Moringa Products: Opportunities and Challenges for Mozambique
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<td>Agência de Desenvolvimento Económico Local da Provincia de Sofala / Local Development Agency of the Sofala Province</td>
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<tr>
<td>AFRISCO</td>
<td>Africa's Farms Certified Organic</td>
</tr>
<tr>
<td>AGOA</td>
<td>African Growth and Opportunity Act</td>
</tr>
<tr>
<td>BMZ</td>
<td>Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung / Federal Ministry for Economic Cooperation and Development</td>
</tr>
<tr>
<td>CIDE</td>
<td>Centro de Investigação e Desenvolvimento em Etnobotânica / Centre for Research and Development in Ethnobotany</td>
</tr>
<tr>
<td>CITT</td>
<td>Centro de Investigação e Transferência de Tecnologia para o Desenvolvimento / Centre for Research and Technology Transfer for Development</td>
</tr>
<tr>
<td>DCs</td>
<td>Developing Countries</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FACIM</td>
<td>Maputo International Trade Fair</td>
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<tr>
<td>GIZ</td>
<td>Deutsche Gesellschaft für Internationale Zusammenarbeit</td>
</tr>
<tr>
<td>GLOBALG.A.P.</td>
<td>Global Good Agricultural Practices standards</td>
</tr>
<tr>
<td>IIAM</td>
<td>Instituto de Investigação Agrária de Moçambique / Mozambican Institute for Agricultural Research</td>
</tr>
<tr>
<td>INNOQ</td>
<td>Instituto Nacional de Normalização e Qualidade / National Institute of Standardization and Quality</td>
</tr>
<tr>
<td>IPEX</td>
<td>Instituto para a Promoção de Exportações / Mozambican Institute of Export Promotion</td>
</tr>
<tr>
<td>ITC</td>
<td>International Trade Centre</td>
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<tr>
<td>MZN</td>
<td>Mozambican Meticais</td>
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<tr>
<td>SADC</td>
<td>Southern African Development Community</td>
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<tr>
<td>SEMOC</td>
<td>Sementes de Moçambique / Mozambican Seed Company</td>
</tr>
<tr>
<td>SIMA</td>
<td>Sistema de Informação de Mercados Agrícolas / Agricultural Markets Information System</td>
</tr>
<tr>
<td>UEM</td>
<td>Universidade Eduardo Mondlane / Eduardo Mondlane University</td>
</tr>
<tr>
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<td>United Kingdom</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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A Moringa é uma das plantas mais versáteis, a partir da qual se pode fazer um grande número de produtos, para variados fins, como por exemplo pó de chá, óleo vegetal, cosméticos, suplementos nutricionais ou medicamentos. A árvore da Moringa cresce naturalmente em Moçambique, graças à terra adequada que encontra e às excelentes condições climáticas do país.

O presente estudo, analisa as oportunidades e desafios para a produção comercial de produtos derivados da Moringa em Moçambique, com particular ênfase no Pó da Folha de Moringa e no Óleo de Moringa. Fornce também recomendações para a melhoria dos processos-chave na cadeia de valor, incluindo a produção, processamento e comercialização. Este estudo, combina pesquisa teórica e de campo. Diversas partes interessadas foram consultadas em Maputo, nas províncias de Sofala, Inhambane e Gaza, bem como no exterior.

Em Moçambique, os benefícios dos produtos da Moringa são bem conhecidos, dada a sua difusão nos meios de comunicação e às campanhas de informação. O mais popular destes produtos é o Pó da Folha de Moringa, que é produzido e comercializado no país. Em países ocidentais, o Pó da Folha de Moringa é usado como um “super-alimento verde”. A indústria global deste suplemento nutricional tem conhecido uma alta taxa de crescimento nos últimos anos e espera-se que continue a crescer.

A cadeia de valor do Pó da Folha de Moringa em Moçambique, pode ser descrita como sendo bastante curta, por vezes frágil e dominada por poucos protagonistas. Para uma melhor exploração do mercado potencial de Pó da Folha de Moringa em Moçambique e no exterior, um dos desafios-chave é o melhoramento da cadeia de valor, de forma a aumentar a competitividade dos produtos a nível dos mercados nacional e internacional.

O Óleo da Moringa, pertence ao grupo de óleos vegetais exóticos, que são usados como ingredientes em produtos cosméticos. Na última década, a demanda global destes óleos cresceu, devido à mudança de comportamento do consumidor. Em Moçambique, o Óleo de Moringa ainda não é produzido numa base comercial, mas diversas empresas com experiência na produção de óleos vegetais tradicionais, expressaram já interesse em produzir Óleo de Moringa.

Moçambique beneficia de um acesso preferencial aos mercados mais importantes para os produtos derivados da Moringa, incluindo a União Europeia e os Estados Unidos da América. Contudo, os produtores têm de preencher um certo número de requisitos e cumprir uma série de regras exigidas para a importação de produtos para o seu respectivo mercado. Em relação aos produtos derivados da Moringa, o mais relevante destes requisitos é o cumprimento das normas sanitárias e fitossanitárias. Para além disso, muitos dos retalhistas globais exigem o preenchimento dos padrões voluntários reconhecidos internacionalmente, tais como o GLOBALG.A.P, orgânica ou Fairtrade.

Com base nos resultados do estudo levado a cabo, se pode fazer as seguintes recomendações:

1. Produção
O cultivo de árvores de Moringa necessita de ser expandido, para que se torne possível atingir uma economia de escala tanto na produção de folhas como de sementes de Moringa. A agricultura de pequena-escala ora existente, deve ser complementada com a plantação semi-industrial ou mesmo industrial. Sementes viáveis, limpas e livres de doenças devem estar disponíveis e o seu rendimento deve ser aumentado através da aplicação de técnicas de cultivo adequadas.

2. Processamento
Apesar de o processamento da folha de Moringa não ser tecnicamente complicado, um sistema de gestão logística funcional, que inclua comunicação efectiva, cooperação e
coordenação entre os pequenos agricultores e os serviços de transporte dos produtos, necessita de ser implementado. Centros de processamento com altos padrões de higiene, devem ser estabelecidos e operados pelas associações e cooperativas. Deve ser usado um empacotamento adequado e tanto agricultores como associações devem ser apoiados e treinados em métodos de processamento. Dado que, comparativamente, os requisitos para a produção de Óleo de Moringa são tecnicamente mais elevados, deve ser iniciado um projecto-piloto com uma empresa interessada que já esteja produzindo outros óleos vegetais.

3. Comercialização
A comercialização de produtos derivados de Moringa em Moçambique, é ainda muito informal, o que faz com que se torne difícil conseguir informação sobre os volumes e preços de produção. Para a exploração efectiva do mercado potencialmente existente, a comercialização deve tornar-se mais estruturada e formalizada. Para tal, a coordenação vertical entre produtores, grossistas e retalhistas, deve ser melhorada e informação fiável sobre a produção nacional de derivados de Moringa deve ser regularmente recolhida e disponibilizada. Padrões nacionais de qualidade e segurança para os produtos derivados da Moringa, devem ser desenvolvidos. Além disso, formação e esquemas de financiamento que permitam a conformidade com as normas internacionais, devem ser disponibilizados.

