

SECTOR STUDY PROCESSED MANGO



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This document is part of the mango sector study. This study explores the technical and economic feasibility of different processing and waste valorisation activities. The other chapters are available here: [resources.colead](#)

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1. Mango butter

1.1 What is mango butter?

Mango butter is an oil that has been extracted from the seed of the mango. It is also known as mango kernel butter. Like shea and cocoa butter, it is a light oil that melts when slightly warmed. Mango butter is sometimes used as an ingredient in skin care products such as lotion, face cream, soaps, body butter or lip balm.

Like shea or cocoa butter, it is possible to use mango butter as an ingredient in foods such as chocolate or other snacks, but this is rare.



Source: www.isvunonaturals.com

1.1.1 Cocoa butter and animal fat replacement

Mango butter has similar properties to cocoa butter and can replace cocoa butter in chocolate. The EU allows up to 5% of cocoa butter to be replaced by other butters. Shea butter often replaces cocoa butter; Cocoa Butter Equivalent (CBE) is the biggest market for shea butter.

The USA does not allow cocoa butter substitution. Other countries, including some in Asia, do allow substitution. This is a particularly relevant issue as there are shortages in the global cocoa butter market. Mango butter can also be used to replace margarine and other animal fats in recipes for desserts and baked goods.

1.1.2 Oils in nutraceuticals

Mango butter is rich in vitamin C and other nutrients that research has linked to improved collagen synthesis in the body. Mango butter is currently a popular ingredient that has received significant attention from various companies supplying supplements.

1.1.3 Oils in cosmetics

The texture, low melting point and vitamin content of mango butter make it an interesting ingredient for cosmetics and personal care products. Mango oil is used in products such as lotions, face moisturisers, shampoos and lip balm.

2. Demand

2.1 Market size

Mango butter is a relatively new product on the market. It has a high price, which may hamper its growth potential. Nevertheless, according to several studies, the mango butter market size was valued at US\$100.4 million in 2019 and was projected to reach US\$163.4 million by 2027. This is a growth of 13.0% from 2021 to 2027.¹

Most of the demand is driven by interest from the personal care industry, particularly in North America and Europe, which are currently the largest markets for mango butter. However, the demand for natural cosmetic products in the Asia-Pacific region is expected to grow.

Technological advancements have helped producers of mango butter in Europe to refine mango butter, so the mango butter market in Europe is witnessing considerable development.

2.2 Market trends

2.2.1 Novelty and trends

Several studies suggest that the demand for mango butter will grow. However, demand for ingredients such as aromas and oils in the cosmetics industry is very trend-driven. Demand in one year can spike, only to be followed by a fall in the next year. For example, woody fragrances can be very popular, only to be replaced by cleaner, fresher fragrances in the next year. This is how cosmetics companies drive interest in the category. However, it can be problematic for processors, who might have to develop a supply chain in order to satisfy market demands. Currently, mango butter satisfies many popular market trends, but it is important for processors to consider whether these trends will be sustained. If they are likely to be short-term trends, investors must decide whether this justifies investment.



Source: Brand website

2.2.2 Clean beauty



Source: skyorganics.com

Shoppers are increasingly seeking out cosmetic products that claim “natural” credentials. Many beauty companies are replacing artificial colours and fragrances with natural oils and vegan and organic ingredients. Raw mango butter is particularly interesting in this trend as it offers a natural, minimally processed product. It can also claim to be vegan, is not tested on animals and, depending on the source of the mango seeds, may be organic. These qualities may be beneficial for both marketers and processors.

¹ Allied market research (2020). Mango Butter Market by Type (Refined and Unrefined) and Application (Food, Cosmetics, and Pharmaceutical): Global Opportunity Analysis and Industry Forecast, 2021–2027. <https://www.alliedmarketresearch.com/mango-butter-market>

2.2.3 Floral fragrances



Floral fragrances are currently an important fragrance trend. These fragrances may appeal to a sense of nostalgia or tradition among consumers. Currently, these products are taking up more space on retail shelves, reducing opportunities for fruity fragrances. This is another example of the unpredictable nature of the cosmetics and personal care category. This possible risk needs to be considered by potential investors.

Source: *The Body Shop*

2.2.4 Responsible citizenship

Becoming a “good global citizen” is a trend that is currently affecting many product categories. This trend includes the desire for vegan products that are made sustainably. There is also a desire for more inclusive products, whether from the perspective of gender, sexuality or general economic welfare. Processors of mango butter who can offer positive sustainability stories might have an advantage over companies that cannot offer these benefits.



Source: *The Body Shop*

2.2.5 Mango blends



Mango is most often sold as a raw or unblended product, while mango oil is often blended with a variety of oils in the final product. However, this is not always stated on packaging. Where blends are stated, they tend to be combinations of tropical fruits or nuts. Some popular blends claimed on product packaging are coconut, shea, mandarin, papaya and marula.

Source: www.petalfresh.com



2.3 Certifications and quality standards

2.3.1 Visual

Clear butter with no visible impurities or unpleasant smells. Easily spreadable once heated.

