



# FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



## NATURAL RESOURCE PRODUCT SECTOR ANALYSIS – MORINGA, TAMARIND, AND DAWADAWA

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## GHANA AGRICULTURE AND NATURAL RESOURCE MANAGEMENT PROJECT

### NATURAL RESOURCE PRODUCT SECTOR ANALYSIS – MORINGA, TAMARIND, AND DAWADAWA

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Prepared by: TechnoServe

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## ABBREVIATIONS & ACRONYMS

AgNRM	Agriculture and Natural Resource Management Project
BRC	British Retail Consortium
BSCI	Business Social Compliance Initiative
CAGR	Compound Annual Growth Rate
CREMA	Community Resource Management Area
ECOWAS	Economic Commission of West African States
ETI	Ethical Trading Initiative
EU	European Union
FDA	Food and Drugs and Authority
FSSC	Food Safety System Certification
Gh₵	Ghanaian Cedi
GSA	Ghana Standards Authority
ha	Hectare
IFS	International Food Standard
ISO	International Organization for Standardization
kg	Kilogram
MT	Metric ton
MRL	Maximum Residue Levels
NRP	Natural Resource Products
PNDCL	Provisional National Defense Council Law of Ghana
SQF	Safe Quality Food Programme
UER	Upper East Region
USA	United States of America



# EXECUTIVE SUMMARY

Natural resource products (NRPs) have enormous potential to enhance incomes and improve nutrition in developing countries. NRPs are used in many different industries, including food, health, cosmetics, construction, and in Africa, as fuel. Globally, it is estimated that 1 to 1.5 billion people benefit from the sale or use of NRPs.<sup>1</sup> However, in Ghana, NRPs are significantly under-utilized. NRPs generate income for 31 percent of the Ghanaian population, but generate only 10 percent of total household income.<sup>2</sup>

In addition to providing general background information on the NRP sector in Ghana, this report aims to describe the current state of the moringa, tamarind, and dawadawa value chains and analyze their potential. This report also seeks to identify critical pathways that will propel sustainable development of the NRP sector in Ghana, specifically by AgNRM within participating CREMA areas. In undertaking this study, a combination of quantitative and qualitative methodologies of data collection and analysis were used, including focus group discussions, site observations, key informant interviews, structured questionnaire interviews, and a review of relevant literature.

Moringa is a vegetable plant that produces edible leaves that are rich in protein; calcium; iron; the nine essential amino acids; and Vitamins A, B, and C. Moringa is used in cosmetics and health products. In 2016, global trade in moringa products was estimated at US\$4.5 billion and is projected to grow to US\$7 billion by 2020 due to its increasing demand in nutritional supplements, snack foods, beverages, and organic personal care products.<sup>3</sup> This indicates a strong potential for exports from countries in the tropics including Ghana. However, the moringa value chain in Ghana is underdeveloped and constrained by subsistence production, disorganized producers, weak access to quality planting material, and lack of technical support. Although a number of processors exist, processed volumes traded on both domestic and export markets are limited. The moringa tree population in the Community Resource Management Areas (CREMAs) is dominated by a young tree population with an average age of less than three years.<sup>4</sup> This means that moringa yields in the CREMAs are anticipated to increase significantly as the trees mature and reach their peak production at around five years. With improved production in the coming years, coupled with investments in replanting, increased volumes in the CREMAs could supply local processors to drive domestic value addition, or tap export markets where premiums are possible for organic and FairTrade products.

Tamarind is an evergreen tree that produces pods containing edible pulp and seeds. The pulp and bark are also used in dyes and polishes. Tamarind is used as a flavoring agent in many cuisines around the world and has a good export potential, especially to Asia and specialty/boutique food shops in Europe and the United States. However, both the export and domestic market for Ghanaian tamarind is underdeveloped. Production levels in Ghana are low, with supply coming almost entirely from wild collection. Currently, the majority of collected tamarind volumes are consumed at home, or traded as raw fruit. With minimal processing, there is limited value addition opportunities. However, the tree population in the CREMAs is considered young at an average of 4-7 years, compared to peak production after trees are fully grown at around 20-30 years.<sup>5</sup> As yields from existing trees in the CREMAs mature, the increased volumes can be used for local processing to supply domestic markets, with an opportunity to explore export markets where premiums are possible for organic and Fairtrade products.

The African locus bean, referred to in Ghana as dawadawa, is a perennial tree legume that produces pods that contain both an edible seed and pulp. The primary product is the dawadawa condiment, a

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<sup>1</sup> Agrawal et al., 2013

<sup>2</sup> Ahenkan & Boon, 2011

<sup>3</sup> See for instance: <https://medium.com/global-entrepreneurship-summit/money-does-grow-on-trees-why-we-invested-in-moringaconnect-774b50cf8d3f>

<sup>4</sup> AgNRM Tree Inventory Survey, 2017

<sup>5</sup> El-Siddig et al., 2006

popular flavoring agent used in soups and stews in northern Ghana. There is currently no visible evidence of export demand for dawadawa and though there is local demand for dawadawa products, it is threatened by inconsistent quality. The value chain is further constrained by an aging tree population, including in the CREMAs. Considering dawadawa's long gestation period of 8-10 years,<sup>6</sup> renewed investment is required to increase future yields and meet demand. With improved processing and a focus on quality standards, dawadawa condiment powder and tea can be promoted to domestic consumers for their nutritional and medicinal properties.

Overall, the study has identified six key findings:

1. Access to official market information on NRPs, especially information on prices, quality requirements, as well as demand and supply are limited. Most available information comes from informal and undocumented sources such as middlemen and local village markets.
2. The market for NRPs is small but growing and is driven by growing domestic demand. In the case of moringa and tamarind, growing global demand may also contribute. As a result, NRP markets in Ghana have experienced increased commercialization with an estimated 79 percent of producers reporting that they now exploit NRPs for commercial purposes.
3. The economic viability of NRPs in the CREMAs will require renewed investment to increase the resource base. While moringa has already been domesticated and has a short gestation period of less than a year, tamarind and dawadawa exist predominantly in the wild and take several years to fruit (approximately 6-8 years for tamarind, and 8-10 for dawadawa).
4. NRP markets are made up of geographically dispersed small producers, who have limited access to processing technology, poor access to credit, and weak access to markets.
5. NRP trade in Ghana is dominated by women. While men are commonly involved in the production, processing, and marketing of moringa, they are rarely involved in the processing and marketing of tamarind or dawadawa. Women, however, play a major role for all three crops.
6. Government regulation in the NRP sector is weak and poorly implemented.

Based on these findings and considering domestic and global trends, the following recommendations are made to strengthen and support the growth of the NRP sector in Ghana.

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<sup>6</sup> Booth, 1988



## Exhibit I: Summary of recommendations for strengthening Ghana's NRP sector

	Moringa	Tamarind	Dawadawa
1 Expand supply	<ul style="list-style-type: none"> <li>• Intensification of existing, planting of new farms</li> <li>• Improve access to quality seed</li> <li>• Outgrower schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborative management and regulatory measures to protect existing tree stock</li> <li>• Farmer-managed natural regeneration</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborative management and regulatory measures to protect existing tree stock</li> <li>• Farmer-managed natural regeneration</li> </ul>
2 Build capacity of producer/collector groups	<ul style="list-style-type: none"> <li>• Build entrepreneurial capacity</li> <li>• Group nurseries, seed, and leaf aggregation</li> <li>• Potential for processing</li> </ul>	<ul style="list-style-type: none"> <li>• Build entrepreneurial capacity</li> <li>• Aggregate produce for sale to domestic markets</li> <li>• Potential for processing</li> </ul>	<ul style="list-style-type: none"> <li>• Build entrepreneurial capacity</li> <li>• Aggregate produce for sale to domestic markets</li> </ul>
3 Promote enhanced processing	<ul style="list-style-type: none"> <li>• Enhance business skills</li> <li>• Expand local processing capacity</li> <li>• Identification of new products</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance business skills</li> <li>• Expand local processing capacity</li> <li>• Identification of new byproducts</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance business skills</li> <li>• Improve quality of dawadawa condiment</li> </ul>
4 Expand market prospects	<ul style="list-style-type: none"> <li>• Organic and FairTrade certification for exports</li> <li>• Strengthen market linkages</li> <li>• Marketing campaign</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen market linkages</li> <li>• Explore export potential</li> <li>• Marketing campaign</li> </ul>	<ul style="list-style-type: none"> <li>• Improved branding</li> <li>• Strengthen market linkages</li> <li>• Innovative marketing strategies that promote nutritional benefits</li> </ul>
5 Improve access to finance	<ul style="list-style-type: none"> <li>• Planting material, fencing</li> <li>• Cold press equipment</li> <li>• Raw materials for processors</li> </ul>	<ul style="list-style-type: none"> <li>• Processing equipment (dryers and drying platforms)</li> <li>• Improved packaging</li> </ul>	<ul style="list-style-type: none"> <li>• Processing equipment (dryers and drying platforms)</li> <li>• Improved packaging</li> </ul>
6 Promote research and technology development	<ul style="list-style-type: none"> <li>• Improved planting technologies</li> <li>• Processing technologies for food and cosmetic products</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of suitable varieties for domestication</li> <li>• Identification of suitable varieties for Asian market</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of early maturing varieties for domestication</li> </ul>

# CHAPTER 1: INTRODUCTION

## 1.1 Project background

The Agriculture and Natural Resource Management project (AgNRM) is a five-year, US\$24 million program supported by the United States Agency for International Development's (USAID) under the Feed the Future initiative. It serves as the main vehicle to address environmental and natural resource management issues in Northern Ghana under a five-year period (May 2016 to April 2021).

In close partnership with the Government of Ghana (GoG), AgNRM is building on the concept of Community Resource Management Areas (CREMAs), a model under which rural communities collaborate to share and manage their natural resources more sustainably in order to diversify income streams, maintain social cohesion, and minimize environmental degradation.<sup>7</sup> AgNRM employs a value chain approach to facilitate collaboration between collector and processor groups, buyers, and marketing agents in the shea value chain (producing kernel or butter products) as well as for other NRPs.

## 1.2 Report objectives

Developing effective value chains for NRPs requires a thorough understanding of their prevalence, production, processing, and marketing dynamics, as well as identification of key industry actors and their needs. For this reason, AgNRM commissioned a comprehensive set of sector analyzes on existing NRP value chains in northern Ghana. This report focuses specifically on the moringa, tamarind, and dawadawa value chains. This report seeks to detail major demand- and supply-side issues related to the NRP markets in the CREMAs and formulate appropriate interventions to improve NRP management while addressing the needs of the local communities. This report may benefit multiple industry actors including collectors, processors, and agents, as it provides specific measures to promote a sustainable and profitable industry in Ghana.

This report presents an overview of the following for moringa, dawadawa, and tamarind:

1. Size (demand and supply) of global and Ghanaian markets for the products;
2. Product uses and quality specifications;
3. Key value chain actors in Ghana and their role and function;
4. Relevant regulations and certification schemes;
5. Strengths, weaknesses, opportunities, and threats;
6. Gender roles within the value chains;
7. Pricing, competitiveness, and value addition opportunities, and;
8. Recommendations to improve the competitiveness of NRP value chains.

## 1.3 Process and methodology

The study employed qualitative and quantitative research methods. It commenced with a literature review; engaged NRP industry stakeholders; and conducted a preliminary field survey to collect relevant industry data to provide the research team with an overview of the NRP sub-sector. Following the preliminary visit, survey instruments including questionnaires and a checklist for key informant interviews were then developed, pre-tested and finalized to be administered in the field.

A purposive sampling method was adopted by targeting only households involved in the production, processing, and marketing of NRPs. The questionnaires and checklists were then administered. Key informants were interviewed via telephone and face-to-face meetings. Market surveys were conducted in the market towns of Wa, Tamale, and Bolgatanga, as well as in the CREMAs using the structured questionnaire. A total of 180 respondents were interviewed comprising six respondents from five communities in each of the six CREMAs, as well as 29 key informants.

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<sup>7</sup> Asare et al. 2013

# CHAPTER 2: OVERVIEW OF NRPs IN GHANA

## 2.1 The role of NRPs in the Ghanaian economy

Improved NRP production and trade holds enormous potential to enhance human livelihoods, improve nutrition, and increase national incomes.<sup>8</sup> NRPs are multi-purpose and they provide a source of food, fodder, fuel, medicine, cosmetics, and construction materials. Globally, it is estimated that between 1 billion and 1.5 billion people directly and indirectly benefit from NRPs in the form of employment, forest products and contributions to livelihoods and incomes.<sup>9</sup>

NRPs in Ghana are used for a variety of purposes including household consumption and medicinal remedies. The economic, social, and environmental potential of NRPs has received growing interest in recent years, with increasing private sector participation. Rural smallholders are integral to the management of NRPs as their actions or in some cases, lack of actions, can contribute significantly to landscape use changes. This report focuses on the CREMAs, where conscious efforts are being made to manage natural resources sustainably, including the management of moringa, dawadawa, and tamarind.

Currently, there is insufficient aggregated data on the economic potential of NRPs, which would otherwise support private sector-led investment and expansion. It is widely recognized that NRPs play a very important role in the Ghanaian economy, especially for women. However, much of that value is not formally recorded and is therefore inadequately represented in policy analysis. Information on the location of NRPs in Ghana is also limited. Government budgets are silent on specific NRPs and other forest extractives allocation, and as a result, no public information is provided on such activities. However, it is estimated that, the economic value of NRPs for both commercial and household purposes may outweigh that of timber.<sup>10</sup>

However, despite the fact that an estimated 31 percent of poor Ghanaian households benefit from the exploitation of NRPs, NRPs account for only 10 percent of household income. The households sampled in the AgNRM's baseline survey indicated earning an average of US\$65 per year from NRP sales.<sup>11</sup> The likely reason for this low income is that, the economic value of NRPs is low, as most are sold in the raw state, with little or no value addition. Furthermore, NRPs are not treated as cash crops—each producer/collector reserves significant quantities to first address household needs and only the excess volumes are sold. Another possible reason for the low-income contribution of NRPs is that traded NRP volumes are generally sold at the farm gate with little awareness as to urban market price and/or negotiation leverage. This places small producers at a disadvantaged position as they do not benefit from the higher margins enjoyed by some traders and middlemen.