Para uma melhor exploração do potencial da produção comercial de produtos derivados da Moringa, o principal desafio é identificar os “estrangulamentos” na cadeia de valor. Tal só é possível através da congregação de esforços por parte do sector privado, incluindo os pequenos produtores, associações e grandes empresas, bem como uma articulação eficaz com as instituições públicas.
Moringa is one of the most versatile plants, out of which a number of products can be made for a variety of purposes, such as tea powder, vegetable oil, cosmetics, nutritional supplements and medicine. In Mozambique, Moringa trees grow naturally due to the country’s suitable land and excellent climatic conditions.

The present study analyzes the opportunities and challenges in Mozambique for commercial production of Moringa products with a particular focus on Moringa Leaf Powder and Moringa Oil. It provides recommendations for the improvement of key processes in the value chain, including the production, processing and commercialization. The study combines desk and field research. A variety of stakeholders was consulted in Maputo, the provinces of Sofala, Inhambane and Gaza, as well as abroad.

In Mozambique, the benefits of Moringa products are well-known due to media broadcasts and information campaigns. Most popular is Moringa Leaf Powder, which is commercially produced and merchandised in the country. In Western countries, Moringa Leaf Powder is used as a “green superfood”. The global industry of such nutritional supplements has enjoyed a high growth rate in recent years; a trend, which is expected to continue.

The value chain of Moringa Leaf Powder in Mozambique can be described as being rather short, sometimes fragile and dominated by a few actors. With regard to better exploiting the existing market potential for Moringa Leaf Powder in Mozambique and abroad, one of the key challenges is to upgrade the value chain and thereby enhance the competitiveness of the products at the national and international markets.

Moringa Oil belongs to the group of exotic vegetable oils, which are used as ingredient for cosmetic products. In the last decade, global demand for these oils increased due to changed consumer behavior. In Mozambique, Moringa Oil is not yet produced on a commercial basis, but several companies have experience in the production of traditional vegetable oils and have expressed interest in producing Moringa Oil.

Mozambique enjoys preferential access to the most important markets for Moringa products, including the EU and the USA. Nevertheless, producers need to fulfil a number of mandatory regulations and standards that are required for imports to the respective market. With regard to Moringa products, most relevant is the compliance with sanitary and phytosanitary standards. In addition to that, many global retailers demand the fulfillment of internationally recognized voluntary standards, such as GLOBALG.A.P., organic or Fairtrade.

Based on the findings of the study, the following recommendations can be made:

1. Production
The cultivation of Moringa trees needs to be expanded to achieve economies of scale in the production of both Moringa leaves and seeds. The already existing small scale farming should be complemented by semi-industrial or even industrial plantations. Viable, clean and disease-free seeds should be available and yields should be increased by applying adequate cultivation techniques.

2. Processing
While the processing of Moringa leaves is technically not complicated, a functioning logistics management system, including effective communication, cooperation and coordination between smallholders and transport services, need to be implemented. Processing centers with high hygienic standards should be established and operated by associations or cooperatives. Adequate packaging should be used and farmers and associations should be supported...
and trained in processing methods. Given the comparatively high technical requirements for Moringa Oil production, a pilot project should be initiated with an interested enterprise that is already producing other vegetable oils.

3. Commercialization
The commercialization of Moringa products in Mozambique is still very informal and makes it difficult to get reliable information of production volumes and prices. To effectively exploit the existing market potential, the commercialization should become more structured and formalized. Thus, the vertical coordination between producers, wholesalers and retailers should be improved and reliable data on the national production of Moringa products should be regularly collected and made available. National quality and food safety standards for Moringa products need to be developed. Moreover, trainings as well as finance schemes concerning the compliance with international standards should be made available.

To better explore the potential of commercial production of Moringa products, the key challenge is to overcome the identified bottlenecks in the value chain. This will only be possible through joint efforts by the private sector, including smallholders, associations and larger companies, and public institutions.
1 Introduction

Mozambique has a great potential for agricultural production, which is far from being fully exploited. At the same time, there is a need to diversify agricultural and export products. In this regard, a promising area are plants, such as the Moringa tree, whose commercial potential remains mainly untapped.

Moringa is a plant, out of which a number of products can be made for a variety of purposes, such as tea powder, vegetable oil or nutritional supplements. Virtually all parts of the tree are edible or can be processed for therapeutic, prophylactic, medicinal and cosmetic purposes.

In Mozambique, Moringa trees grow naturally given the country’s suitable land and excellent climatic conditions. Therefore, Moringa is well-known and mostly consumed as Moringa Leaf Powder. There is a great potential for smallholders to engage in Moringa production, offering them both a crucial nutritional input for their own families and an income opportunity, by selling surpluses to the market.

Globally, the demand for Moringa products, such as Moringa Leaf Powder and Moringa Oil, has been growing. Moreover, international organizations and institutions are exploring the best ways on how to use Moringa as a nutritional supplement and in food fortification.

Given these trends, the present study analyzes the potential of Moringa production in Mozambique with the following objectives:

- To provide an overview of the multiple uses of Moringa;
- To analyze the market and production potential of Moringa Leaf Powder;
- To analyze the market and production potential of Moringa Oil; and
- To analyze the requirements of international markets.

The present study combines desk and field research, which was conducted by PERENE Consulting. After a review of existing literature, key stakeholders were consulted in Maputo, the provinces of Sofala, Inhambane and Gaza, and abroad. Interview partners represented government agencies, research institutes, associations, small and medium-sized enterprises, as well as farmers. The preliminary findings of the study were discussed at a multi-stakeholder workshop in October 2013 in Beira.
2 Characteristics of the Moringa tree

*Moringa Oleifera Lam* (referred to as Moringa in the present study) is one of the 14 plant species belonging to the family *Moringaceae*. It is native to the sub-Himalayas in northwest India, Pakistan, Bangladesh and Afghanistan. Along the ancient trade routes, it had reportedly been brought first to East Africa, from where it progressively proliferated throughout the whole continent. Today, Moringa can be found in tropical and sub-tropical regions all over the world.

As displayed in Table 1, the different parts of the Moringa tree possess characteristics that are interesting for both scientific and commercial use. Most remarkable are the low level of toxic substances, the high level of proteins in seeds and branches, the excellence of the seed oil, and the prevalence of growth factors, such as sugar and starch in the leaves.

Moringa has another notable characteristic: It is a plant, which is relatively easy to propagate given its low requirements in terms of nutrients and water. Whilst it grows best in countries that have semi-arid and monsoonal climates, it has a large climatic tolerance (The State of Queensland, 2010). The young Moringa tree can grow at a significant rate of up to three meters in the first year. Under cultivation, trees that were raised from seeds start flowering after two years of growth, whilst trees grown from large cuttings can begin to produce fruits even 6 to 12 months after planting. A single tree can produce 300 to 400 fruits per year within the first three years of planting, while a mature tree can produce up to 1000 fruits per year. As each fruit contains approximately 20 seeds, a mature tree can produce about 20,000 seeds per year. Under favourable conditions, mature trees can reach a height of 6 to 15 meters (Orwa et al., 2009).

In Mozambique, Moringa trees grow naturally and are spread over most parts of the country. Mozambique’s semi-arid and semi-humid zones provide suitable altitudes and sufficient rainfall of between 400 to 1400 mm a year. These favourable agro-climatic conditions allow for medium to large scale cultivation of Moringa trees. To increase plant yields for commercial production, however, irrigation systems are required in some regions.

