawit Dikasso — Food Medicine and Health Care Administration and Control Authority (FMHACA)
- Ato Yilma Mengistu — Ethiopian Standard Agency (ESA)
- Ato. Theophilos Tesfaye — Kalehiwot Church, Arba Minch
- Dr. Simion Shibiru — Arba Minch University
- Dr. Guchie Gule — V/President of Arba Minch University and Director of Social and Research Division
- Dr. Ashebir Balcha — Director of Arba Minch Agricultural Research Centre
- Ato Germame Garuama — Deputy Head/Core Process Owner of the Crop Department of BONAR
- Rosella Belli — Senior Gender Expert
- Dr. Lemlem Sissay FETENE — UNIDO CTA/NPC

Rules and criteria for Technical Advisory Group (TAG) Members

- The TAG members shall meet every three months to review the progress of the project and advise the SC on technical matters;
- The TAG meetings normally shall take place in Hawassa, but it can also be conducted at the pilot project site;
- The Chairperson of the TAG shall be nominated by the SC to serve for 1 year;
- Additional member can be nominated if it deemed necessary;
- TAG members are expected to attend extraordinary meeting and events such as field day other project promotion events;
- The Project National Coordinator shall serve as a secretary of the TAG;
- Agenda must be distributed to all members 2 weeks prior to meeting. Additional items can be added up to 2 days before meeting;

- The SC will give annual feedback to the TAG with regard to minutes, direction and priorities.

Language

The working language of the TAG will be English, all reports and minutes will be submitted in English.

Financial and administrative arrangements

If the meeting of TAG is conducted out of their duty station, financial and administrative arrangements will be made in accordance with UNIDO's rules and regulations: a Daily Subsistence Allowance (DSA) at the prevailing UN rate of Birr per day will be paid to the participants. The DSA will cover taxi rent, lodging, and incidentals for the number of days on mission for the specific purpose of project.

UNIDO will not assume responsibility for the following expenditures:

a) Cost incurred by the participants with respect to travel insurance, accidental insurance, medical bills and hospitalization fees in connection with their attendance of the meeting,

b) Compensation in the event of illness of the participants in connection with their attendance of the meeting,

c) Loss or damage of personal property of the participants while attending the meeting,

d) Purchase of personal belongings and compensations in the event of damage caused by them, by climatic or other conditions,

e) Travel and any other costs incurred by dependents who might accompany the participants.

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