## 2.2 Market dynamics of NRPs in Ghana

In Ghana, the markets for moringa, tamarind, and dawadawa although still small, are growing. NRPs are generally collected from the wild and sold with little processing. While traditionally collected volumes were solely used for home consumption, collectors from the CREMAs indicated that they now sell quantities of NRP up to four times what they consume at home, as a result of increasing market demand.<sup>12</sup> The increased market for NRPs has helped to provide important livelihood and

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<sup>8</sup> NRP are biological resources of plant and animal origin, harvested from natural forests, man-made plantations, wooded land, farmlands, and trees outside forests and or domesticated fruits and berries, nuts, spices, medicinal plants, oils, gums, resins, honey, mushrooms, weaving and dyeing materials, aromatics, and recreation. (Anokye & Adu, 2013.)

<sup>9</sup> Agrawal et al., 2013

<sup>10</sup> Ministry of Lands and Natural Resources, 2012a

<sup>11</sup> AgNRM Baseline Survey, 2017

<sup>12</sup> Analyzing the visibility of NRPs in the CREMAs, 2017

income generating opportunities for collectors in the CREMAs, but the higher volumes has implications for the resource base within the open access areas of the CREMAs.

NRP markets are characterized by geographically dispersed small producers with limited access to processing and packaging technology, as well as difficult access to urban markets. Thus, with the exception of shea, NRP exports from Ghana are limited.

Commercialization of moringa in Ghana was promoted in the 1990s and 2000s due to its export potential. However, weak market linkages and low domestic market development left many farmers frustrated. Consequently, there was a decline in production levels from 2000 onwards as farmers abandoned production. Recently, there have been renewed efforts to develop the domestic market for moringa through improved capacity for local processing.<sup>13</sup> Similarly, the demand for moringa leaves, seeds, and oil on export markets has increased due to growing consumer awareness of its health benefits.<sup>14</sup>

Currently, the market for Ghanaian dawadawa and tamarind is limited to the domestic market. Efforts to add value to dawadawa and tamarind, led mainly by NGOs, has facilitated penetration into urban markets. However, the largest market for these products remains in northern Ghana where they are traditionally consumed. Compared to other NRPs such as moringa and shea, the export market is poorly developed for tamarind and dawadawa.

### 2.3 Constraints to the NRP trade

Table I ranks the major constraints to NRP trading. Access to credit and markets plays a critical role in hindering the NRP trade, limiting the role of smallholder farmers to that of collectors, as well as their ability to add value to NRPs. Related to this is a lack of processing infrastructure, which was ranked by participants as the second most critical challenge confronting NRP trade. Lack of access to improved technology and uncompetitive pricing of NRPs constitute the third most critical challenges cited. Others critical constraints mentioned during interviews included unsustainable exploitation practices and inaccessibility of production areas.

Constraints to the sustainability of NRP trade are discussed below at a high-level. Constraints specific to moringa, tamarind, and dawadawa are presented in more detail in the following chapters that focus on each individual NRP.

**Table I: Constraints to NRP trade<sup>15</sup>**

Indicator	Rank
Poor access to credit	1
Poor access to market	1
Lack of processing infrastructure	2
Poor access to technology	3
Uncompetitive pricing	3
Unsustainable exploitation	4
Inaccessibility of the production areas	5

**Poor access to markets:** As a result of poor infrastructure, most of the production areas are inaccessible during the rainy season, which coincides with the major harvesting season for most NRPs. Collectors have limited access to buyers and must rely on middlemen who benefit from significantly higher prices in the end markets.

**Poor access to credit:** Access to credit is generally a challenge for NRP collectors due to their physical location far from branches of financial institution -- Transportation to reach the closest

<sup>13</sup> See for instance: <https://d-lab.mit.edu/news/scale-ups-report-field-moringaconnect-ghana>

<sup>14</sup> See for instance: <https://www.newyorker.com/tech/elements/meet-the-moringa-tree-an-overqualified-underachieving-superfood>

<sup>15</sup> AgNRM Field Survey, 2017

branch is typically costly. Second, as smallholders with relatively small incomes, they have trouble meeting the basic requirements of operating a bank account which would help them to qualify for credit from formal financial institutions.

**Lack of processing infrastructure:** Access to processing infrastructure is critical for value addition at the community level. Currently, little or no value addition is being done by collectors.

**Uncompetitive pricing:** Uncompetitive pricing in NRP markets results mainly from the fact that producers are poorly organized and geographically dispersed and therefore, lack awareness on market pricing and are unable to negotiate better prices as a group for their products.

**Unsustainable exploitation:** A sustainable NRP trade, in the long term, depends on sound management and exploitation of the natural resource base. In effect, 90 percent of respondents noted that income from NRPs has decreased over the years because of declining available quantities associated with felling of trees for farming and fuel wood production.

## 2.5 Gender roles in NRP value chain

Women play a leading role in NRP value chains in rural Ghana, including in commercial trade. In effect, 100 percent of women in all of the 180 households surveyed indicated their active involvement in NRP value chains, compared to 30 percent of men interviewed. Though women are more likely to be directly involved in the NRP value chain, men do exploit NRPs for medicinal and construction purposes, as well as for honey and charcoal production.

There are distinct gender roles in the gathering, processing and marketing of NRPs in northern Ghana. While men are engaged in the gathering, marketing, and processing of moringa, they are typically only involved in the gathering of dawadawa or tamarind, leaving the marketing and processing to the women. On the other hand, women are actively involved in all of the key activities for each of these three NRPs.

**Table 2: Gender roles in the moringa, dawadawa, and tamarind value chains<sup>16</sup>**

<b>NRP</b>	<b>Male</b>	<b>Female</b>
<b>Moringa</b>	Cultivation Processing Marketing	Cultivation Processing Marketing
<b>Dawadawa</b>	Gathering	Gathering Processing Marketing
<b>Tamarind</b>	Gathering	Gathering Processing Marketing

## 2.6 Regulatory environment

Despite the Government of Ghana's commitment to local participation in forest resource management in off-reserve areas (including CREMAs), up until 2011 the forestry policy was skewed in favor of timber products and the off-reserve areas were neglected.<sup>17</sup> In 2011, however, a new forestry policy was developed by the Government of Ghana that represented a departure from the norm.<sup>18</sup> This policy includes the following provisions regarding the management of NRPs:

<sup>16</sup> AgNRM Field Survey, 2017

<sup>17</sup> See a compilation of forest laws and regulations pre-2011 on the Forestry Commission website at <http://www.fcghana.org/library.php?id=15>

<sup>18</sup> Ministry of Lands and Natural Resources, 2012b

1. Develop the capacities of decentralized local institutions including the District/Municipal/Metropolitan Assemblies, Traditional Authorities, and civil society organizations in sustainable “off-reserve” timber resources and non-timber forest products management.
2. Enact the necessary legislation to support and ensure that forests, trees, wildlife and NRPs on private and communal lands are managed according to the national forestry development objectives and resource owner’s priorities.
3. Develop a national regulatory framework for the commercial exploitation of defined NRPs at district levels.
4. Promote research and development programs for commercially viable NRPs.

Although the policy mentions developing a regulatory framework for the commercial exploitation of NRPs, there is no evidence that any of these provisions have been implemented and stakeholders interviewed in the NRP sector had no knowledge of these policy provisions. Consequently, NRP trade remains unregulated in practice and unaccounted for in national statistics. For instance, although compliance with the Food and Drugs Authority of Ghana and the Ghana Standards Authority certification standards are mandatory by law for the processing and sale of NRP products, the majority of processors interviewed are either not aware of these provisions or simply do not comply with them.

## 2.7 Certification schemes

Certification schemes can unlock entry to global markets. However, they represent barriers to entry for smallholder producers who lack the resources and capacity to attain certification. In Ghana, the demand for certification is restricted to export products since exporters require these to be able to sell in international markets.

Certification schemes commonly applied to NRP value chains in Ghana include the following:

**Organic and FairTrade certification.** The most recognized certifications in the NRP sector in Ghana are organic and FairTrade. Although domestic consumers are aware of these certification schemes, most Ghanaians are not willing to pay a premium for organic and fair trade NRPs. Conversely, the organic and fair trade markets in Europe are supported by a strong growth in demand. For instance, it is reported that global demand for certified organic moringa leaf powder exceeds supply.<sup>19</sup> There is evidence of certified organic shea and moringa in Ghana, however, there is no evidence of certified organic tamarind or dawadawa. This is not surprising, given that tamarind and dawadawa are mainly sold in local markets, therefore organic and/or fair trade certification are less meaningful as these certifications are limited to export markets. Generally, certifications for NRPs are only pursued by larger producers, given that the cost is beyond the means of most smallholder producers, at approximately US\$13,500.

**The Green Label Scheme.** The Ghana Green Label Scheme is supported by the Ministry of Trade and Industry. The scheme is aimed at promoting safe food production, postharvest handling, and distribution using environmentally sustainable agricultural practices. It aims to certify farms that comply with the requisite production and distribution systems that ensure that safety and environmental sustainability are not compromised within the value chain. Starting in January 2018, the Green Label certification is expected to be mandatory for all export commodities.<sup>20</sup> In the CREMAs, this will affect shea and tamarind.

**Food and Drug Authority Law.** The Food and Drug Law of 1992 (PNDCL 305B) established the FDA as the regulator of the manufacture, importation, exportation, distribution, use, and advertisement of food, drugs, cosmetics, medical devices, and household chemicals with respect to their safe use, quality, and efficacy.<sup>21</sup> As such, NRPs fall into the category of products that require

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<sup>19</sup> CBI, 2016a

<sup>20</sup> AgricIn Ghana Media, 2017

<sup>21</sup> World Intellectual Property Organization, 1992



certification by the FDA. However, enforcement has been low and most producers do not comply with these regulations.

**Ghana Standards Authority.** The Ghana Standards Authority (GSA) is Ghana's national standards and conformity assessment body, which is mandated to ensure conformity to quality standards. The authority has been mandated by law to undertake the following services:

1. Develop and disseminate national standards;
2. Provide testing services;
3. Inspect operations;
4. Manage product certification scheme;
5. Provide calibration and verification services;
6. Provide weighing and measuring services;
7. Approve new weighing and measuring instruments;
8. Inspect destination of imported High Risk goods;
9. Promote quality management systems in industry, and
10. Provide advisory to the Ministry of Trade and Industry on standards.

The Food, Chemistry and Materials Department is responsible for the development and maintenance of food, agriculture, materials, and chemistry standards and contributes to efforts to develop and harmonize regional and international standards with organizations such as the Codex Alimentarius Commission, the International Organization for Standardization (ISO), the African for Organization Standardization, and the ECOWAS Commission under the ECOWAS Standards Harmonization Mechanism.

## 2.8 NRP production and commercialization in the CREMAs

In this survey, 89 percent of the respondents in the CREMAs reported that they depend on NRPs for food and for medicine, but 41 percent of the respondents also indicated that they are engaged in the exploitation of NRPs because they have no other choice.

The survey found that collectors travel on average 1.1 hours to their collection point. Moringa may be harvested twice a year, while tamarind and dawadawa are collected only once a year. Production, i.e. collected volumes, percent of volume sold, average price, cost of production, and revenues vary by crop and are discussed in the individual NRP chapters below.

Overall, the commercial potential of NRPs relies upon a stable natural resource base. A review of the tree population in three CREMAs in the Upper West region shows that investments in new trees are being made for tamarind and moringa, but not for dawadawa. In addition to lack of re-planting, dawadawa has witnessed a decline in tree health with the number of matured trees outweighing the number of young trees.<sup>22</sup> For every matured dawadawa, moringa, and tamarind tree, there is 0.9, 1.5, and 1.8 young dawadawa, moringa, and tamarind trees, respectively.

The following challenges have been identified as factors that may mitigate against the sustainability of CREMA NRP development:

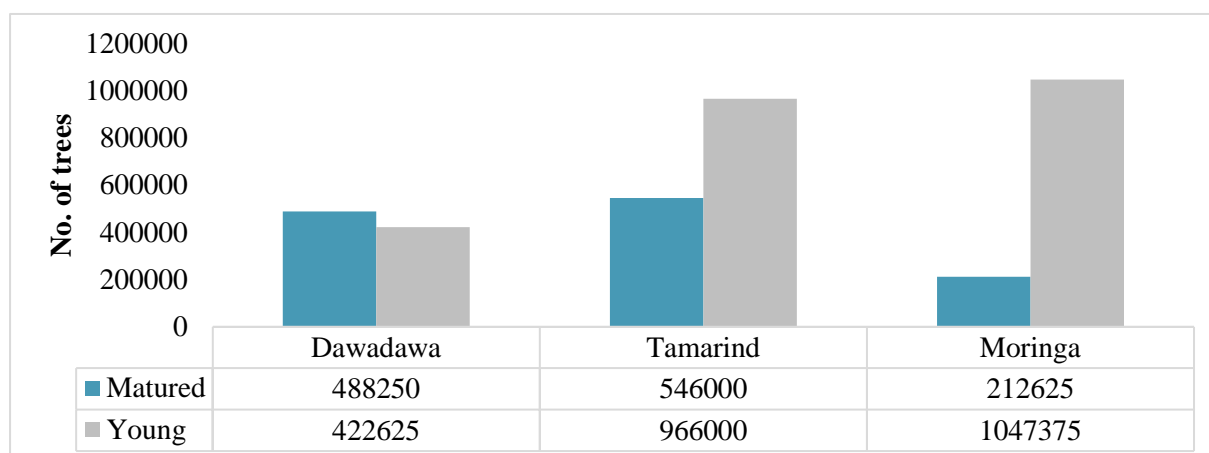
**Invasion of farms by nomadic herdsmen:** The activities of Fulani nomadic herdsmen constitute a major threat to the successful development of the CREMAs. These herdsmen, who arrive annually from neighboring countries, live outside the communities and therefore, do not feel obliged to obey the CREMA rules and regulations. Some of their activities, such as indiscriminate cutting of trees and bush burning are in direct contradiction of the principles underlying CREMA development.