<table>
<thead>
<tr>
<th>Characteristic</th>
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<tbody>
<tr>
<td>Lignin / cellulose</td>
<td>Stem</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Stem</td>
</tr>
<tr>
<td>Hormones</td>
<td>Leaf</td>
</tr>
<tr>
<td>Bioflavanoid</td>
<td>Leaf, flower and stem</td>
</tr>
<tr>
<td>Arachidic acid</td>
<td>Seed and leaf</td>
</tr>
<tr>
<td>Oleic acid</td>
<td>Seed and leaf</td>
</tr>
<tr>
<td>Linoleic acid</td>
<td>Seed and leaf</td>
</tr>
<tr>
<td>Linolenic acid</td>
<td>Seed</td>
</tr>
<tr>
<td>Pterygospermin</td>
<td>Flower</td>
</tr>
</tbody>
</table>

*Table 1: Characteristics of different parts of the Moringa tree*

*Source: Moringanews (Moringanews / Moringa Association of Ghana, 2010)*
3  Multiple uses of Moringa

Moringa is one of the most versatile plants and had already been used by the ancient Egyptians, Greeks and Romans as medicine, perfume and body cream. In Mozambique, it became particularly popular as tea powder and nutritional supplement for dishes, and is also used for prophylactic and therapeutic treatments.

Figure 1 gives an overview of how the different parts of the tree can be used as ingredients for Moringa products, which will be further described in the following sections.

The seeds can be used for the production of oils and their casing can be used for the production of meal.

Various methods exist to extract oil from Moringa seeds. A widespread method is the so-called “cold pressing”, where yields vary according to the type of press used and the kind of technique applied. The kernel must be de-husked before the oil can be extracted. Depending on its refinery processing, the oil can be used in the following forms:

**Vegetable oil** – Moringa Oil is commonly used for human consumption due to its fine taste when refined and long durability. The quantity of fatty acids present is very similar to that of macadamia nut oil. Furthermore, Moringa Oil is considered to have potential as a substitute for olive oil.

**Industrial oil** – It is used as a lubricant for fine machinery, as it does not tend to deteriorate or become rancid or sticky at high temperatures.

![Flowchart](image)
Cosmetics – Fine Moringa Oil is sold on the world market as 100 per cent pure oil. It is also used as a component of many other products, such as soaps, body lotions, face-masks, shower gels and pre-shampoo hair cleanser. Moringa is further used as a carrier-oil in the home-blending of fragrances and essential oils. Some cosmetics companies have taken advantage of the specific proteins found within Moringa Oil in order to develop new products, which protect skin cells against damaging pollutants.

Medical use – Moringa seeds are known for decreasing liver lipid peroxides and are used as an antihypertensive.

Meal, or the so-called “press-cake”, which is what remains of the seed after the oil extraction, can be used in the following forms:

Water purifier – The press-cake can be used to impure water, where it acts as a coagulant, clearing the water and reducing its bacterial concentration. In the process, the press-cake attracts particles and bacteria in the water, causing them to form sediments. Despite the fact that this method has been applied for centuries, its wider use has only recently been propagated. It has the potential to substitute alum, a more costly alternative for water purification. Having been used in water purification, the residue of the press-cake can be further used as animal feed or as a fertilizer.

Fertilizer – The press-cake contains high levels of protein, rendering it a good agricultural fertilizer. It was also found a rich nitrogen complement for crops.

Animal feed – The press-cake is being used as an animal feed.

Human consumption – The roots of young Moringa plants can be ground into a powder and used as culinary spice. They have a taste similar to that of horse radish. In some regions, Moringa is therefore also referred to as the “Horseradish Tree”.

Medical use – Moringa roots have many medical uses. However, the bark should first be removed due to the alkaloids and moringinine toxin contained within. Without the bark, roots are used in antilithic, rubefacient, vesicant, carminative, anti-fertility and anti-inflammatory treatments; as a stimulant in paralytic afflictions; as a cardiac circulatory tonic, a laxative, and an abortifacient; and in treatments for rheumatism, inflammations, articular pains, lower back or kidney pain, and constipation. Root powder is said to have an aphrodisiac effect. When mixed with milk, it is considered useful against asthma, gout, rheumatism and an enlarged spleen or liver. It can also be used to alleviate ear- and toothaches.

Moringa leaves have a high nutritional value and contain amino acids, which are rarely found in other plants. While data differ substantially, Moringa leaves were found to contain a high concentration of vitamin A (approximately ten times the amount found in carrots), vitamin B, vitamin C (at least eight times the amount present in oranges), minerals (in particular iron), and the sulphur-containing amino acids methionine and cystine. The leaves are also an outstanding source of calcium (at least four times the amount obtained from milk), protein, and potassium (at least three times that gained from bananas). The composi-
tion of the amino acids in the leaf protein is well-balanced; and carbohydrate, fat and phosphorous contents are low.

Moringa leaves can be processed and subsequently be used in the following forms:

**Human consumption / Leaf powder** – Dried Moringa leaves can be ground into a powder, which is being used as a nutritional supplement. The regular consumption of Moringa Leaf Powder could be an effective and rather simple way of reducing the number of people suffering from malnutrition. It can be added to meals and drinks without altering their taste. Recently, Moringa has attracted attention in Western markets as a “green superfood”, i.e. an energy catalyst for athletes and a dietary supplement. Both dry and fresh Moringa leaves are also consumed as tea.

**Medical use** – Juice that is made out of Moringa leaves has a stabilizing effect on blood pressure. It also controls glucose levels, which is therefore used by diabetics. Fresh leaves and leaf powder are recommended for tuberculosis patients, because of their high vitamin A content, which boosts the immune system. When used as a diuretic, the juice increases urine flow and cures gonorrhoea. Mixed with honey, it also treats diarrhoea, dysentery and colon inflammation. Fresh Moringa leaves are beneficial for pregnant women and lactating mothers as they improve milk production. Moringa leaves may also be used to treat anaemia.

**Animal feed** – Fresh Moringa leaves are used as forage material for breeding livestock due to their excellent nutritional characteristics. Another important advantage of Moringa as a forage crop is the comparatively high yield obtained per unit area.

Moringa leaves are used to feed cattle, pigs, chickens and poultry. Research by the Mozambican Institute for Agricultural Research (IIAM) showed that the use of Moringa as a fodder supplement had a positive impact on weight increase in chickens, pigs and cattle. It also positively impacted the colour and size of chicken eggs.

**Plant growth enhancers** – The extract obtained from Moringa leaves contains growth enhancing substances, which can be used for the production of a foliar spray. This spray accelerates the growth of young plants and also causes the plants to be firmer and more resistant to pests and disease. Plants that are treated with this spray will also bear more and larger fruits, and will consequently produce a higher yield at harvest time (Becker & Makkar, 1996).

**Medical use** – Moringa bark is used to cure eye diseases, to treat delirious patients, to prevent enlargement of the spleen and formation of tubercular glands in the neck, to destroy tumors, and to heal ulcers. In some countries, the juice from the bark is used to relieve ear aches and is applied to tooth cavities as a painkiller. In other cultures, a paste made from the bark is used to treat boils, and is applied as a painkiller to scorpion stings as well as snake and insect bites.

**Medical use** – Moringa flowers have a high medicinal value as an aphrodisiac, abortifacient and cholagogue stimulant. The flowers are also used to cure inflammations, muscle diseases, hysteria, tumors and enlargement of the spleen.
4 Moringa Leaf Powder

4.1 Market of Moringa Leaf Powder

In Mozambique, the benefits of Moringa products are well-known due to media broadcasts and information campaigns. Most popular is Moringa Leaf Powder, which is commercially produced and merchandised in the country. Many of the persons interviewed, across all income groups, mentioned that they regularly consume Moringa Leaf Powder. However, they also referred to a lack of knowledge about the recommended dosage, which inhibits a more effective consumption. There is certainly a significant, unsatisfied demand for this product, especially among middle and higher income groups.

The local market was described as being rather informal. Farmers in rural areas often source from Moringa trees in their garden or neighbourhood and process on their own. Consumers in cities, in contrast, referred to informal traders or markets, where they buy the product. Indeed, Moringa Leaf Powder is most frequently sold at small shops and local agricultural markets, but also bigger trade fairs, such as the Maputo International Trade Fair (FACIM).

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

The market for nutritional supplements is diverse and, in the European Union (EU), for example, is composed of a multitude of more than 400 substances (European Union, 2013). It can be divided into the following three segments: vitamins and minerals; food supplements (sport nutrition, herbs and botanicals); and specialty supplements. Moringa Leaf Powder falls into the category of herbs and botanicals.

Figure 2 illustrates the EU market for nutritional supplements, where vitamin and mineral products account for the largest share (50 per cent). While food supplements (sport nutrition, herbs and botanicals) still account for 43 per cent, the specialty supplements make up for only 7 per cent. Italy, Germany, the United Kingdom (UK) and France are the major European players in the nutritional supplements market (NutraIngredients-USA, 2008).

The food supplements market segment was found to possess a comparably high growth potential (see Figure 3). Indeed, various enterprises mentioned an interest to maintain, expand or diversify their operations in that area, indicating a particular interest in the herbs and botanicals sub-category, which Moringa Leaf Powder belongs to.

Moringa Leaf Powder is mainly traded in bulk by Indian internet wholesale and Western retail shops, who sell smaller packages to end consumers. The main concern of retailers is to guarantee a constantly high product quality. Therefore, they seek to establish direct links with producers and processors. Nevertheless, retailers reported to frequently face difficulties, because suppliers, including Mozambican pro-
ducers, often fail to deliver the ordered quantities and to fulfil the required quality standards.

A German company, which is selling organic food supplements over the internet, for example, mentioned that it tried to import Moringa Leaf Powder from Mozambique. This, however, was not possible due to the low quality of the product samples received. The company emphasized its strong interest in importing organic and Fairtrade certified Moringa Leaf Powder to fulfil the existing demand for such products.

There is certainly a substantial national and international demand for Moringa Leaf Powder, which currently cannot fully be met. The demand ranges from simple packed Moringa Leaf Powder for the local Mozambican market, up to high-segment products for niche markets in Western countries.

4.2 Value chain of Moringa Leaf Powder in Mozambique

The value chain of Moringa Leaf Powder in Mozambique can be described as being rather short, sometimes fragile and dominated by a few actors. Figure 4 illustrates the links in the value chain, which are described in greater detail below.

Cultivation of Moringa trees
As described in Chapter 2, Moringa trees are found all over Mozambique, with a higher incidence in the provinces of Inhambane, Sofala, Gaza and Cabo Delgado. Apart from wild growing trees, they are mainly cultivated as a means of fencing smallholder household compounds and small plantations. While some small scale Moringa farms exist, bigger, commercially operating farms are not yet established in Mozambique. The interviewed smallholders stated that they did not fertilize, water or prune trees, but only harvested the leaves. One of the main constraints mentioned by smallholders and rural households was the loss of leaves due to ruminant animals, particularly goats.

Collection of Moringa leaves
The collection of Moringa leaves is mainly carried out by smallholder families. In many cases, it is a part-time activity for farmers, who also produce other crops such as maize, sesame and soya. The leaves are either directly consumed in the respective household or further processed.

Processing of Moringa leaves
The processing of leaves is usually performed by women. The leaves are stripped from their branches and left to dry in the open for between two and four days, depending on the humidity of the climate. The dry leaves are then pounded in a wooden mortar. The resulting powder is packaged into small paper or plastic bags, which are acquired in the local market and mostly contain between 100 to 200 grams. More solid plastic boxes are also being used for packaging.

This informal processing results in a great variation in the granulation grade of the powder and irregular package sizes. Open-air drying of the leaves results in losses due to climatic influences and ruminants. Moreover, basic hygiene standards cannot always be guaranteed. The plastic bags used are generally not fit for the purpose, as they al-
low oxidation and the consequent rapid deterioration of nutritional value.

**Commercialization of Moringa Leaf Powder**

The commercialization of Moringa Leaf Powder follows a simple and informal system. Processors sometimes sell the powder directly to the end consumer, but usually sell it to middle men or wholesalers. These either sell it to the end consumer or to bigger retailers, who in turn sell it at the local and regional markets or even abroad. The price for 100 grams of Moringa Leaf Powder varies greatly between approximately Mozambican Meticas (MZN) 50 in Beira and around MZN 100 in Maputo. Small companies are also able to directly sell it at bigger trade fairs, such as the FACIM (see Box 1).

An interesting model is practiced by the Local Development Agency of the Sofala Province (ADEL-Sofala) that acts as a wholesale organization. ADEL-Sofala initiated a Moringa project in 2007, which was supported by Irish Aid (ADEL-Sofala, n.d.). Over the course of this program, ADEL-Sofala distributed plants to 15 associations in Sofala Province and incentivized farmers to produce leaf powder as a nutritional supplement. ADEL-Sofala decided to continue the project and to go beyond household consumption by marketing the Moringa Leaf Powder, as a means to finance its own operational costs. Currently, ADEL-Sofala collects the packaged Moringa Leaf Powder from farmers, who belong to the associations linked to ADEL-Sofala. The leaf powder is collected at the farm gate and its sale to regional retailers is facilitated by ADEL-Sofala. The Local Development Agency has been approached by new retailers, even from abroad, who are interested in buying Moringa Leaf Powder in greater quantities. Given the still small production capacity of the associations linked to ADEL-Sofala, however, no business relation could be established yet. This example shows the need to improve the value chain of Moringa Leaf Powder and subsequently increase the production volume.

**Box 1: Example of a small Moringa company in Beira**

A small company was interviewed, which had started its Moringa business in 2010. The company has three hectares of Moringa plantation in Beira and employs 10 workers. In the rainy season, the production capacity of Moringa leaves is up to 40 kg a month, while it is only around half that volume during the dry season. The Moringa leaves are picked from the tree, washed with running tap water and dried in a small shed, which was constructed for this purpose. The drying period is usually three to four days. However, it may take substantially longer in colder, less sunny periods. Leaf-harvesting is regularly halted due to the low capacity of the drying shed. To process the leaves, the same mill is used, as the one for milling corn. The leaf powder is then dried again before being packed and sealed in bottles and transparent plastic bags. These are acquired from the local market and are labeled, citing the name of the company. Packages of 100 grams and bottles of 200 grams of Moringa Leaf Powder are sold to retailers in Quelimane and Maputo. The transport of the product is paid for by the buyer. Most buyers from Maputo sell their product in South Africa, where higher revenues can be achieved. The company participated in the Maputo International Trade Fair (FACIM), where the products were also sold.

With regard to better exploiting the existing market potential for Moringa Leaf Powder in Mozambique and abroad, one of the key challenges is to upgrade the value chain and thereby increase the competitiveness of the product. This chapter will describe in greater detail how this could be done and Figure 5 provides an illustrative overview.