**Poor knowledge of CREMA rules and regulations:** Some CREMA communities are poorly sensitized regarding their roles and responsibilities within the CREMA. As such, most community members still equate the CREMAs to forest reserves. This has limited effective participation and support from the community members.

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<sup>22</sup> Analysing visibility of NRPs in CREMAs, 2017

**Table 3: Status of moringa, dawadawa, and tamarind population in the CREMAs<sup>23</sup>**



**Unsustainable exploitation of NRPs:** Unsustainable exploitation of NRPs constitutes a major challenge confronting the CREMAs. With a long history of poor natural resource management in the region, there is a risk that the exploitation of moringa, dawadawa, and tamarind in the CREMAs further weakens the natural resource base.

**Lack of support from Chiefs:** Chiefs are the custodians of land and therefore, have broad discretionary powers regarding how the land should be used and who should be allocated land. As such, they are major stakeholders in CREMA development that can champion sustainable or unsustainable practices, such as the recent overexploitation of rosewood.

**Fear of declining rights to use land:** Some community members hold the view that they may not have adequate land for farming in the future as the population increases and that their right to CREMA resources may be lost to the state as in the case of the forest reserves. This is likely to affect cooperation from communities in the future.

<sup>23</sup> Ibid

# CHAPTER 3: ANALYSIS OF THE MORINGA VALUE CHAIN

This chapter focuses specifically on moringa. It begins with a description of the crop and covers its common uses. It then describes key value chain actors, provides an analysis of the commercial and export potential of the crop, and ends with a SWOT analysis.

## 3.1 Crop description

Moringa is a tree native to northern India that is now cultivated in many parts of the world due to its ability to withstand a wide range of weather conditions.<sup>24</sup> Though moringa has proven to be grown in a variety of terrains, yields vary based on climate, soil fertility, rainfall, and applied farming techniques. Leaves are typically ready for harvest within 6 to 8 months after planting, yielding approximately 6 tons per ha. In the second year, about 300 pods are produced per plant, increasing to between 400 to 500 pods in the third year. Some trees have been noted to yield up to 1,000 pods per plant, averaging 31 tons of pods per ha per year.<sup>25</sup>

Among the 13 identified moringa species,<sup>26</sup> *Moringa oleifera* (on which this report focuses) is particularly easy to reproduce and grows faster than the other species. According to the World Agroforestry Centre<sup>27</sup> the moringa tree thrives on well-drained soils and under savannah conditions.

**Table 4: Ecological requirements for moringa<sup>28</sup>**

Requirement	Optimal Range
Climate	Tropical or sub-tropical
Altitude (ft)	0-6,500
Temp. (°C)	20-35 (7-48)
Rainfall (mm)	700-2,200 (400-2,600) (Irrigation needed for leaf production if rainfall <800mm)
Soil Type	Loamy, sandy, or sandy-loam
Soil pH	5.5 - 7 (5 - 8.5)
Soil Salinity	Low (<4 dS/m)

Moringa is tolerant to extreme weather conditions, however continuous exposure to stress reduces yields. The moringa tree can be propagated directly from seeds or from cuttings, though the majority of the moringa farmers interviewed during this study indicated that they plant moringa by direct seeding.

## 3.2 Uses

Moringa is widely recognized for its nutritional, medicinal, agricultural, and industrial purposes. The leaves are rich in minerals, vitamins, and antioxidants. In addition to being multi-purpose, a particular advantage to moringa is that the entire plant can be used. For food products, all parts of the moringa tree—roots, tubers, bark, pods, leaves, nuts, seeds, and flowers are edible. Typically, the leaves, roots, and immature pods are consumed as a vegetable. The leaves can be used both fresh or dried and

<sup>24</sup> Gopalakrishnan et al., 2016.

<sup>25</sup> Price, 1985.

<sup>26</sup> These include *M. arborea*, *M. borziana*, *M. concanensis*, *M. drouhardii*, *M. hildebrandtii*, *M. longituba*, *M. oleifera*, *M. ovalifolia*, *M. peregrina*, *M. pygmaea*, *M. rivae*, *M. ruspoliana*, and *M. stenopetala*.

<sup>27</sup> For more details, see: [http://www.worldagroforestry.org/treedb/AFTPDFS/Moringa\\_oleifera.PDF](http://www.worldagroforestry.org/treedb/AFTPDFS/Moringa_oleifera.PDF)

<sup>28</sup> Bhargave et al., 2015.

ground into powder. While still green, the seeds can be eaten fresh or roasted. Seeds can also be made into a powder and used to cook stews or curries; steeped and consumed as a tea; or processed into an oil that is sweet and resistant to rancidity. The resulting seed cake can then be used to purify water for drinking.<sup>29</sup>

Extracts from the leaves are used to treat malnutrition in children under the age of five as daily consumption of moringa in any form (powder, fresh leaves, pods) provides nutrients that reduce the risk of malnutrition.<sup>30</sup> Consumption of moringa is beneficial for pregnant women and lactating mothers as well, as it helps to stimulate lactation and reduce anemia.<sup>31</sup>

In northern Ghana, moringa is marketed as a remedy for hypertension, due to its high level of nutrients such as magnesium, potassium, zinc and vitamin E that help to regulate high blood pressure.<sup>32</sup> There is also potential to use moringa leaves as a protein-rich source of livestock feed.<sup>33</sup>

**Health Benefits of Moringa**

Moringa leaf powder contains:

- 10 times the Vitamin A of carrots
- ½ the Vitamin C of oranges
- 17 times the calcium of cabbage
- 15 times the potassium of bananas
- 88 times the iron of mustard greens
- 9 times the Protein of morning glory

Source:  
[http://pdf.usaid.gov/pdf\\_docs/PA00K8N9.pdf](http://pdf.usaid.gov/pdf_docs/PA00K8N9.pdf)

**Table 5: Common uses of moringa**<sup>34</sup>

Type	Specific use
<b>Nutritional</b>	<ul style="list-style-type: none"> <li>• Entire plant contains highly digestible protein, high levels of Vitamins A, B, C</li> <li>• High levels of minerals (including iron, calcium, and potassium)</li> <li>• High levels of essential amino-acids (including carotenoids)</li> </ul>
<b>Industrial</b>	<ul style="list-style-type: none"> <li>• Oil content of de-hulled seeds used in cosmetic products as soaps, perfumes, lotions, facemasks, shower gels, shampoos</li> <li>• Oil used as lubrication of fine machines</li> <li>• Cake by-product of oil extraction can be used in water purification<sup>35</sup></li> </ul>
<b>Food</b>	<ul style="list-style-type: none"> <li>• Leaves used as vegetable in cooking</li> <li>• Green seeds eaten fresh or roasted</li> <li>• Seeds powdered and used in stews and curries</li> <li>• Seed processed into high quality, food-grade vegetable oil</li> </ul>
<b>Agriculture</b>	<ul style="list-style-type: none"> <li>• Soil incorporation of leaves to prevent seedling damping off used as bio-pesticide</li> <li>• Living trees used for fencing</li> <li>• Seed cake used as fertilizer</li> <li>• Juice expressed from leaves used as foliar nutrient</li> <li>• Leaves and treated seed cake used as animal feed stock</li> <li>• Alley cropping used for biomass production</li> <li>• Leaves used as green manure</li> </ul>

<sup>29</sup> More information available on the FAO website at <http://www.fao.org/traditional-crops/moringa/en/>

<sup>30</sup> USAID, 2012.

<sup>31</sup> Ibid

<sup>32</sup> See for instance <https://www.cnbcafrica.com/news/west-africa/2016/03/28/ghanaian-moringa-plant-entrepreneur/>

<sup>33</sup> Worku, 2016

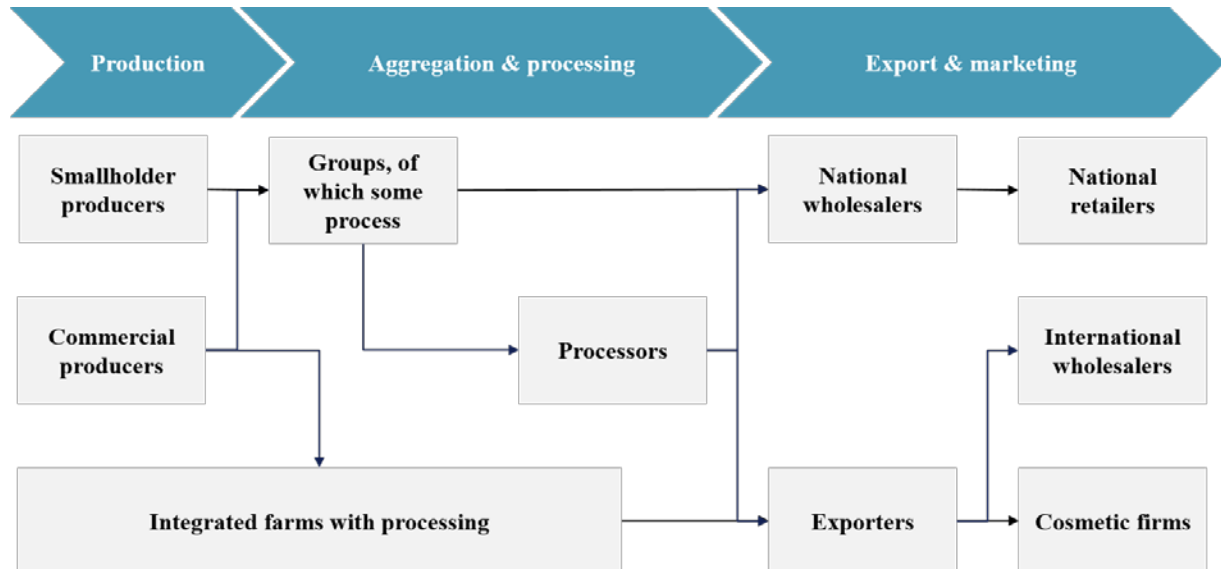
<sup>34</sup> Bhargave et al., 2015

<sup>35</sup> Saavedra & van der Maden, 2015

### 3.3 Value chain actors

This section describes the key value chain actors and their role within the value chain. This section also addresses relationships between actors.

**Exhibit 2: Overview of main moringa value chain actors<sup>36</sup>**



**Seed producers:** Seed sales for moringa is poorly developed as most farmers depend on seed from the previous harvest or borrowed from other farmers. Available varieties include KPM1, KPM2, and KPM5. However, farmers prefer KPM2 because it is disease resistant and has a stronger stem.

**Producers:** Two types of producers were identified: smallholder and commercial producers. Traditionally, moringa is largely cultivated by women who usually plant a few trees at home for household consumption. Commercial production of moringa, however, is male dominated, with farm sizes typically about 0.4 to 0.8 ha. The Ministry of Agriculture estimates there are approximately 20,000 active producers of moringa in Ghana.

**Processors:** There are only a handful of moringa processors and most of them produce at a small scale. Entrepreneurs process the leaves into tea and powder for sale while others extract the oil for export or process soap and cosmetics targeted to the domestic market. Major processors include Moringa Connect, ORGIIS, Agape Moringa, and the Ghana Permaculture Institute.

**Retailers:** Most of the processors double as retailers. Moringa products are retailed in small quantities. The most popular retail products are the cosmetics and soaps.

**Exporters:** These are essentially intermediaries who are usually contracted by importers to supply quantities of various products. They play the role of export agents and serve as a link between exporters and processors. These include Sekaf, ORGIIS, and Savannah Fruits Company.

**The Food and Drugs Authority:** The FDA, as regulator, plays an important role in certifying moringa products for commercial scale production.

**Consumers:** Consumers are segmented into household and the urban middle class. Household consumers are consumers that purchase fresh leaves directly from farmers for the preparation of food. The urban middle-class consumers consist of relatively more informed urban residents that purchase moringa for its health benefits.

**NGOs and social businesses:** NGOs and social businesses have been instrumental in the promotion of moringa in Ghana. Apart from promoting moringa production and mobilizing farmers into cooperative societies, they provide technical training on the processing and marketing of moringa

<sup>36</sup> AgNRM Stakeholder Interviews, 2017

products. Notable among these include ORGIIS in Paga, Widows and Orphans Ministry in Bolgatanga, TreeAid, Drive Aid, Africa Moringa Hub, and Moringa Connect.

**Middlemen:** Middlemen mobilize small quantities from the farm gate and supply domestic processors and/or export agents who are usually contracted by importers to supply larger quantities. Notable among these middlemen are Zabrama traders from Niger. These traders, noted for petty trading, sometimes exchange their wares for seed.

**Producer cooperatives:** Although there are not many producer cooperatives in the moringa value chain, the cooperatives that do exist facilitate farmer mobilization for production.

**Ghana Export Promotion Authority:** The Ghana Export Promotion Authority provides capacity building, information, and support to exporters of Ghanaian products.

### 3.4 Production and processing

The majority of Ghanaian moringa producers are smallholders who are not organized and grow moringa for subsistence purposes. As such, estimating production volumes is challenging. However, the four organizations interviewed are engaged in commercial production and have a total of 21.8 ha under cultivation. Additionally, these organizations support a total of 8,500 outgrowers, which can be added to the 20,000 active producers of moringa throughout Ghana that the Ministry of Agricultural and the Forestry Commission indicate are active.

**Table 6: Commercial production of moringa<sup>37</sup>**

Organization	Size of plantation, excluding outgrower (ha)	Outgrowers (total number)
READ (NGO)	12.8	100
ORGIIS (NGO)	1	-
Moringa Connect (Private Sector)	-	2,500
Ghana Permaculture Institute (Private Sector)	8	6,000
<b>Total</b>	<b>21.8</b>	<b>8,500</b>

The following districts in northern Ghana are identified as high production zones for moringa.

**Table 7: Major production zones of moringa<sup>38</sup>**

Region	District
<b>Northern</b>	West Gonja
	Sawla-Tuna-Kalba
	West Mamprusi
	Bole
<b>Upper West</b>	Jirapa
	Lawra
	Wa East
	Wa West
	Nadowli
	Nandom
<b>Upper East</b>	Bolgatanga
	Kasena/Nankana

<sup>37</sup> AgNRM Field Survey, 2017

<sup>38</sup> Ahenkan & Boon, 2011



The production details of major processors of moringa sampled for interview during this study are presented in the table below.