**4.3 Upgrading the value chain of Moringa Leaf Powder in Mozambique**

**Inputs supply: Propagation of Moringa plants**

Currently, seeds for Moringa plants are only reproduced through collection from wild growing Moringa trees. For an intensive or semi-intensive production, however, it is essential that seeds stem from trusted sources in order to guarantee that they are viable, clean and disease-free. Moreover, the seeds’ quality needs to be analyzed and improved with regard to the following determinants:

- Seed germination;
- Yield capacity; and
- Leaf nutrient quality.
Although there are a number of enterprises active in seed multiplication and sale, Moringa seeds are not yet commercialized in Mozambique. The Mozambican Institute for Agricultural Research (IIAM) and the Centre for Research and Development in Ethnobotany (CID) are seeking to identify the sub-species of Moringa Oleifera Lam that are best adapted to the climate and soils of Mozambique and which have the highest ratings with regard to the characteristics described in Table 1. While CID has already tested the leaf quality, analyses of the other characteristics are not yet consolidated or are still to be conducted.

The state-owned Mozambican Seed Company (SEMOC) confirmed its interest in producing Moringa seeds for sale, on the basis of research undertaken and sufficient demand identified. Meanwhile, certified seeds could be imported from other countries experienced in the production of Moringa, such as India, Kenya, Ghana, Tanzania or Ethiopia.

Moringa could also be grown from cuttings cultivated in nurseries. However, these seedlings are more prone to attack by pests and their root system is less deep, rendering it more easily affected by climate changes, such as drought or wind.

**Production of Moringa leaves**

For commercial Moringa leaf processing, a stable production basis is required. This cannot be achieved through collection from wild growing trees, which may produce low and unreliable yields of vastly varying quality.

As outlined in Chapter 2, Moringa grows on fairly poor soil. Consequently, it does not compete with food crops for rich soils. Farmers in rural or peri-urban Mozambique can easily undertake Moringa leaf production. Whilst creating additional income, cultivation requires little financial investment and can be carried out without the use of chemicals. For commercial leaf production, the trees need to be pruned in order to obtain bushy leaf-growth, need to be irrigated sparsely but regularly, and should be manured organically. A Moringa plantation can produce leaves in abundance the whole year round, with a production peak in the rainy season. For small fields, producing leaves from

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**Figure 5: Upgraded value chain of Moringa Leaf Powder**

Source: Own compilation
trees at 1 m² spacing is perhaps the best option, where fresh leaf weight yield is 1 to 5 kg per tree and year, which is the equivalent of 10,000 to 50,000 kg/ha per year. This is estimated to be reduced to around 1/6th of the volume after processing. One hectare of Moringa plantation would therefore result in between 1.67 kg and 8.3 kg of leaf powder after processing (Foidl, Makkar, & Becker, 2001).

IIAM has developed a handbook for farmers that want to start producing Moringa. In addition to that, the internet portal Moringanews provides a detailed manual on Moringa leaf production and processing (Moringanews / Moringa Association of Ghana, 2010). While this is a good starting point for small scale household production, commercial Moringa farming requires further knowledge transfer and training.

**Processing of Moringa Leaf Powder**
The processing of Moringa Leaf Powder needs to start directly after the collection of the leaves due to their rapidly perishable nature. Therefore, a functioning logistics management system is a critical element in the value chain. It requires smallholders to communicate, cooperate and coordinate their harvest with transport services to the processing centre to maintain the quality of the leaves and avoid deterioration (Moringanews / Moringa Association of Ghana, 2010). Transport should be carried out in closed receptacles, e.g. boxes, which require air-conditioning or refrigeration for longer distances.

The processing center needs to be equipped with:
- A washing station for washing the fresh leaves;
- A drying room (or solar drying equipment); and
- A burr mill (or a rented commercial hammer mill).

Until specific processing centers for Moringa production are in place, the fresh leaves could alternatively also be washed and dried on-farm before transportation. Moreover, an existent food mill, such as a corn or cassava mill, could be used. However, great attention must be paid to the conditions of these mills and the cleaning methods, given that strict hygiene standards need to be met. Moringa Leaf Powder is easily contaminated by moulds, as it strongly attracts moisture and the particles of finely milled powder are more easily penetrated by bacteria.

**Packaging and labelling**
Moringa Leaf Powder should be packaged in containers that prevent moisture absorption and should not be stored for over six months as the powder quickly loses its quality. It could either be packed in plastic bags for bulk sale and repackaging purposes or in packages for retail sales. Packages should be opaque and should be made of materials that do not affect the quality of the product and which comply with packaging requirements of goods for human consumption.

CIDE has developed two types of packing for Moringa Leaf Powder, using locally available materials with the pack-
age type depending on the product form. One option is a
typical cardboard box, containing 25 paper teabags of 2.5
grams each. The cost of the packaging was quoted as MZN
60. Another option is an opaque plastic container, hold-
ing 60 capsules of 200 milligrams of Moringa Leaf Powder
each. CIDES expressed interest in exploring additional
types of packaging for Moringa Leaf Powder.

Labelling must provide the buyer with basic information
about the content of the product and about how best to
handle it. Therefore, the labels of Moringa Leaf Powder
should mention the following details:

- Name of the product;
- Net content;
- Name and address of the producer;
- Place of origin;
- Lot / batch identification number or code;
- Instructions for use;
- Production date;
- Nutritional information (optional).

Quality standards
Many countries with Moringa Leaf Powder production
have mandatory national standards in place that define
the minimum quality requirements for the respective
product. In Mozambique, national standards for Moringa
products have not been established yet. The responsible
institution in that regard is the National Institute of Stan-
dardization and Quality (INNOQ). It has the mandate to
progressively improve the quality system by developing
classifications, standards, norms and regulations. While
INNOQ has experience in the horticulture sector, it could
make use of existing standards for Moringa products of
other countries, such as Ghana. A national standard would
provide a strong incentive to further invest in Moringa
production given that it increases the market value of the
product by enhancing the trust of traders as well as of
consumers.

Commercialization: Wholesale and retail
Although there is a growing demand for Moringa Leaf
Powder, its commercialization still remains very infor-
mal. Consequently, reliable market information, such as
production volumes and prices on the national and in-
ternational markets, is also difficult to obtain. These data,
however, are necessary for producers to make informed
business decisions.

Once a critical production volume and the required level
of quality are achieved, a broader marketing campaign
should be started, which could even lead to the creation
of a national brand for Moringa products. Producers and
producer associations should be supported in establishing
strong links to national and international wholesalers and
retailers. Business relations with larger retail shops and in-
ternational supermarket chains, such as Shoprite, Spar and
Pick n’ Pay, seem particularly promising. A range of differ-
ent local products have already been successfully placed
into the assortment of these supermarkets.

The Mozambican Institute of Export Promotion (IPEX)
could identify potential export markets and promote the
products at international fairs in Mozambique, like the
FACIM, or even abroad. In order to have the necessary
statistical basis, production data for Moringa Leaf Powder
should be regularly collected and included in, for instance,
the national Agricultural Markets Information System
(SIMA).

To effectively tackle these challenges in the value chain
of Moringa Leaf Powder, it is recommended that both the
horizontal and vertical coordination between all involved
actors is improved.

Horizontal coordination between the producers is neces-
sary to achieve economies of scale and to reduce transac-
tion costs. Smallholder farmers, in particular, should form
viable associations or cooperatives to achieve a higher
accumulated production volume, to profit from joint
production management, product marketing and price
bargaining, and to improve access to finance. Vertical co-
ordination between producers, wholesalers and retailers
is necessary in order to identify and best exploit business
opportunities.

Finally, extension services should be established that pro-
vide the producers with the necessary knowledge, skills
and technology to improve their competitiveness. Such
services could also be provided under the framework of
outgrower schemes. While various outgrower schemes are
operational in Mozambique, the most suitable for at least
semi-industrial Moringa Leaf Powder production should
be identified.
5 Moringa Oil

5.1 Market of Moringa Oil

Consumers in developed countries increasingly prefer cosmetics that are from extracts of plants rather than from mineral oils. Therefore, the cosmetics industry started to differentiate its products by using more vegetable oils in the production. This trend triggered a growing international demand, and thereby higher prices, for oils obtained from exotic plants like the Moringa tree. Even though the market for exotic oils and fats is still very small, it is growing at a faster rate than that of traditional vegetable oils.

Global trade statistics are only available in an aggregated form for exotic vegetable oils. Besides Moringa Oil, which constitutes a minor proportion, this product group also includes apricot kernel oil, cupuacu butter, argan oil, baobab, papaya seed oil, shea butter and others. Moreover, these data do not allow distinguishing between fully natural products and chemically refined products (CBI, 2009). Therefore, this chapter is limited to analyzing the general market trends for exotic vegetable oils, which includes Moringa Oil.

As illustrated in Figure 6, the volume of global imports of exotic vegetable oils was at a high level in 2007 (approximately 700,000 tons) and maintained a quite constant level during 2010 and 2011 (approximately 600,000 tons). The single most important importer was the EU, which imported around half of the volume from Developing Countries (DCs).

As illustrated in Figure 7, the value of global imports of exotic vegetable oils increased from around USD 1.05 billion in 2009 to almost USD 1.4 billion in 2011. This shows that exotic vegetable oils are an increasingly attractive high value added commodity.

The EU is by far the largest market and, therefore, will be analyzed in greater detail (see Figure 8). In 2011, the EU accounted for almost half (49 per cent or USD 666.7 million) of global imports of exotic vegetable oils. The market of the USA accounted for 7 per cent or USD 97.6 million. The remaining share of 44 per cent, or USD 595.9 million, was made up by imports to Asian countries, most importantly Japan, Malaysia and Singapore.
Within the EU, the three largest importing countries (accounting for 26 per cent of global imports) were France, the Netherlands and Germany. Exotic vegetable oils are typically imported to the EU in crude form and then processed and refined inside the EU, which results in considerable value addition and mark-up. Thereby, a significant intra-EU trade with exotic vegetable oils is taking place, which is difficult to measure and generally underestimated (CBI, 2009).

Figure 9 shows that the price for exotic vegetable oils is considerably higher and has proven more stable than the one for more widely used vegetable oils. The world market price for exotic vegetable oils has grown from around USD 1,450 per ton in 2007 to almost USD 2,300 per ton in 2011. Remarkably, it did not experience the same steep decline of the prices of other vegetable oils during 2009 and 2010.

With regard to the EU market, the price for exotic vegetable oils remained comparably stable between 2009 and 2011, while the prices for other vegetable oils increased sharply during the same period (see Figure 10).
It is important to note that the price spectrum in the group of exotic vegetable oils itself varies significantly. Moringa Oil, together with argan and papaya seed oils, is at the very high end of this spectrum (CBI, 2009). One reason is the small amount of Moringa Oil that is currently available on the world market, which renders it a rare and expensive commodity. Moreover, the price obtained for Moringa Oil varies again depending on the quality of the oil. Finally, the price is influenced by the certifications (e.g. organic, Fairtrade) of the final product.

As Moringa Oil is not traded on a large scale, most companies possess direct links with producers and processors in order to guarantee the availability and quality of the product. Some cosmetics companies have expressed interest in exploring the possibility of purchasing from new Moringa Oil producers, if the international quality standards for natural cosmetics are being met.

5.2 Production of Moringa Oil in Mozambique

The production of Moringa Oil is a complex process and results in high production costs. This renders the product uncompetitive compared to other edible vegetable oils, such as palm and sunflower. Therefore, Moringa Oil is currently only used and traded as exotic vegetable oil in the cosmetics industry.

In Mozambique, Moringa Oil is not yet produced on a commercial basis. Several companies, however, have experience in the production of traditional vegetable oils, particularly from coconut and sunflower seeds. First experiences also exist with the production of Moringa Oil. This knowledge could be built upon for starting a small scale production of Moringa Oil in Mozambique. In fact, three oil-extracting companies expressed interest in exploring the possibilities of Moringa Oil production. One of the enterprises is already in the phase of testing Moringa Oil pressing with its machinery.

In contrast to the cultivation of Moringa trees for leaf powder production, the trees that are planted with the aim of harvesting the seeds as input for Moringa Oil production do not need to be pruned. Depending on water and manure management, each tree can produce between 15,000 and 25,000 seeds per year (Foidl, Makkar, & Becker, 2001).

The subsequent oil manufacturing requires quality seeds with the same degree of ripening. The process stretches from the seeds’ initial transport after harvest through their temporary storage and de-husking, and finally to their pressing and cleaning. Seeds are not as sensitive to transport as leaves and can be extracted, packed and stored in a dry place for some time before transportation for processing. The oil extraction itself is a more complex process and constitutes a challenge, particularly for smallholders without adequate equipment. Technical problems were reported, e.g. during the processes of polymerisation and filtering, which lower the productivity and extraction yield, and result in large variations in the oil quality.

For small scale production, the presses can be manual, while motorized presses of appropriate sizes are required for semi-industrial and industrial production for export purposes. In Mozambique, an association or cooperative could jointly invest in the acquisition of a manual or motorized oil press. Some of the companies interested in producing Moringa Oil are planning to work with outgrower and community schemes. Since the requisites for oil extraction, such as a rigorous control of plant material, are demanding, the companies mentioned that comprehensive extension services are indispensable.
6 Access to international markets

Mozambique enjoys preferential access to the most important markets for Moringa products, including the EU and the USA. As a least developed country, Mozambique qualifies for the Everything But Arms initiative of the EU, which grants duty free and quota free market access for virtually all exports from these countries. Mozambique also benefits from preferential access to the USA under the African Growth and Opportunity Act (AGOA), which, however, is more limited with regard to the products covered. Moreover, as a member of the Southern African Development Community (SADC) Free Trade Area, Mozambique enjoys preferential market access to the SADC member states, including South Africa.

In order to benefit from these preferential trade agreements, producers need to fulfil a number of mandatory regulations and standards that are required for all imports to the respective market. With regard to Moringa products, the most relevant are sanitary and phytosanitary standards, which define the requirements for food safety (bacterial contaminants, pesticides, inspection, labelling) and for animal and plant health (phytosanitation). Furthermore, many global retailers demand the compliance with internationally recognized voluntary or private standards, such as GLOBALG.A.P., organic or Fairtrade.

The following two sub-chapters provide further information on the regulations of the EU as the principal market for nutritional supplements and exotic vegetable oils, and on selected voluntary standards that are relevant for Moringa products.

6.1 EU regulations and standards

The EU has developed a sophisticated system of regulations and standards to guarantee consumer health and safety, and to take into account social and environmental aspects.

Moringa Leaf Powder falls under the category of nutritional supplements, which the EU defines as “concentrated sources of nutrients, or other substances, with a nutritional or physiological effect, the purpose of which is to supplement the normal diet” (European Commission, 2006). Nutritional supplements are food products that, when imported to the EU, need to comply with the regulations concerning public health, particularly food hygiene. This includes food safety standards, general hygiene provisions, the application of the Hazard Analysis and Critical Control Points (HACCP) system and product-specific requirements. While the compliance with these regulations is normally controlled at the point of entry, pre-export inspections are reportedly possible in certain cases. As a principle, there are shared obligations between the food business operators, importers, and the respective authorities in EU member states and exporting countries. Given the strict regulations, importers typically require that all producers have a food safety system in place, e.g. to make sure that the necessary phytosanitary certificate is issued by the Ministry of Agriculture in the respective exporting country.