**Table 8: Industrial processing of moringa<sup>39</sup>**

Organization	Location	Products	2016 production	Target market
Agape Moringa	Tamale	Powder, cosmetics, seed, oil	<ul style="list-style-type: none"> <li>• 1 MT of powder</li> <li>• 1 MT of oil</li> <li>• 12.5 MT of soap</li> </ul>	Ghana, Germany, USA
Ghana Permaculture Institute	Techiman	Powder, cosmetics, oil, cake	<ul style="list-style-type: none"> <li>• 7 MT of leaf powder</li> <li>• 3 MT of oil</li> </ul>	UK, Austria, South Africa, USA, Namibia, Portugal, Switzerland, Nigeria
Moringa Connect	Accra	Powder, oil	<ul style="list-style-type: none"> <li>• 8 MT of oil</li> <li>• 2 MT of powder</li> </ul>	USA, Japan, Southeast Asia
ORGIIS	Paga	Oil	<ul style="list-style-type: none"> <li>• 1 MT of oil</li> </ul>	Toll milling for exporters

This study found some level of local, industrial processing of moringa oil. In all cases, the oil is extracted by cold pressing and the processing machines are capable of operating for 24 hours per day. A major challenge to commercial processing of moringa oil, however, is lack of moringa seeds. This was mentioned as a key constraint during interviews with Ghanaian moringa processors as demand currently exceeds supply. Processors mentioned that due to limited supply, they are currently processing volumes significantly less than their installed capacity.

**Table 9: Industrial processing capacity of Ghanaian moringa oil processors<sup>40</sup>**

Organization	Throughput	Productivity
Moringa Connect	50kg of seed/day	Data not available
Ghana Permaculture Institute	100-150kg of seed/day	5kg of fresh seed/5hr cycle 7.5kg/of dry seed/5hr cycle
ORGIIS	50kg of seed/day	9kg of seed/5hr cycle

### 3.5 Commercial potential

In 2017, farm gate prices for moringa seeds and leaves ranged between US\$2.1 and 6.6 per kg and US\$2.1 and 5.5 per kg, respectively. Retail prices of various moringa products are presented in the table below.

**Table 10: Retail prices of various processed moringa products<sup>41</sup>**

Product	Retail price per kg Gh¢	Retail price per kg US\$
Seed	40	8.80
Dry leaf	30	6.00
Leaf powder	40	8.80
Oil (liter)	3,500	76.90
Seed cake	20	4.40
Seed cake	7	1.50
Tea (25 tea bags)	20	4.40
Capsules (30)	35	7.70

<sup>39</sup> AgNRM Field Survey, 2017

<sup>40</sup> AgNRM Field Survey, 2017

<sup>41</sup> Ghana Permaculture Institute. For more details, see: <https://permacultureghana.wordpress.com/products-and-services/moringa-products/>

As an example of the commercial potential, Moringa Connect, a major actor in the Ghanaian value chain, estimates that the potential annual income from a one-acre (0.4 ha) moringa farm with a planting density of 500 trees to be between US\$51-513 in year one and grow to an estimated US\$5,798 to US\$8,283 by the fifth year. They estimate total income over the first five years to be between US\$11,242 to US\$20,972. The average cost of investment including land, and planting material is estimated at US\$1,016 per annum.<sup>42</sup> This indicates that given the required investments, moringa production would be profitable and yield appreciable profits within three years.

The table below presents the profitability of moringa farmers based on the results of the field survey conducted in the CREMAs. At the farmer level, surveyed farmers have reported average earnings of US\$1.40 per kg of seed and US\$1.90 per kg of leaf.

**Table 11: Profitability analysis for moringa farmers<sup>43</sup>**

Indicator	Results from survey		Comments
	Seed	Leaf	
Average quantity produced per year (kg)	33.5	25	Quantity harvested per household ranged from 6 kg to 100 MT per annum. Currently, the seed is the main moringa product produced by farmers. Smallholders are usually contracted by processors to produce leaves.
Average price (Gh□)/kg	9.20	9.20	
Average percent of collection sold	100	100	The seed is not consumed by households. Farmers producing moringa leaf were specifically contracted by processors and therefore produced it specifically for commercial purposes.
<b>Average revenue (Gh□)</b>	<b>308.2</b>	<b>230</b>	
Average collection costs (Gh□)/kg	100	20	Seed production cost is limited to cost of labor (for harvesting, de-husking, drying) and packaging. Leaf production cost is limited to cost of harvesting. Processors purchase the fresh leaves as it is difficult for producers to process it due to quality concerns.
<b>Average profits (Gh□)</b>	<b>208.2</b>	<b>210</b>	Farmers reported that they earn an average of Gh□ 208.2 from the sale of moringa seed per annum, and an average of Gh□ 210 per annum from moringa leaf.

### 3.6 Export potential

With the exception of Europe and North America, all regions of the world produce moringa and supply the global market. India is currently the world's largest supplier, producing 1.3 million MT of moringa on 380 km<sup>2</sup> of land. India's production accounts for an estimated 80 percent of global supply and their moringa exports are projected to grow by 26 to 30 percent annually.<sup>44</sup> The plant is also

<sup>42</sup> Moringa Connect, 2017. Proposal submitted to AgNRM. Confidential.

<sup>43</sup> AgNRM Field Survey, 2017. The analysis is based on survey of primary producers.

<sup>44</sup> Moringa Connect, 2017. Proposal submitted to AgNRM. Confidential.

commonly grown in Ethiopia, the Philippines, and Sudan.<sup>45</sup> Data on Ghana's current annual moringa production is limited, but estimates are substantially lower at somewhere around 60 to 80 MT including seeds and leaves.<sup>46</sup> The largest importers are the EU (for leaves), the United States (for oil), China (for seeds), and Gulf countries (for drumstick/fruits).<sup>47</sup>

Among all moringa products, moringa leaf powder offers the greatest export market opportunity for producers in less developed value chains such as in Ghana. This is supported by a strong growth in the European food supplement market and the fact that the investment required for the moringa leaf powder is comparatively low.<sup>48</sup>

Available information<sup>49</sup> indicates that the global trade in moringa products in 2016 was valued at US\$4.5 billion. At an estimated compound annual growth rate of 9 percent, the global market for moringa products is projected to reach US\$7 billion by 2020. Based on current global trends, there is an increasing opportunity for moringa products to be marketed as an immune-booster and energy increaser. Consumers in high-income countries, in particular, have become more attracted to preventative health, including consumption of immune-supporting food supplements. Moringa also offers an alternative source of energy to caffeine, making it a potential ingredient in the market for energy-increasing products.

In Europe, increased demand is driven by increasing a recognition of the health benefits of moringa. It is reported<sup>50</sup> that the European moringa market amounted to around €363 million in 2016 and is expected to reach €626 million by 2020. Major importers of moringa in Europe include Germany, the United Kingdom, Austria, and the Netherlands. Currently, European buyers have concerns about the quality of Indian moringa leaves, creating an opportunity for smaller exporters, like Ghana. However, this has led to increased international competition, with other countries including South Africa, Kenya, Malawi, and Mozambique entering this growing market.<sup>51</sup>

To ensure a successful entry into the EU market, the following considerations are important:<sup>52</sup>

- **Quantity:** Given that Ghana's production of moringa is relatively small,<sup>53</sup> a stable supply, both in terms of quality and quantity would place it in a better position to compete against suppliers such as India, where moringa production is done on large plantations at a more commercial level. While it is unlikely that Ghanaian moringa production would be able to compete on price, specialty and niche markets may offer the most potential.
- **Quality:** The following legal requirements must be complied with: European legislation for food supplements (composition and labeling requirements); General Food Law Food Safety, food safety requirements (maximum residue levels); extraction solvents; irradiation of food, traceability, contaminants in food and microbiological contamination of food. Regarding food safety, contamination with *Salmonella* is the main issue for moringa entering Europe. Other quality considerations include hygiene of food (Hazard Analysis Critical Control Point) and extraction solvents irradiation of food. Some buyers have additional quality requirements, beyond the mandatory legislative instruments, verifying active ingredient content, moisture content, contaminants and residue levels.
- **Niche markets:** There is a trend towards organic and fair trade certified moringa products. These include: FairWild, FLO FairTrade, FairForLife, UNCTAD BioTrade Initiative, and

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<sup>45</sup> More information available on the FAO website at <http://www.fao.org/traditional-crops/moringa/en/>

<sup>46</sup> Field surveys and triangulation of available data indicated that Ghana's annual production could be approximately 30 MT for seeds and 30-50 MT for leaves. However, there is a lack of reliable data.

<sup>47</sup> See for instance: <http://www.digitaljournal.com/pr/2709990>

<sup>48</sup> Saavedra & van der Maden, 2015.

<sup>49</sup> See for instance: <https://www.indiamart.com/proddetail/6th-global-moringa-meet-2018-7950052048.html>

<sup>50</sup> Ibid.

<sup>51</sup> See for instance: <http://www.digitaljournal.com/pr/2709990>

<sup>52</sup> Ibid

<sup>53</sup> Field surveys and triangulation of available data indicated that Ghana's annual production could be around 30 MT for seeds and 30-50 MT for leaves. However, there is a lack of reliable data.

Union for Ethical BioTrade, Company and supplier codes of conduct and Implementation based on ISO 26000 guidance on social responsibility.

- **Labeling:** The following labeling requirements must be met: establishment of a registration system for individual batches of moringa, mark them accordingly to ensure traceability. Products must be labeled in English, unless the buyer requests labeling in a different language. Labels must include: product name/INCI name, batch code, place of origin, name and address of exporter, date of manufacture, best before date, net weight, and recommended storage conditions. For organic moringa, the label needs to include the name/code of the inspection body and certification number. The buyer must also be provided the following documentation: Technical Data Sheet (TDS), CAS number, and Certificates of Analysis, Safety Data Sheet (SDS) and Certificate of Origin Product information sheet.
- **Competitor landscape:** Economies of scale allow Indian producers to sell moringa at lower prices. As it will be difficult for smaller suppliers to compete on price with Indian companies, Ghanaian producers need to find their own competitive advantage, which include ensuring high quality and certification in order to access niche markets.

As for the United States, moringa is increasing in popularity but is still a relatively new and less common product. Major exporters of moringa to the US include India (79 percent), South Korea (5.4 percent), Ecuador (2.5 percent), and Honduras (1.5 percent). Other countries who export smaller volumes include China and Singapore. Between August 2016 and October 2017, the total imports of moringa powder by US companies amounted to an estimated 5.03 MT.<sup>54</sup> With a large consumer base for health products, the US market holds great potential.

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<sup>54</sup> See <https://www.seair.co.in/us-import/product-moringa-leaf-powder.aspx>

### 3.7 SWOT analysis

The key findings of the value chain analysis of moringa are summarized in the SWOT exhibit below.

**Exhibit 3: Moringa SWOT analysis**

	<b>Opportunities</b>	<b>Threats</b>
<i>External</i>	<ul style="list-style-type: none"> <li>• Market is growing locally and internationally. Increasing global demand for moringa offers producers an opportunity to access niche export markets, particularly organic or FairTrade</li> <li>• The presence of NGOs in the sub-sector is a catalyst for awareness creation and promotion of moringa value chains.</li> <li>• Both the leaf and seeds can be processed into food and cosmetic products.</li> <li>• Easy to manage in backyard gardens and under agroforestry.</li> <li>• Is suitable for cultivation in all AgNRM CREMAs.</li> </ul>	<ul style="list-style-type: none"> <li>• Initial capital requirement may require fencing and irrigation which might be beyond the smallholder's resources.</li> <li>• Poor access to quality seed has resulted in low yields.</li> <li>• Inadequate enforcement of domestic market standards.</li> <li>• High certification cost required to access niche markets.</li> <li>• Limited access by farmers to quality planting material.</li> <li>• Low access to credit has resulted in under-developed moringa value chain.</li> <li>• Strong competition on price from countries like India where there are economies of scale</li> </ul>
	<b>Strengths</b>	<b>Weaknesses</b>
<i>Internal</i>	<ul style="list-style-type: none"> <li>• The leaf and seed have high nutritional value.</li> <li>• It is easy to propagate by seed and has short gestation period for leaf and seed production (within a year).</li> <li>• Once established, the tree can grow under drought conditions.</li> <li>• Sub-sector has received a great deal of support from NGOs.</li> </ul>	<ul style="list-style-type: none"> <li>• Limited access to processing technology by smallholders, resulting in limited value addition.</li> <li>• Disorganized and geographically dispersed farmers, resulting in high cost product mobilization</li> <li>• Lack of well-developed domestic market for moringa-based products</li> <li>• Increasing distance to collection points, poor infrastructure, and lack of logistics means that not all the volumes are collected.</li> </ul>

# CHAPTER 4: ANALYSIS OF THE TAMARIND VALUE CHAIN<sup>55</sup>

This chapter focuses on tamarind. It begins with a crop description and covers the uses of tamarind. This chapter also describes key value chain actors in the Ghanaian tamarind sector, provides an analysis of the commercial and export potential of the crop, and ends with a SWOT analysis.

## 4.1 Crop description

Tamarind (*Tamarindus indica*) is an evergreen tree that is grown across the tropics and semi tropics, typically in the wild, but is also cultivated in many countries.<sup>56</sup> Major producing countries include Brazil, Cost Rica, Cuba, Egypt, Guatemala, India, Indonesia, Mexico, Nicaragua, Puerto Rico, Philippines, Sri Lanka, Thailand, and Venezuela. Other countries that produce smaller volumes include the Bahamas, Bangladesh, Burma, Cambodia, Dominican Republic, Fiji, Gambia, Kenya, Pakistan, Senegal, Tanzania, Vietnam, Zambia, and Tanzania.<sup>57</sup> India, Thailand, and Mexico are the major global exporters of tamarind, with the major export destinations being Europe, the United States and the Middle East.<sup>58</sup> The international market for tamarind, although small, is reported to be well established.

In Africa, tamarind is widely available in arid and semi-arid regions. In Ghana, tamarind grows in the wild in savannah woodlands. In many of the smaller producing countries, such as Ghana, tamarind is cultivated for subsistence purposes.

Tamarind is typically propagated from the seed. This technique of propagation is reported to be easier and significantly less expensive than other methods, and a seed germinates one month after planting. Tamarind can also be propagated by several vegetative propagation methods including: root and stem cuttings, air layering, stem layering budding, and grafting. Although much easier than other techniques, propagation by seed is exposed to extraneous factors. Vegetative propagation is therefore recommended as the better way of maintaining the quality of tamarind, though it is not currently common practice in Ghana.<sup>59</sup>

Tamarind has a long gestation period of 6 to 8 years. A young tamarind tree is reported to yield between 20-30 kg of fruits per year while mature trees above 20 years of age are capable of yields between 150-200 kg per tree per year, or the equivalent of 12-16 tons per ha.<sup>60</sup> While these are averages, higher yields have been noted elsewhere. The table below presents the climatic requirements for tamarind production.

**Table 12: Ecological requirements for tamarind<sup>61</sup>**

Requirement	Optimum
Climate	Arid, Semi-arid
Altitude (m)	0-2,000 m
Temp. (°C)	9.5-20° C to 33-37°C
Rainfall (mm)	500-1500
Soil Type	Loamy, deep, well drained

<sup>55</sup> This section is derived largely from El-Siddig et al., 2006

<sup>56</sup> Bhadoriya et al., 2011

<sup>57</sup> Ibid

<sup>58</sup> Rao et al., 1999

<sup>59</sup> Von Maydell, 1986

<sup>60</sup> Chapman, 1984

<sup>61</sup> National Research Council, 1979



Soil pH	5.5-6.8
Soil Salinity	Up to 80 mM NaCl

## 4.2 Uses

Tamarind is used for various domestic and industrial purposes. The most commonly used product of the tamarind tree is the pulp.<sup>62</sup> Rich in calcium, phosphorus, iron, thiamine, and riboflavin and a good source of niacin, the nutritional and health benefits of the tamarind pulp are substantial.<sup>63</sup>

Traditionally, tamarind has been used as food in various forms. In Ghana, an infusion of the pulp is made into a popular beverage and used to cook cereals and to detoxify poisonous yam.<sup>64</sup> Common uses of tamarind are indicated in the table below.

**Table 13: Uses of Tamarind<sup>65</sup>**

Product	Use
<b>Fruit pulp</b>	<ul style="list-style-type: none"> <li>• Diluted to make beverages</li> <li>• Concentrated into syrups and used as a flavoring agent</li> <li>• Preserved into cakes and confectionaries with added sugar</li> <li>• Used as a dyeing agent</li> <li>• Used as a polish for metals when mixed with salt</li> </ul>
<b>Pods</b>	<ul style="list-style-type: none"> <li>• Young pods roasted, boiled, or pickled and eaten as a vegetable or added to salads</li> </ul>
<b>Leaves</b>	<ul style="list-style-type: none"> <li>• Dietary supplements</li> <li>• Fodder for livestock and silkworm</li> <li>• Eaten as a vegetable or used as a seasoning in food preparation</li> </ul>
<b>Seed</b>	<ul style="list-style-type: none"> <li>• Boiled or roasted to be consumed as a starchy seed or processed into flour</li> <li>• In textile industry as dyes, color printing, paper sizing, and leader treating</li> <li>• Wood glue</li> <li>• Stabilizer in bricks</li> <li>• Binder in sawdust briquettes.</li> </ul>
<b>Bark</b>	<ul style="list-style-type: none"> <li>• Rich in tannins, used extensively as dyes</li> </ul>
<b>Wood</b>	<ul style="list-style-type: none"> <li>• Furniture, wheels, mallets, rice pounders, mortars, pestles, ploughs, well construction, tent pegs, canoes, side planks for boats, cart shafts and axles, and naves of wheels, toys, oil presses, sugar presses, printing blocks, tools and tool handles, and turnery</li> <li>• Charcoal and firewood</li> </ul>

The main traded product from tamarind in Ghana is the fruit. Survey results from three major cities in northern Ghana (Tamale, Wa, and Bolgatanga) show that limited commercial processing of tamarind takes place. It is important to note, however, that processing and retail of tamarind products with improved packaging is on the rise in the Ghanaian market. The current price of raw tamarind in India, the world's largest supplier, is about US\$1.00 per kg.<sup>66</sup> In Ghana, the price for de-husked raw fruit is US\$1.30 per kg—suggesting growing demand. In beverage form, the cost is US\$0.22 per 350 ml bottle.<sup>67</sup>

<sup>62</sup> Kulkarni et al., 1983

<sup>63</sup> Morton, 1987

<sup>64</sup> El-Siddig et al., 2006

<sup>65</sup> Morton, 1987. See also: <http://blogs.worldwatch.org/nourishingtheplanet/tamarind-not-just-for-sauce/>

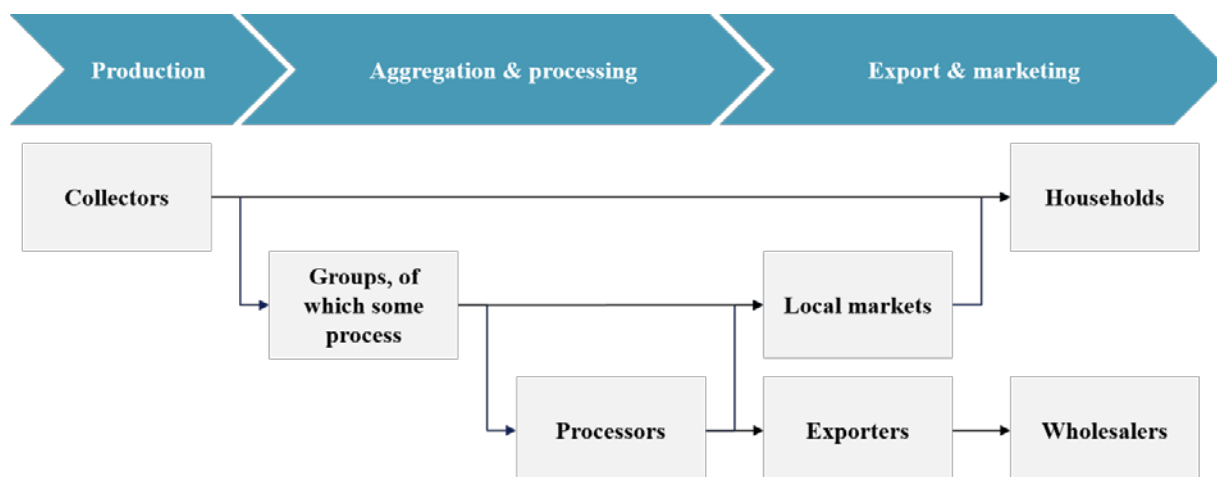
<sup>66</sup> See [http://trifed.in/trifed/\(S\(x4i3kx4rfg3noai2xk2gaz\)\)/Commodity\\_Price\\_Report.aspx](http://trifed.in/trifed/(S(x4i3kx4rfg3noai2xk2gaz))/Commodity_Price_Report.aspx)

<sup>67</sup> AgNRM Field Survey, 2017

### 4.3 Value chain actors

The actors involved in the tamarind value chain are similar to those in the dawadawa value chain discussed in the section below. Tamarind production and trade, like many other indigenous food tree crops in Ghana, is a female-dominated value chain. There are three main categories of actors in the tamarind value chain: 1) local collectors, 2) aggregators and traders, and 3) processors of end products such as tamarind juice.

**Exhibit 4: Overview of main tamarind value chain actors**



**Local collectors:** These consist of independent collectors that harvest the mature pods from trees scattered about the open woodlands and parklands. They clean and shape the fruits into balls for sale. They are the base of the value chain as there are currently no cultivated orchards or plantations of tamarind in Ghana. These collectors are mostly women, although some men do participate in the harvesting/collecting. Women typically are responsible for selling the products in the local markets where the buyers are usually female traders from nearby towns and villages.

**Aggregators and traders:** These are market women that buy directly from the producers in village markets. They are the aggregators that later sell their volumes at the larger district and regional markets. These are individual actors without any formal groupings or associations, which makes it difficult to put a figure on the number of such traders in any particular market.

**Processors of end products (tamarind juice):** There are two distinct kinds of processors in Ghana; women producing the local tamarind juice (*puha-beer*) and medium scale producers, who are bottling tamarind juice with improved methods and modern equipment. The former are women producing under very simple unregulated environments for local consumers. The latter are registered enterprises usually working under licenses from the FDA. For the most part, these medium-scale producers are male entrepreneurs, a factor likely linked to the initial capital requirements for obtaining and setting up modern equipment. These more professional processors are supplying a growing number of restaurants and supermarket outlets, as well as high-end urban consumers.

The supply of tamarind is generally considered to be low by individuals involved in both production and trade, which is partly related to an aging tree population. In the Upper East region, the main sources are the Bawku East, Bawku West, and Garu-Tempene districts. In the Northern region, the main sources are the northern-most districts. Although producers of the local beverage are able to secure supplies from local markets, there are seasonal shortages. Those who are unable to buy and stock in bulk against the off-season sometimes go out of production for a period of time.

### 4.4 Production and processing

Production of tamarind (pulp and juice) is mostly limited to home use, with some sales on local markets. An estimated 154 MT per annum is traded in the three major markets of Wa, Tamale, and Bolgatanga. However, there are indications of cross-border trade, meaning that some of the tamarind

traded on these markets is coming from neighboring countries, and production levels in Ghana might be lower. Due to lack of data, the volume of tamarind produced outside the three northern regions cannot be determined.

**Table 14: Ghanaian tamarind trade volumes in local markets<sup>68</sup>**

Market	Estimated number of traders	Estimated volumes of sale per annum per trader (kg)
Va	4	2,400
Tamale	5	3,000
Bolgatanga	7	4,200
<b>Total</b>	<b>16</b>	<b>9,600</b>

## 4.5 Commercial potential

As noted in earlier sections, a major constraint to increasing collector margins is lack of value addition by collectors. The market potential of tamarind could be substantially increased if farmers engaged in value addition, improved quality, and were able to penetrate urban markets. Instead of over reliance on wild collection, domestication of the tamarind tree planting would also ensure long-term sustainability of the tamarind value chain by sustaining the resource base.<sup>69</sup>

The field research conducted for this report indicates that the volume of tamarind collected by farmer is relatively low and profits are limited given the dependence on entirely on wild collection, which takes place over a period of a few months in the year.

The table below presents the profitability of tamarind collectors based the field survey conducted in the CREMAs. At the collector level, those surveyed reported earning an average profit of US\$0.77 per kg.

**Table 15: Profitability analysis for tamarind collectors<sup>70</sup>**

Indicator	Results from survey	Comments
Average quantity produced per collector per year (kg)	350	Quantity collected ranged from 120 kg to 550 kg per collector per year.
Average price (Gh¢)/kg	5	Price reported ranged from Gh¢ 4 to 6
Average percent of collection sold	80	The rest of the collected volumes are consumed by the households.
<b>Average revenue (Gh¢)</b>	<b>1,400</b>	Average revenue for traded volumes.
Average cost (Gh¢) of collection & handling	450	Cost of labor for harvesting (travel time), de-husking, drying, and transportation to market.
<b>Average profits (Gh¢)</b>	<b>950</b>	Collectors reported that they earn an average of Gh¢ 1300 from the sale of tamarind per annum. This amount is low because of low volumes collected, no value addition, and low prices received by collectors.

## 4.6 Export potential

Tamarind is used extensively in cuisines around the world. Outside of food products, other uses include traditional medicine and metal polish. Because of tamarind's many uses, cultivation has spread in tropical and subtropical zones especially in India, Sri Lanka, and a few other Asian

<sup>68</sup> AgNRM Field Survey, 2017

<sup>69</sup> Anecdotal evidence suggests that the tamarind tree is on the decline.

<sup>70</sup> AgNRM Field Survey, 2017. The analysis is based on survey of primary collectors.

countries. From November 2016 to May 2017, India exported tamarind-powder valued at US\$754,454. China is the largest market accounting for imports valued at US\$292,429, followed by Republic of Korea and Indonesia, which imported tamarind-powder valued at US\$137,304 and US\$95,040 respectively.

While the European market for tamarind is relatively small and is still developing, the number of distributors of tamarind products across Europe is growing, and pulp powder and juice concentrates have potential.<sup>71</sup> To ensure a successful entry into the EU market, the following competition considerations are important:<sup>72</sup>

- **Product specifications:** All products should, at the very least, be: intact, clean and sound, free from pests, free from damage and bruising, fresh in appearance, free from external moisture, foreign smell, and taste and in a condition able to withstand transport and handling. Checks on conformity are randomly carried out when goods enter the European Community customs territory. In certain third countries, which provide satisfactory guarantees of conformity, pre-export checks may be carried out by the inspection bodies of these third countries.
- **Minimize pesticide residues:** Pesticide residues constitute a crucial issue for suppliers of fruits and vegetables. With the objective of avoiding health and environmental damage, the European Union has set maximum residue levels (MRLs) for pesticides in and on food products. Products containing more pesticides residue levels than allowed will be withdrawn from the European market. Buyers in several countries such as the United Kingdom, Germany, the Netherlands, and Austria also set MRLs that may differ from those set by the EU.
- **Comply with phytosanitary requirements:** Fruit and vegetables exported to the European Union must comply with the European legislation on plant health. The European Commission has established phytosanitary requirements to prevent the introduction and spread of organisms harmful to plants and plant products in Europe. These requirements are managed by the competent food safety authorities in the importing and exporting countries.
- **GLOBALG.A.P. and other certification as guarantee:** The most commonly requested certification for fresh fruit is GLOBALG.A.P., a pre-farm-gate standard that covers the whole agricultural production process, from before the plant is in the ground to the non-processed product (processing is not covered). Whether GLOBALG.A.P. is required also depends on the destination country, market conditions and market channel. For very exotic varieties GLOBALG.A.P. is a great advantage, but not always a strict requirement. For more common varieties, it has become almost a standard requirement, especially in northern European supermarkets. Other food safety management systems that can be required are: British Retail Consortium (BRC), International Food Standard (IFS), Food Safety System Certification (FSSC22000), Safe Quality Food Programme (SQF).
- **Growing demand for organic fruits:** An increasing number of European consumers prefer food products that are produced and processed using natural methods. The market for organic exotic fruit is relatively small, but with interesting prospects and a limited supply. In order to market organic products in the European Union, the exporter must use organic production methods according to European legislation. Furthermore, the farmer must use these production methods for at least two years before he/she can market your fresh exotic fruit as organic. In addition, the farmer (or his/her European importer) must apply for an import authorization from organic control bodies.
- **Fair and sustainable trade:** There is a growing focus on the social and/or environmental conditions in production areas. Most European buyers have a social code of conduct that they will expect exporters to adhere to. A few specialized buyers provide extra opportunities for socially certified products. Buyer initiatives, which have an impact on exporters in terms of social compliance, are: Ethical Trading Initiative in the United Kingdom, Business Social Compliance Initiative in north-western Europe, and Global Social Compliance

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<sup>71</sup> See <https://www.foodl.com/tamarind-importers/europe>

<sup>72</sup> CBI, 2016b.