Moringa Oil, when used in the cosmetics industry, needs to comply with the EU Cosmetics Directive that specifies the requirements concerning the composition, labelling and packaging of cosmetic products (European Union, 2011). Exotic vegetable oils, including Moringa Oil, that are not chemically modified are exempted from the EU’s regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). For exotic vegetable oils, which are imported into the EU for the first time, the importer is required to present a proven record of use in the country of origin, which serves as an informal verification of its safety for use as a cosmetic product (UK REACH Competent Authority, 2012).

6.2 Voluntary standards

In the food sector, voluntary standards and initiatives, such as GLOBALG.A.P., organic and fair trade play an important role. A number of global retailers have made public commitments to increasingly source their products from producers that possess specific certifications, such as GLOBALG.A.P. Moreover, products that are certified with e.g. organic or fair trade labels get a better price on the market than without having the label.

Moringa products, such as Moringa Leaf Powder and Moringa Oil are highly specialized products for niche markets, where these labels are “de facto” mandatory given the prevailing consumer preferences.
Table 2 gives an overview of selected voluntary standards that seem particularly relevant for exports to the EU market; they will be explained in greater detail in the following sections.

GLOBALG.A.P.
GLOBALG.A.P. is a standards setting organization for the certification of Good Agricultural Practices (G.A.P.). The established standards are mainly based on criteria for food safety and sustainable production methods. Today, most global retailers in the food sector demand the certification from their suppliers (GlobalG.A.P., 2013).

GLOBALG.A.P. certifications can be obtained from authorized private agencies. Individual producers and groups of producers can apply for certification, the cost of which depends on the certification agency chosen and the time spent on the inspection. In addition to the certification fee, the producer must pay an annual fee to GLOBALG.A.P. in order to maintain the certification. Given that in Mozambique no private agencies operate, the certifications are being done mostly by South African certification bodies, such as Ecocert Southern Africa.

Organic
In Mozambique, traditional agricultural production is “de facto” organic. Therefore, organic farming has a significant potential in the country. Organic production systems focus on environmental conservation and on food quality and safety.

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>PARTICULARLY RELEVANT FOR</th>
<th>MAIN OBJECTIVES OF THE STANDARD</th>
<th>CERTIFYING ORGANISATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLOBALG.A.P.</td>
<td>Export-oriented medium and large scale agro-industries and producer groups</td>
<td>Improvement of food safety and traceability of products</td>
<td>e.g. Ecocert Southern Africa</td>
</tr>
<tr>
<td>Organic</td>
<td>Small, medium and large scale producers</td>
<td>Improvement of food quality and safety and environmental conservation</td>
<td>e.g. Ecocert Southern Africa; AFRISCO</td>
</tr>
<tr>
<td>Fair trade</td>
<td>Small scale producers that are organized in associations and producers with an organized labour force</td>
<td>Improvement of the trading and, thereby, living conditions for producers in developing countries; promotion of the concept of sustainability</td>
<td>Private fair trade organizations, such as FLO-CERT</td>
</tr>
</tbody>
</table>

Table 2: Selected voluntary standards relevant for exports to the EU
Source: Own compilation
In Mozambique, organic certifications are undertaken by foreign agencies. It is important to note that a certification agency must be officially recognized in the country where the product is to be sold. While the requirements for organic certification vary, Box 2 provides an overview of the most important ones.

**Box 2: Selected requirements for organic certification**

- Farmland needs to be free from prohibited synthetic chemicals for a specific number of years
- Synthetic chemical inputs, such as fertilizers, pesticides and genetically modified organisms, cannot be used
- Organic products need to be separated strictly from non-organic ones
- Detailed production and sales records need to be provided

In Southern Africa, the Africa’s Farms Certified Organic (AFRISCO) certification scheme has become increasingly important for organic products. It licenses organic food production, processing and packaging. AFRISCO’s scheme is accredited by the International Federation of Organic Agriculture Movements (IFOAM), which is the international umbrella organization for the organic agricultural sector. AFRISCO has also applied for accreditation by the EU in order to allow certified operators to export to the EU (AFRISCO, n.d.).

Another important certifying body is Ecocert, which has established itself as Ecocert Southern Africa in the region. Ecocert focuses on the certification of organic agricultural products, but has extended its services also to organic and natural cosmetics, ecoproducts, fair trade and others (Ecocert, n.d.).

**Fair trade**

Another promising certification for Moringa products is fair trade, which seeks to improve the trading and, thereby, living conditions of producers in developing countries. The fair trade standards aim at establishing a partnership between producers and consumers. Therefore, the standards apply not only to the production process, but also to the commercialization and trading conditions.

Fair trade certification can be applied for by a group of producers in a cooperative, farmer associations or large farms with an organized labour force. IKURU, a Mozambican Farmers’ Cooperative, for instance, already successfully exports Fairtrade certified cashew nuts from Mozambique to the EU.

There are various fair trade organizations on the market, which use different marketing strategies and certification bodies for their labels. Among the most common and renowned organizations are Fairtrade International (FLO), the World Fair Trade Organization and Fair Trade USA.
The present study has shown that there is a potential in Mozambique to commercially produce and trade Moringa products. This, however, requires various changes in the production, processing and commercialization processes and practices. In this regard, the following key recommendations can be made:

1. Production

The cultivation of Moringa trees needs to be expanded to achieve economies of scale in the production of both Moringa leaves and seeds. The already existing small scale farming should be complemented by semi-industrial or even industrial plantations.

- Seeds: The availability of viable, clean and disease-free seeds must be guaranteed to grow and cultivate Moringa trees of good quality. While in the short-term, certified seeds could be imported, it is recommended to develop and certify national Moringa seeds. IIAM and CID should intensify their efforts to identify the subspecies of *Moringa Oleifera* Lam that are best adapted to the climate and soils of Mozambique, and which guarantee the highest yields. Subsequently, SEMOC could be approached that expressed its interest in producing Moringa seeds for sale.

- Cultivation techniques: Although Moringa trees grow naturally in Mozambique due to the country’s favourable agro-climatic conditions, yields could be increased by applying specific cultivation techniques. Available information, such as the handbook of IIAM, and trainings should be provided on the most adequate cultivation techniques, including irrigation and pruning practices.

- Organization of producers: Horizontal coordination between producers should be improved to achieve economies of scale and to reduce transaction costs. Smallholders, in particular, should form viable associations or cooperatives to achieve a higher accumulated production volume and to profit from joint production management. Technical advice should be offered to set up well-functioning organizational structures and to apply good management practices. The establishment of outgrower schemes should be further explored; support might be needed to create systems that guarantee mutually beneficial business relations.

2. Processing

While the processing of Moringa leaves is technically not complicated, it requires a functioning logistics management system. In contrast, the processing of Moringa Oil is a technically more demanding process with higher investment costs involved.

- Logistics management: A functioning logistics management system should be built up, which includes effective communication, cooperation and coordination between smallholders and transport services. The transport of Moringa leaves should be carried out in closed receptacles, e.g. boxes, which require air-conditioning or refrigeration for longer distances.