Programme providing reference and self-assessment tools. Social or sustainable labels for fresh fruit and vegetables include Fair for Life, FairTrade.

Like moringa, the US market for tamarind is small but shows signs of strong growth over the medium to long term with increasing interest shown by consumers in natural products. Between June and October 2016, US companies imported a total of 58,295 MT of tamarind amounting to an estimated US\$78,253 in value.<sup>73</sup> Ghana, like other tropical countries, is suitable to gain from the increasing US imports of tamarind. However, with the current low production volumes based on wild collection, it will be difficult for Ghana to export significant volumes of tamarind to the US market in the near future.

## 4.7 SWOT analysis

The key findings of the value chain analysis of tamarind are summarized in the SWOT exhibit below.

**Exhibit 5: Tamarind SWOT analysis**

	Positive	Negative
Internal	<b>Strengths</b> <ul style="list-style-type: none"> <li>• Fruit is used for drinks and sauces in most communities including the CREMAs.</li> <li>• Once established, tamarind can survive in dry weather conditions.</li> <li>• Widely consumed as food or drink across northern Ghana.</li> </ul>	<b>Weaknesses</b> <ul style="list-style-type: none"> <li>• Long gestation period to propagate (6-8 years).</li> <li>• Weak market information and limited participation by producers.</li> <li>• Increasing distance to collection points, poor infrastructure, and lack of logistics means that not all volumes are collected.</li> <li>• Poor access to processing technology, resulting in limited value addition.</li> <li>• Trees are scarce in some of the CREMAs making it difficult to exploit its economic potential.</li> <li>• Disorganized and geographically dispersed farmers, resulting in high cost of product mobilization.</li> </ul>
	<b>Opportunities</b> <ul style="list-style-type: none"> <li>• Tamarind drinks are becoming popular in Ghanaian supermarkets and shops and can be promoted to attract investment.</li> <li>• Once quality standards are addressed and export potential has been clarified, can be branded and promoted as organic and fair trade.</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>• Current production depends on wild collection, which is not sustainable in the long-term.</li> <li>• Disliked as an on-farm tree due to large shade area.</li> <li>• Low access to credit has resulted in under-developed tamarind value chain.</li> <li>• Entry to export market is constrained by strong competition from major producing countries like India where there are strong economies of scale.</li> </ul>
External		

<sup>73</sup> See [http://www.infodriveindia.com/india-export-data/tamarind-powder-export/fc-united\\_states\\_of\\_america-report.aspx](http://www.infodriveindia.com/india-export-data/tamarind-powder-export/fc-united_states_of_america-report.aspx)

# CHAPTER 5: ANALYSIS OF THE DAWADAWA VALUE CHAIN

This chapter focuses specifically on dawadawa. This section begins with a crop description and covers the uses of dawadawa. This section also describes key value chain actors, provides an analysis of the commercial and export potential of the crop, and ends with a SWOT analysis.

## 5.1 Crop analysis

Dawadawa is the common name in northern Ghana for the African locus bean (*Parkia biglobosa*). In Ghana, the term dawadawa is the term used both to refer to the tree as well as the popular condiment that is made out of the seed. The African locus bean is a perennial tree legume that produces pods that contain both a seed and a pulp. The seed is high in protein (30 percent) and fat (20 percent), with 15 percent starch, 12 percent sugar, and 12 percent fiber. The pulp that surrounds the seed is made up of 60 percent sugar and is also high in Vitamin C. Productive during the dry season, the seeds and pulp are important sources of nutrients in surrounding communities.

The existing species of *Parkia biglobosa* have almost all grown in the wild.<sup>74</sup> The tree grows across a wide geographical area, ranging across the Sudan and Guinea Savannah ecological zones. It is widely distributed in several countries in Africa including: Senegal, the Gambia, Guinea-Bissau, Guinea, Sierra Leone, Mali, Côte d'Ivoire, Burkina Faso, Ghana, Togo, Benin, Niger, Nigeria, Cameroon, Chad, Central African Republic, Zaire, Sudan, and Uganda.<sup>75</sup> In Ghana, dawadawa is found in the savannah woodlands in the northern part of the country.<sup>76</sup>

Propagation of the dawadawa tree is mainly by seed. The seed is reported to remain viable up to 8.5 years. However, the best germination rate is obtained if stored at 4°C and 60 percent relative humidity. The tree bears fruits within 8 to 10 years.<sup>77</sup> Average annual fruit yields vary widely at 25 to 130 kg per tree.<sup>78</sup> In Ghana, the tree grows in the wild, but other methods of propagation include vegetative propagation through grafting and marcotting, and in vitro propagation.

## 5.2 Uses

The most utilized part of the tree is the seed, which in Ghana, is used to produce a local condiment 'dawadawa' which is popular among local tribes in northern Ghana. The condiment is further dried to reduce the odor and is sold in urban centers either in the form of whole seed or a powder. In Ghana, the product is also marketed as a remedy for hypertension.<sup>79</sup>

**Table 16: Major uses of dawadawa<sup>80</sup>**

Part	Uses
Pulp	<ul style="list-style-type: none"><li>• Eaten fresh for its sweet flesh</li><li>• Commonly mixed with water into a thick paste and eaten, especially, by children</li><li>• As a sweetener</li><li>• Can be fermented into an alcoholic beverage</li><li>• Fodder for livestock and small ruminants</li></ul>

<sup>74</sup> National Research Council, 2006.

<sup>75</sup> Hall et al., 1997.

<sup>76</sup> Shao, 2002.

<sup>77</sup> Booth, 1988.

<sup>78</sup> For more details, see: [http://uses.plantnet-project.org/en/Parkia\\_biglobosa\\_\(PROTA\)](http://uses.plantnet-project.org/en/Parkia_biglobosa_(PROTA))

<sup>79</sup> National Research Council, 2006.

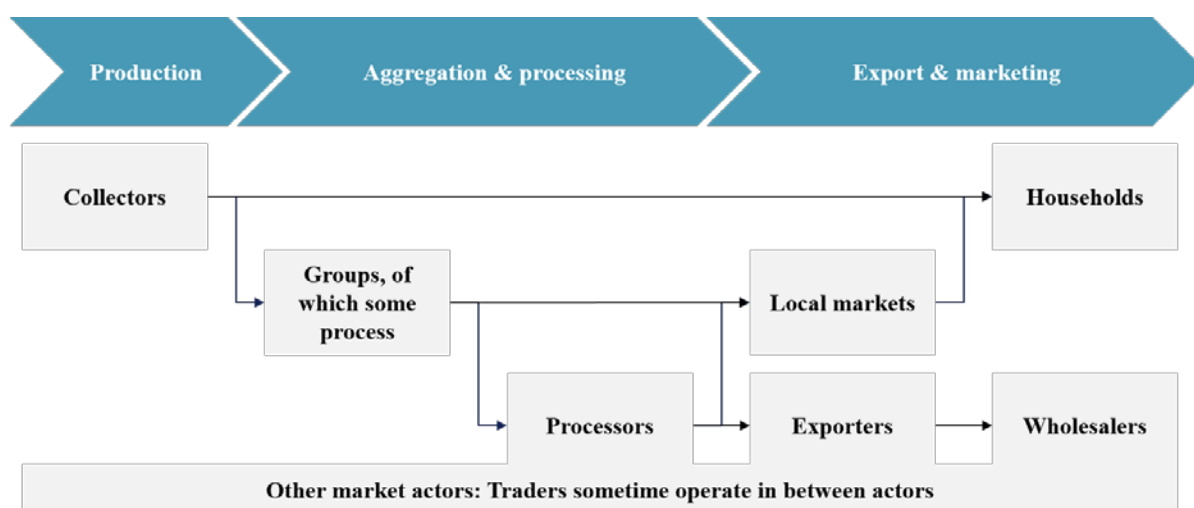
<sup>80</sup> Ibid.

<b>Seed</b>	<ul style="list-style-type: none"> <li>• Fermented and used to produce a popular condiment used as a seasoning, as an ingredient in local soups and stews, or as a solid as a meat or cheese substitute</li> <li>• Roasted seed is grinded into powder and consumed as a tea for its health benefits</li> </ul>
<b>Bark</b>	<ul style="list-style-type: none"> <li>• Twigs are used similar to a tooth brush, as the bark contains saponins (which manifest as soapy compounds)</li> <li>• Serves traditional medicinal purposes—promoted as a remedy for toothaches or earaches</li> </ul>
<b>Leaves</b>	<ul style="list-style-type: none"> <li>• Used as fodder for livestock and small ruminants, especially during the dry season</li> </ul>
<b>Wood</b>	<ul style="list-style-type: none"> <li>• Carpentry and furniture (posts for houses, bowls, mortars, etc.)</li> <li>• Charcoal and firewood</li> </ul>
<b>Husk</b>	<ul style="list-style-type: none"> <li>• The pod valves are soaked in water and used to decorate buildings</li> <li>• Used as waterproof plaster for mud houses</li> </ul>

### 5.3 Value chain actors

This section describes the key value chain actors and their function/role within the value chain. This section also addresses relationships between actors.

**Exhibit 6: Overview of main dawadawa value chain actors**



**Collectors:** Consist of mostly women and a few men who do the initial collection, processing, and storage at the village level. Pods are collected from the wild or harvested on individual farmlands and then transported by women by foot, or by bicycles by men. The pulp is traded to a lesser extent as the collectors themselves mostly consume it fresh.

**Middlemen:** Typically, there are two kinds of middlemen: village brokers and urban traders. The urban traders travel to major rural markets to mobilize dawadawa seeds for sale in urban markets to wholesalers. However, most collectors prefer to sell their seeds directly to urban traders on market days. At least five intermediaries were found to be operating in the Bolgatanga, Wa, and Tamale markets. These are urban traders who travel to rural markets to mobilize small quantities of seed at a time.

**Wholesalers:** Wholesalers are market traders located in the major market centers of Wa, Bolgatanga, and Tamale. They supply seed and pulp directly to local processors. The number of wholesalers varied from three in the Bolgatanga market, to five in the Wa market, and four in the Tamale market. The wholesalers, unlike the middlemen, usually store the seed for a period of time to take advantage of higher prices later on in the season.



**Processors:** Processors of the dawadawa condiment are mostly women. The majority of them process the seed into dawadawa condiment for sale directly to consumers at local markets. Seeds are also semi-processed and sold to middlemen who in turn sell to processors. The estimated numbers of processors in the sampled communities varied from 10 to 30 per community.

**NGOs:** A few NGOs have provided support to collectors on improved processing, packaging, and marketing of dawadawa. These include TreeAid and Widows and Orphans Movement.

## 5.4 Production and processing

The major traded product is the dawadawa condiment. Given the lack of statistical data for NRPs, this study has made projections from the data available for dawadawa. An estimated 31 percent of all household members in northern Ghana engage directly in the exploitation of NRPs<sup>81</sup> accounting for a total of 974,363 collectors (876,927 females and 97,436 males).<sup>82</sup>

The table below presents monthly traded volumes of the dawadawa seed in northern Ghana.<sup>83</sup> A total of about 39.5 MT of dawadawa seed is traded annually in the three major markets in Wa, Tamale, and Bolgatanga.<sup>84</sup> Several processors interviewed, however, indicated that they purchase dawadawa seed directly from rural markets for processing. Based on discussion with these processors, the actual volume of dawadawa seed traded could be twice as much as what is traded in these urban markets.

**Table 17: Dawadawa volumes traded in local markets<sup>85</sup>**

Market	Dawadawa seed	
	Estimated number of traders	Estimated volumes of sale per annum per trader (kg)
Wa	8	192
Tamale	12	360
Bolgatanga	15	576
<b>Total</b>	<b>35</b>	<b>1,128</b>

As previously mentioned, the population of dawadawa trees is declining at a faster rate compared to other NRPs in northern Ghana. However, some areas still remain fairly productive. Key production zones for dawadawa are presented in the table below.

**Table 18: Major production zones of dawadawa in Ghana<sup>86</sup>**

Region	District
<b>Northern</b>	Tolon
	East Gonja
	Tamale
	East Mamprusi
	West Mamprusi
<b>Upper West</b>	Wa Municipality
	Wa West
	Wa East
	Nadowli
	Lawra
	Jirapa

<sup>81</sup> AgNRM Field Survey, 2017. See also Ahenkan & Boon, 2011.

<sup>82</sup> This is calculated based on the estimated population of northern Ghana.

<sup>83</sup> These volumes are calculated based on the average sale of Dawadawa seed per month per trader.

<sup>84</sup> AgNRM Field Survey, 2017.

<sup>85</sup> Ibid.

<sup>86</sup> For more details, see: [http://uses.plantnet-project.org/en/Parkia\\_biglobosa\\_\(PROTA\)](http://uses.plantnet-project.org/en/Parkia_biglobosa_(PROTA))

**Upper East** Bolgatanga Municipal  
Bawku West  
Talensi  
Nabdram  
Kasena-Nankana West  
Kasena-Nankana East

The following markets are noted as major market centers for processed dawadawa.<sup>87</sup>

**Table 19: Major markets for processed dawadawa**<sup>88</sup>

Region	Community	District	Product
<b>Northern</b>	Kpalsi	Tamale Metropolis	Dawadawa condiment
	Katinga	Tolon	Seed
	Salaga	East Gonja	Seed
	Chamba	East Gonja	Seed
	Sabongida	East Gonja	Seed
	Afayili	East Gonja	Seed
	Quarters	East Gonja	Seed
<b>Upper West</b>	Cheria	Wa Municipal	Dawadawa condiment
	Sankana	Wa Municipal	Dawadawa condiment
	Doremon	Wa Municipal	Dawadawa condiment
	Goli	Wa Municipal	Dawadawa condiment
	Sombo	Wa Municipal	Dawadawa condiment
<b>Upper East</b>	Zuarungu	Bolgatanga Municipal	Dawadawa condiment
	Zebila	Bawku West	Dawadawa condiment

## 5.5 Commercial potential

Commercial exploitation of dawadawa is limited. Currently, dawadawa use in northern Ghana is largely in the condiment form. Trade is limited as most collectors produce the condiment for their own domestic use.

**Table 20: Retail prices of dawadawa products**

Product and unit of measurement	Average price (Gh¢)
Raw seed/kg	2.5-3.5
Condiment (500g)	0.2-1
Powder/500g	5-10
Tea/500g	5-10

A survey of the annual costs and revenues of a sample of dawadawa condiment processors in Cheria in the Upper West region reveals that profit levels are very low, and approximately 59 percent of processors reported a loss. Production costs include cost of seed, firewood, transportation, and time spent in collection and processing.

A constraint to the profitability of the dawadawa condiment is that historically production has been for solely household consumption. However, given the growing demand for dawadawa condiment, collectors are now increasing their volumes to meet increasing demand. That said, as increased volumes are being collected without investments in new trees, the current resource base is being stretched to capacity.

<sup>87</sup> Ahenkan & Boon, 2011

<sup>88</sup> Ibid

The table below presents the profitability of dawadawa collectors based on the results of the field survey conducted in the CREMAs. At the collector level, surveyed collectors have reported earning an average profit of US\$0.69 per kg.

**Table 21: Profitability analysis for dawadawa collectors<sup>89</sup>**

Indicator	Results from survey	Comments
Average quantity produced per farmer per year (kg)	300	Quantity collected ranged from 95 MT to 510 MT per annum.
Average price (Gh□)/kg	4.30	
Average percent of collection sold	80	The rest of the collected volumes are consumed by the households.
<b>Average revenue (Gh□)</b>	<b>1,032</b>	Average revenue derived by traded volumes
Average cost (Gh□) of collection & market preparation	300	Cost of production consist of labor for collection (travel time), de-husking, washing, drying, packaging material, and transportation to market.
<b>Average profits (Gh□)</b>	<b>732</b>	Collectors reported that they earn an average of Gh□990 from the sale of dawadawa per annum. This amount is low due to low collected volumes and low prices received by collectors.

## 5.6 Export potential

The export market for dawadawa is the least developed and presents the biggest challenge of all the NRPs reviewed as no records were found on international or cross-border dawadawa trade.

The dawadawa value chain is better described as a niche market whose export potential could be explored. It is expected that the market conditions and requirements would be similar to those required for the moringa and tamarind markets; however, dawadawa's greatest potential is in domestic urban markets. However, significant improvements are required in terms of processing and packaging.

## 5.7 SWOT analysis

The key findings of the value chain analysis of dawadawa are summarized in the SWOT exhibit below.

### Exhibit 7: Dawadawa SWOT analysis

	Strengths	Weaknesses
<i>Internal</i>	<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>• Both the pulp and the seed are edible</li> <li>• Seed is rich source of protein, vitamins, and food energy for most homes in the CREMAs.</li> <li>• It is popular seasoning and soup ingredient and can store</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>• Dawadawa markets are not well developed.</li> <li>• Increasing distance to collection points, poor infrastructure, and lack of logistics means that not all the volumes are collected.</li> <li>• Trade volumes are low as families reserve at least 20 percent of collected volumes for home consumption.</li> </ul>

<sup>89</sup> AgNRM Field Survey, 2017. The analysis is based on survey of primary collectors.

- well without refrigeration even in the tropical heat.
- Is productive during the dry/lean season.

- Very limited access to processing technology by smallholders, resulting in limited value addition opportunities.
- Producers and processors lack basic processing skills also limiting value addition.
- Disorganized and geographically dispersed farmers, resulting in high cost of product mobilization.
- Inconsistent quality—some processed condiments have bad odor which drives down demand and prevents expansion into new markets.
- No export market for dawadawa.

External

Opportunities
<ul style="list-style-type: none"> <li>• Can be promoted as food and nutrition security crop in local communities.</li> <li>• With improved quality and marketing, trade can be increased to promote products on urban domestic markets.</li> </ul>

Threats
<ul style="list-style-type: none"> <li>• Inadequate enforcement of domestic market standards.</li> <li>• The use of soybean for the production of dawadawa condiment may discourage the cultivation of the dawadawa tree.</li> <li>• Disliked as an on-farm tree due to being a large shade area.</li> <li>• With high prevalence of ageing tree population and limited investment in new planting, the exploitation of the economic potential of dawadawa may not be sustainable.</li> <li>• Low access to credit has resulted in under-developed dawadawa value chain.</li> </ul>

# CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

The economic potential for each of the NRPs covered by this report varies greatly. Of the three NRPs under review, dawadawa is the most prevalent in AgNRM's geographies. About one-fifth (21 percent) of the households in the CREMAs where AgNRM is active already earn a significant amount of income from dawadawa, while far fewer households earn significant income from moringa and tamarind (3 percent and 1 percent respectively).<sup>90</sup> Though dawadawa exists in larger quantities, the growth potential for moringa is arguably larger than for either of the two other NRPs.

For moringa, there appears to be strong global demand and a significant potential to increase production. As opposed to the other two crops, moringa is actively produced on farms and has a gestation period of less than a year, which allows for intensification of production in the short-term. Given the economic potential of moringa compared to dawadawa and tamarind, AgNRM should consider planning more resources and activities to focus on moringa than on the latter two. Moringa appears worthy of being a focus crop alongside shea.

Dawadawa has lower growth potential, albeit from a higher starting point due to its higher prevalence within the CREMAs. There is no existing export market for dawadawa and local sales are already relatively well established. A wild tree with long gestation period, increasing dawadawa production would require domestication, establishment of nurseries, and 8-10 years for the tree to develop. As a result, farmers may lack financial incentives to embark upon that journey.

Just like dawadawa, tamarind is a tree that currently only grows in the wild and requires 6 to 8 years to bear fruit. However, there appears to be a more significant potential to increase sales from local processing of tamarind juice and other products. However, to tap the export market, differences in varieties grown in Ghana and Asia would need to be investigated further to determine viability.

The following recommendations aim to inform AgNRM activities, particularly under Outcome 1. In some cases, these recommendations reinforce activities that have already begun or have been planned, while in other cases, these recommendations may inspire new or expanded activities for AgNRM. Though these recommendations focus on development of the NRP sector in AgNRM CREMAs, they may also serve industry actors and policymakers. General recommendations that apply to all three NRPs are provided first, followed by specific suggestions for each crop.

## 6.1 Overall recommendations

In order to unleash the full potential of the NRP sector, the following are identified as key priorities that cut across all three NRPs. Detailed recommendations per NRP are provided in the following sections.

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<sup>90</sup> AgNRM Baseline Survey, 2017.

## Exhibit 8: Summary of recommendations

	Moringa	Tamarind	Dawadawa
1 Expand supply	<ul style="list-style-type: none"> <li>• Intensification of existing, planting of new farms</li> <li>• Improve access to quality seed</li> <li>• Outgrower schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborative management and regulatory measures to protect existing tree stock</li> <li>• Farmer-managed natural regeneration</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborative management and regulatory measures to protect existing tree stock</li> <li>• Farmer-managed natural regeneration</li> </ul>
2 Build capacity of producer/collector groups	<ul style="list-style-type: none"> <li>• Build entrepreneurial capacity</li> <li>• Group nurseries, seed, and leaf aggregation</li> <li>• Potential for processing</li> </ul>	<ul style="list-style-type: none"> <li>• Build entrepreneurial capacity</li> <li>• Aggregate produce for sale to domestic markets</li> <li>• Potential for processing</li> </ul>	<ul style="list-style-type: none"> <li>• Build entrepreneurial capacity</li> <li>• Aggregate produce for sale to domestic markets</li> </ul>
3 Promote enhanced processing	<ul style="list-style-type: none"> <li>• Enhance business skills</li> <li>• Expand local processing capacity</li> <li>• Identification of new products</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance business skills</li> <li>• Expand local processing capacity</li> <li>• Identification of new byproducts</li> </ul>	<ul style="list-style-type: none"> <li>• Enhance business skills</li> <li>• Improve quality of dawadawa condiment</li> </ul>
4 Expand market prospects	<ul style="list-style-type: none"> <li>• Organic and FairTrade certification for exports</li> <li>• Strengthen market linkages</li> <li>• Marketing campaign</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen market linkages</li> <li>• Explore export potential</li> <li>• Marketing campaign</li> </ul>	<ul style="list-style-type: none"> <li>• Improved branding</li> <li>• Strengthen market linkages</li> <li>• Innovative marketing strategies that promote nutritional benefits</li> </ul>
5 Improve access to finance	<ul style="list-style-type: none"> <li>• Planting material, fencing</li> <li>• Cold press equipment</li> <li>• Raw materials for processors</li> </ul>	<ul style="list-style-type: none"> <li>• Processing equipment (dryers and drying platforms)</li> <li>• Improved packaging</li> </ul>	<ul style="list-style-type: none"> <li>• Processing equipment (dryers and drying platforms)</li> <li>• Improved packaging</li> </ul>
6 Promote research and technology development	<ul style="list-style-type: none"> <li>• Improved planting technologies</li> <li>• Processing technologies for food and cosmetic products</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of suitable varieties for domestication</li> <li>• Identification of suitable varieties for Asian market</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of early maturing varieties for domestication</li> </ul>

### 6.1.1 Expand supply

Sustaining the resource base is critical for NRPs. For non-cultivated NRPs such as tamarind and dawadawa, collaborative management and locally developed regulatory measures to protect existing trees are required. Farmer-managed natural regeneration should be promoted, along with awareness of the economic potential of NRPs. A strategy for expanded supply must also include domestication efforts. For cultivated NRPs such as moringa, the strategy must include intensification of existing farms and planting of new farms.

### 6.1.2 Build entrepreneurial capacity of producer/collector groups

Producer and collector groups play a critical role at the bottom of the NRP value chain, however, existing groups operate mainly with a social function and require training to become more business-oriented. This is important in ensuring that producers are proactive in taking advantage of the various opportunities offered in the value chain, as well as, exploring alternative product development. Though all producer/collector groups require support, training and advisory to each group should be targeted based on crop. For moringa, support to farmers is needed to help them access seedlings—either through group nurseries or elsewhere. Support is required to help them aggregate seeds and leaves and sell to local processors and exporters. There is also potential for groups to process moringa themselves, but the largest share of their sales will be seeds and leaves. A group's role for dawadawa and tamarind will mainly be to aggregate produce and sell to local markets and processors, though, groups could increase sales and value addition through small-scale processing.

### **6.1.3 Promote enhanced processing**

Recent efforts to support NRP value chains have been largely skewed towards improving producer/collector capacity. To ensure efficiency and effectiveness of the entire value chain and to harness value addition opportunities, it is critical to enhance the capacity of downstream actors, especially processors. Like producers/collectors, processors and processor groups also require training on entrepreneurship. To increase their business skills, processors would benefit from training and coaching on product development, branding and marketing, management, financial literacy, sales tracking, and leadership. Processors would also benefit from training on improved methods of processing to ensure better quality products.

For AgNRM, this could materialize in two specific ways. First, the project is providing business skills training to groups that have mainly played a social and aggregation role in the past. Second, AgNRM could also expand efforts to provide training and technical support to processors further down the value chain.

### **6.1.4 Expand market prospects**

As young moringa and tamarind trees in the CREMAs mature and yields increase and as new trees are planted, linking producer groups to buyers will be critical. AgNRM should identify and link potential buyers with collector groups and/or processing groups.

It will also be important to identify additional market outlets for these NRP products. Marketing opportunities vary across crops. While buyers have already shown interest in organic moringa for export, an opportunity that should be further explored by AgNRM, there is no evidence to suggest that the local market will pay a premium for certified organic dawadawa.

NRP value chains would also benefit from increased consumer awareness and expanded domestic consumption outside of northern Ghana. To this end, improved packaging and promotion of moringa, tamarind, and dawadawa would improve the likelihood that local supermarkets would be willing to sell them. In addition to product quality, this may require research on end market demand for these products and a marketing campaign to promote products to new consumers.

### **6.1.5 Facilitate access to NRP-based affordable credit**

Facilitating access to NRP-based affordable credit is critical for investment in NRP value chains in the longer term. Areas requiring investment include cash and in-kind credits to procure planting materials, develop plantations, and provide affordable fencing for moringa farmers. Across NRPs, working capital is required for groups and processors to buy produce, and processing equipment such as dryers and drying platforms. AgNRM should hold workshops with financial institutions to demonstrate the financial potential of NRPs and encourage the institutions to lend to NRP processors and groups. Processors could also get access to financing through pre-financing agreements with buyers or matching grants from AgNRM. AgNRM should approach buyers to assess the viability of this option.

### **6.1.6 Promote research and technology development**

There is a need to invest in improved technology for effective and efficient methods of production and processing. This may be achieved through collaboration with Ghanaian Universities and Polytechnics. For the moringa value chain, the primary needs are around improved access to reliable planting materials for both seed and leaf and enhanced availability of appropriate processing infrastructure for both food and cosmetic products. For tamarind and dawadawa, the top priority is identification of suitable and early-maturing varieties for domestication. For tamarind, research on the differences in varieties grown in Ghana and in Asia would be needed to determine the viability of exports of Ghanaian varieties and of the introduction of Asian varieties in Ghana.