- Processing centers: In the case of Moringa leaves, specific processing centers with a washing station, a drying room and a burr mill should be installed to guarantee the fulfilment of hygienic standards. As the necessary investment costs often exceed the financial capacity of smallholders, such processing centers should be established and operated by associations or cooperatives. Since CID possesses experience in using machinery for the milling of leaf powder, this knowledge should be made available and disseminated.

- Packaging: Moringa Leaf Powder should be put in opaque packages that prevent moisture absorption and should not be stored for over six months as the powder quickly loses its quality. Based on the prototypes that are already developed by CID, local production of packaging should be supported.

- Extension services: Farmers and associations should be supported and trained in processing methods to improve their competitiveness. Such services could also be provided under the framework of outgrower schemes.

Given the comparatively high technical requirements for Moringa Oil production, it is recommended to initiate a pilot project with an interested enterprise that is already
producing other vegetable oils, such as coconut, sesame or sunflower. Adequate machinery is crucial to guarantee a consistent quality and quantity. An outgrower scheme could be integrated in the project for the cultivation of Moringa trees that are most suitable for oil seeds production.

3. Commercialization

The commercialization of Moringa products in Mozambique is still very informal and makes it difficult to get reliable information of production volumes and prices. To effectively exploit the existing market potential, the commercialization should become more structured and formalized.

- **Access to markets:** The vertical coordination between producers, wholesalers and retailers should be improved. As soon as the required minimum quantity and quality are achieved, local shops should be approached; at a later stage, even international supermarket chains could be contacted to place the products in their assortments of goods. IPEX could support the promotion of the products at international trade fairs in Mozambique, such as the FACIM, or abroad.

- **Market information:** Reliable data on the national production of Moringa products should be regularly collected and included, for instance, the national Agricultural Markets Information System (SIMA). IPEX could assist in the identification of potential export markets, based on international market research.

- **Standards and certification:** INNOQ could develop national quality and food safety standards for Moringa products, which would provide a strong incentive for further investment in Moringa production. Such standards would increase the market value of the product by enhancing the trust of traders as well as of consumers. To access international markets, Moringa products should have voluntary certifications, such as GLOBALG.A.P., organic or Fairtrade. Organic standards seem particularly promising, given that traditional agricultural practices are already “de facto” organic. Moreover, Mozambique could thereby create and promote the image of “pure nature” and use it as part of a broader marketing strategy. However, compliance with international standards is demanding and costly. Therefore, trainings should be offered and adequate finance schemes should be elaborated and made available.
8 Conclusions

There is a growing demand for Moringa products at national, regional and international levels. In Mozambique, Moringa is well-known, but not yet commercially exploited. Moringa trees grow naturally in the country due to the suitable land and excellent climatic conditions. However, there are few Moringa plantations and, currently, only Moringa Leaf Powder is produced, processed and traded in small quantities at the national level.

In the short to medium term, there is a potential to increase the production volume and quality of Moringa Leaf Powder in Mozambique. This would have the double benefit of improving the nutrition situation of the population and offering an additional income for smallholders. The national market could be easily exploited, whereas the regional and international markets are more difficult to enter.

In the medium to long term, there is also a potential to commercially produce Moringa Oil in Mozambique. This requires medium scale investments and technological upgrading. While there is only a very small national market, the rising global prices for exotic vegetable oils indicate that the international market is most promising for this high value niche product.

The key challenge is to overcome the identified bottlenecks in the value chain. This will only be possible through joint efforts by the private sector, including smallholders, associations and larger companies, and public institutions, such as CIDE, IIAM, INNOQ and IPEX.
References

- European Advisory Services (2007). The use of substances with Nutritional or Physiological effect other than Vitamins and Minerals in Food Supplements.
Annex 1
List of companies relevant for Moringa products

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Relevance for Moringa products</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADEL-Sofala</td>
<td>Mozambique</td>
<td>Sells Moringa Leaf Powder on behalf of the members of their associations</td>
</tr>
<tr>
<td>Africa Naturally</td>
<td>Mozambique</td>
<td>Produces essential oils</td>
</tr>
<tr>
<td>Afrilex</td>
<td>South Africa</td>
<td>Sells Moringa Oil in South Africa</td>
</tr>
<tr>
<td>ALDIVIA SA</td>
<td>France</td>
<td>Sells essential and exotic oils</td>
</tr>
<tr>
<td>AMAL Apa Banda</td>
<td>Mozambique</td>
<td>Produces and sells Moringa Leaf Powder</td>
</tr>
<tr>
<td>Eartheil Plantations</td>
<td>UK</td>
<td>Produces and sells Moringa Oil in East Africa</td>
</tr>
<tr>
<td>Imperial-Oel-Import Handelsgesellschaft</td>
<td>Germany</td>
<td>Refines essential and exotic oils</td>
</tr>
<tr>
<td>Maeva Oils</td>
<td>Mozambique</td>
<td>Produces sunflower oil</td>
</tr>
<tr>
<td>Mezimbite Bio Oils Maxixe</td>
<td>Mozambique</td>
<td>Produces essential and exotic oils</td>
</tr>
<tr>
<td>Moringa Farms</td>
<td>USA</td>
<td>Sells Moringa products in the USA</td>
</tr>
<tr>
<td>Nautica organics</td>
<td>South Africa</td>
<td>Sells organic oils and indigenous oils</td>
</tr>
<tr>
<td>Phytotrade Africa</td>
<td>Zimbabwe</td>
<td>Promotes indigenous plants, such as Baobab and Mafura</td>
</tr>
<tr>
<td>San Leaf</td>
<td>Germany</td>
<td>Sells Moringa products on the German market</td>
</tr>
<tr>
<td>Southern Africa Oils</td>
<td>Mozambique</td>
<td>Manufactures coconut oil</td>
</tr>
<tr>
<td>Zaanlandse Olieraffinaderij (ZOR)</td>
<td>Netherlands</td>
<td>Large refinery of essential and exotic oils</td>
</tr>
</tbody>
</table>

Annex 2
Research institutions and projects relevant for Moringa products in Mozambique

<table>
<thead>
<tr>
<th>Institution</th>
<th>Relevance for Moringa products</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centro de Investigação e Desenvolvimento em Etnobotânica (CIDE) do Ministério da Ciência e Tecnologia</td>
<td>Developed methods for the processing of Moringa products and packaging of prototypes</td>
<td><a href="http://www.mct.gov.mz">www.mct.gov.mz</a></td>
</tr>
<tr>
<td>Centro de Investigação e Transferência de Tecnologia para o Desenvolvimento (CITT)</td>
<td>Possesses a Moringa plantation and started a pilot project on how to use Moringa for water purification</td>
<td><a href="http://www.citt.gov.mz">www.citt.gov.mz</a></td>
</tr>
<tr>
<td>Instituto de Investigação Agrária de Moçambique (IIAM)</td>
<td>Conducts research on Moringa and developed a Moringa planters handbook</td>
<td><a href="http://www.iiam.gov.mz">www.iiam.gov.mz</a></td>
</tr>
<tr>
<td>Instituto para a Promoção de Exportações (IPEX)</td>
<td>Interested in Moringa products for export promotion</td>
<td><a href="http://www.ipex.gov.mz">www.ipex.gov.mz</a></td>
</tr>
<tr>
<td>Universidade Eduardo Mondlane (UEM)</td>
<td>Conducted research on Moringa in Mozambique</td>
<td><a href="http://www.uem.mz">www.uem.mz</a></td>
</tr>
</tbody>
</table>