## **6.2 Moringa**

Investments required to unleash the full potential of the moringa value chain include increasing production through intensification and the planting of new trees; improved nursery management; the promotion of an out-grower system; and enhanced processing. Given increased international demand for moringa, enhancing linkages to export markets is also a high priority.



### **6.2.1 Increase production**

To satisfy domestic and export demand, intensification of existing moringa farms and establishment of new plots should be promoted, as local buyers and exporters of moringa leaves and seeds are looking to source from producer groups. AgNRM should support access to planting material and provide training and technical assistance to farmers, especially with regard to protecting young trees from livestock, for example through affordable fencing techniques.

To increase uptake of moringa farming, AgNRM should train farmers on the financial benefits and production practices of moringa. Due to high demand and its short gestation period, farmers can be encouraged to diversify and incorporate moringa into their farms.

A strategy to increase production should also address seed producers, who require support to determine the most suitable moringa varieties in terms of yield and market demand. AgNRM should collaborate with commercial seed growers (READ, ORGIIS, Moringa Connect, Ghana Permaculture Institute) and support seed producers in the CREMAs to acquire improved storage facilities and produce quality, certified seed. AgNRM should link farmers to these seed producers to secure a stable supply of quality seeds.

Another path to ensure effective commercialization of the moringa value chain is the out-grower system that is being practiced by buyers like Moringa Connect. In this system, securing long-term land tenure will provide some security to motivate buyers to invest in best practices such as irrigation and fencing. Such a strategy ensures risk-sharing attitude between producers and buyers and is therefore more effective within the context of semi-subsistence production as is the case in Ghana. AgNRM should continue collaborating with Moringa Connect and support the venture as needed, and consider identifying and supporting additional entrepreneurs suitable for setting up moringa outgrower schemes.

### **6.2.2 Promote processing as value addition strategy**

To harness the economic potential of moringa, local entrepreneurs should be encouraged to add value to raw moringa seed and leaf through the promotion of processed moringa products including moringa oil, body cream, tea, and ointments.

### **6.2.3 Strengthen market linkages and access to specialty markets**

In order for farmers and groups to be incentivized to grow more moringa, they need to be confident that there is a strong demand to absorb the increased supply. As young moringa trees in the CREMAs mature and yields increase, linking producer groups to buyers will be key. Buyers should be mapped to identify their required volumes and specifications and AgNRM should facilitate and organize information sessions, trade fairs, etc. Potential buyers already identified include Moringa Connect, AJA Organics, Moringa King, Ghana Permaculture Institute, Agape Processing Enterprise, and SFC.

Moringa is experiencing a boost in demand due to health trends in high-income countries. AgNRM should explore partnerships with international moringa buyers and brands interested in sourcing and potentially investing in sustainable moringa production. For exports, certification may serve as an easier entry point to niche markets, compared to conventional markets that are dominated by existing large-scale producers, i.e. India, who have a market advantages due to their economies of scale. Niche markets, especially organic and fair trade, should therefore be explored.

## **6.3 Tamarind**

Critical activities to strengthen the tamarind value chain in Ghana include supporting research efforts on domestication to sustain and grow the resource base; supporting diversification of collectors and collector groups to add tamarind to their portfolio of products; and investigating the export potential for Ghanaian tamarind to specialty markets. Local processing capacity is also needed to enhance value addition and address quality issues.

### **6.3.1 Support producer organizations to add tamarind to their portfolio**

Similar to dawadawa, tamarind has been neglected by previous efforts at developing NRPs in Ghana. As such, the producers are widely dispersed geographically and disorganized. Improving the supply of tamarind will be critical to developing the value chain, however, groups and collectors will not be able to rely on tamarind as a major revenue stream. Instead, tamarind could be added as a line of business in parallel with crops that have higher revenue generating potential such as shea and moringa.

### **6.3.2 Support local processing of tamarind**

Promoting enhanced processing of tamarind into various products will provide value addition opportunities for communities within the CREMAs while simultaneously addressing quality issues. AgNRM should support interested collector groups to increase their processing capacity for tamarind-based beverages and juices that are already consumed and recognized on the local market. The project should offer training on improved processing at the farm level as well as training on improved post-harvest handling methods.

Although tamarind is widely recognized and consumed in Ghana, its utilization has been largely limited to pulp, whose infusion is prepared and consumed as a beverage. Beyond this, there is limited commercial utilization of tamarind. AgNRM should support collector groups and processors to diversify their product line into products such as jams, toffee, oil, gum, powder, and innovations using the tamarind seed.

### **6.3.3 Further investigate export market**

There is a potential for Ghanaian tamarind to tap the export markets, especially for niche markets such as organic and fair trade. AgNRM could conduct a targeted analysis to examine demand for tamarind, including the identification of potential buyers and the individual specifications for each. If opportunities exist to link producers with buyers for export markets, AgNRM could support producers to comply with the relevant standards and pursue the relevant certifications.

### **6.3.4 Promote research and development to improve the resource base and product development**

Domestication of the tamarind tree is necessary in order to ensure sustainable commercialization of the value chain. In collaboration with local research institutions such as the Forest Research Institute, should be pursued to develop suitable varieties for Ghana including suitable farming systems. AgNRM should also support awareness raising efforts to promote the economic potential of tamarind to encourage CREMA members to protect the resource base.

## **6.4 Dawadawa**

The critical issue that will determine the future of the dawadawa value chain in Ghana is sustaining and growing the resource base. Collaborative and strategic measures are necessary to protect the aging tree population in open access areas, while research and development efforts are required to identify the suitable and early-maturing varieties for domestication. In the short- to medium-term, the economic generating potential of dawadawa could be increased through improved quality and marketing of the dawadawa condiment.

### **6.4.1 Promote collaborative action to maintain and expand the resource base**

The dawadawa value chain currently depends heavily on wild collection, which is not sustainable considering the rampant felling of trees for fuel wood and other purposes. To address this in the short to medium term, sustainable management strategies such as integrated farming systems, collaborative forest and land management, and farmer-managed natural regeneration should be encouraged. Long-term strategies should include a strong drive towards domestication through research and development of suitable and early maturing varieties to boost production.

#### **6.4.2 Improve quality of dawadawa condiment**

A major constraint to the effective promotion of the dawadawa condiment is the excessive odor. To ensure sufficient demand for the product, it is important to improve methods of processing that address the odor and other quality issues to facilitate increased acceptance. Improved quality will allow the product to be rebranded and will begin to address the negative perception that consumers who are deterred from purchasing the condiment have—that all products have a bad odor.

#### **6.4.3 Promote innovative marketing strategies**

Strong domestic demand is absolutely critical to sustain value chains with lesser known end products such as dawadawa. Efforts at commercializing the dawadawa value chain must be based on a strong domestic market, therefore, it is important to adopt innovative marketing strategies that will promote the consumption of dawadawa among various segments of domestic consumers. Hand-in-hand with the point above on improved quality, the marketing strategy should focus on highlighting the nutritional and health benefits of dawadawa products.

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# APPENDIX I: STAKEHOLDERS AND SUPPORT ORGANIZATIONS CONTACTED

<b>Actor</b>	<b>Name/Contact</b>	<b>Location</b>
<b>Northern Region</b>		
Processor/Marketer of moringa products	Agape Moringa Processor +233 0541113968 / +233 0203 428 936	Tamale
Processor/Marketer of dawadawa and moringa products	Queen Gaf Enterprise 0242075728 / 0204540275	West Gurugu opposite Tizaa Hospital and Jisonayili - Tamale
Processors/Marketers of Dawadawa	Salma Fuseini 0543004946	Kpalsi
Processors/Marketers of Dawadawa	Naa Kojo (Salaga Chekosi Chief) 0248724439	Salaga
Processor/Marketer of dawadawa	Ayishetu and Zoo (Landlord) 0240474611 / 0206663565	Walewale
Department of Community Development	Mr. Swain 0207007328/0243957602	Department of Community Development – Damango
Processor/Marketer of dawadawa/moringa	Azara Taimako 0243856759	Tamale
Drive Aid Ghana	Matorwmasen Clement 0372 025 268	Tamale Office
<b>Upper East Region</b>		
Processor/Marketer of tamarind fruit drink	Yabco Focus Company Ltd 0244143671/0209642207	Bolgatanga
Processors/Marketers of dawadawa	Nbobila 0246397929	Zuarungu
Processors/Marketers of Dawadawa	Samira 0541634869	Zebila
Processor/Marketer of moringa	ORGIIS Ghana Julius Awaregya 0242712735	Paga
Processors of moringa and dawadawa	Widows and Orphans Ministry Fati Abdulai / Madam Betty Ayagiba. 0266081206 / 0244956370.	Bolgatanga
<b>Upper West Region</b>		
Processors/Marketers of Baobab oil and dawadawa(konton)	Mr. Tahidu 0546900862	Cherai
Producer	Mr. Robert Logga 0208072290/0244210608	SUNTAA NUNTAA AGROFORESTRY - Wa
Traders (various NRPs)	Madam Alia Ibrahim 0541102578	Wa - Market
Traders (various NRPs)	Mr. Sei 0246191989/0203783149	Wa
Traders (various NRPs)	Mr. Lawrence Kutre 0208914548	Tumu
Traders (various NRPs)	Mr. Albert Kagua	Tumu

	0207105878	
Traders (various NRPs)	Mr. Tibila Emmanuel 0273517112	EPA Sawla
Produce/Process/Market Moringa	E. P. Devine Ventures 0206426540/0273115540	Jirapa
Produce/Process/Market moringa products	Methodist Clinic 0207980893/0246158703	Lawra
MoFA	Mr. M. K. Alhassan 0208549159	Jirapa
MoFA	Mr. Diyala 0242309518	Lawra
Producers of moringa leaf and seed	READ Ghana Mr. Samir Diedong 0208914122/0244908136	Wa
<b>Various</b>		
Moringa Connect	Giulia Bondesan 0205249823	Accra



# APPENDIX 2: SURVEY INSTRUMENTS

## Mapping the value chain

Purpose: To provide an initial overview of the key aspects of the value chain

### Objectives

1. Gain basic overview of the value chain to guide the full value chain analysis to be undertaken
2. Identify constraints and possible solutions at different levels of the chains
3. Identify the location and position of various actors in the chain
4. Visualize networks to gain a better understanding of connections between actors and processes
5. Demonstrate inter-dependencies between actors and processes in the chain
6. Create awareness of actors to look beyond their own involvement in the chain

### Key Questions

1. What are the core processes in the value chain?
2. Who are the actors involved in these processes and what do they actually do?
3. What are the flow of products, information and knowledge in the value chain?
4. What is the volume of products, the number of actors and jobs?
5. Where does the product (service) originate from and where does it go?
6. How does the value change along the chain?
7. What type of relationships and linkages exist?
8. What types of services are feeding into the chain?
9. What is the position and location of various actors (gender disaggregated) in the chain?
10. What key constraints exist at various levels of the chain and what are the potential solutions to these constraints?
11. How do products, information and knowledge flow through the chain?

## Analyzing technology, knowledge, and upgrading

Purpose: To analyze technology and knowledge present in the value chain and to assess opportunities and possibilities to upgrade technology and knowledge in use.

### Objectives

1. To analyze the efficiency & effectiveness of technology in use within the Value Chain
2. To undertake a typology of current & required technology in the Value Chain
3. To analyze the appropriateness of technology (affordability, suitability, accessibility, replicability and fungibility) matched with skills of technology at different levels of the Value Chain
4. To analyze upgrading options within the Value Chain that provide the required quality of output
5. To analyze the impact of external investments in knowledge and technology (innovation + R&D)

### Key Questions

1. What is the efficiency and effectiveness of technology
2. What is the typology of current technology in use in the Value Chain (per processes, actors, poor & non-poor)?
3. What indigenous + other knowledge is being used in the Value Chain?
4. Does the Knowledge & Technology produce the required output?
5. Who determines orientation and investment in Knowledge & Technology in the Value Chain?
6. What upgrading options are available?
7. Who has access to knowledge and who provides knowledge

## Governance and services (coordination, regulation, and control)

### Purpose

Governance is a broad concept, which encompasses the system of coordination, organization and control that preserves and enhances the generation of value along a chain. The analysis of governance and services aims at investigating the rules operating in a value chain, and at assessing the distribution of power among different actors.

### Objectives

1. Analyze how actors in the value chain coordinate their actions through formal and informal rules
2. Understand how compliance to the rule is monitored, and which sanctions and incentives are available to promote the implementation of the rules
3. Analyze how different groups of value chain participants receive (or lack access to) adequate forms of support that can help them achieve the required standards
4. Assess the impact of the rules on different sets of actors
5. Understand whether a value chain is mostly based on formalized arrangements (contracts, for example) or on trust-based, informal agreements

### Key Questions

1. Understand how the value chain is coordinated including key firms (actors) and mechanisms (contracts, agreement, services) and why these coordination structures have arisen and evolved?
2. Map the formal and informal rules, regulations and standards that influence the value chain, how compliance to the rule is monitored, and what sanctions and incentives are used to ensure compliance?
3. Assess the impact of the rules on different sets of actors
4. Assess how different sets of value chain participants receive (or lack access to) adequate forms of support that can help them to achieve the standards



## Checklist for processors

### Moringa sales record template for processors

Type of Product	No. of retailers	No. of wholesalers	Annual sale volumes (Kg)	Annual sale (GhC)	Source of raw material	Major buyers	Type of markets (Export/Domestic)	Other Details
Dry leaves								
Seed								
Powder								
Cosmetics								
Tea								
Oil								

### Dawadawa sales record template for processors

Type of Product	No. of retailers	No. of wholesalers	Annual sale volumes (Kg)	Annual sale (GhC)	Source of raw material	Major buyers	Type of markets (Export/Domestic)	Other Details
Powder								
Seed								
Condiment								

### Tamarind sales record template for processors

Type of Product	No. of retailers	No. of wholesalers	Annual sale volumes (Kg)	Annual sale (GhC)	Source of raw material	Major buyers	Type of markets (Export/Domestic)	Other Details
Dry leaves								
Fruits								
Beverage								