2.3.2 Packing

Mango butter can be purchased in a range of sizes. The smallest pack size is 20 kg, although volumes can be as large as 36 tons. Some common pack sizes for export are:

- a 20 kg bucket
- 25 kg box
- 190 kg drum
- an Intermediate Bulk Container typically holding 1 ton
- an ISO (International Organisation for Standardisation) tank, which can hold up to 36 tons of product.

2.3.3 Certifications

There are no specific required certifications for mango butter. However, to achieve a competitive advantage it may be useful for producers to consider several certifications that are being used by beauty companies. These include product certified by the Soil Association, artisanal production, fair trade, rainforest alliance and organic certifications.



3. Supply

3.1 How do these products reach the market?

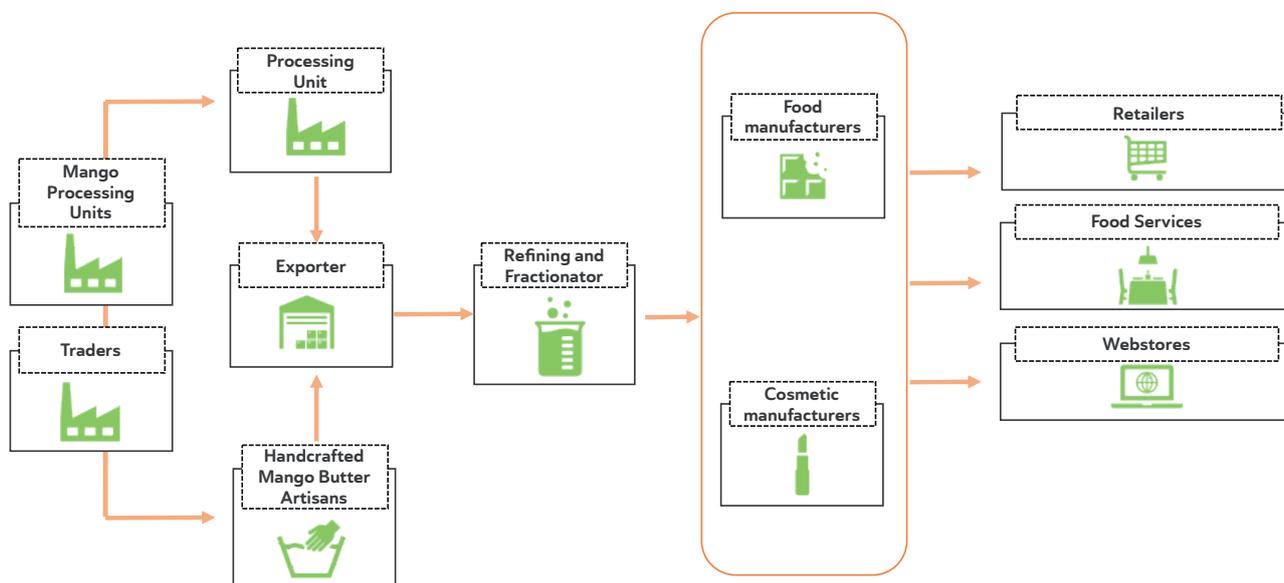


Figure 1. Overview of the mango butter value chain

The value chain for mango butter (Figure 1) is similar to those for other nut butters such as shea or cocoa butter. However, as mango butter is made from the mango seed (waste from mango processing units), the seeds need to be collected and taken to a second processing unit. The processing company extracts the oil from the seed and sells the raw mango butter to an exporter. Mango butter can also be pressed by small-scale artisanal processors.

The more complex process and the specialised knowledge required to successfully extract oils from mango seeds means that there are relatively few companies that extract oils in this way, especially in Africa. Monorama in India is perhaps one of the few companies currently extracting mango oil for the global market. Monorama is able to do this because the company extracts a variety of different oils, such as shea and cocoa, as well as oils from local seeds such as *kokum* and *sal*.

In most parts of the world, mango butter is pressed mechanically. The raw butter is consolidated into batches that can fill a container, then shipped to a refinery, which is typically in a developed market such as the Netherlands or Germany. The raw mango butter is then processed further so that it is smoother and ready for use in cosmetics or food products.

3.2 Main suppliers of mango butter

India is a major mango growing country and the origin of most of the mango butter sold on global markets. Production of mango butter in India is largely manual. Cooperatives tend to arrange for collection of mango seeds from the wild. They then sort, sun-dry and crack the mango seed so that the kernel can be removed. These are then supplied to processing facilities equipped to extract the oil.

3. Supply

The USA and China are also large suppliers of mango butter.² However, in the case of the USA this is because of refining capabilities that enable companies to refine raw mango butter.

In most oils and fats, the higher margins can be found closer to the consumer. The butter extraction often attracts the lower margin, whereas companies who refine fats tend to have higher margins. Fractioning of fats into separate compounds such as olein and stearin is technologically more complex and tends to attract even higher margins. The more complex refining and fractioning is often done in the US and Europe, whereas extraction is increasingly carried out closer to source in developing countries.

3.3 Pricing

It is difficult to obtain reliable pricing for any commodity that is new and has relatively low trading volumes. Furthermore, the prices obtained may only be theoretical prices, because that price would not attract a buyer in practice. An exporter may offer a price based on their cost-price and margin, but because alternatives are much cheaper, few if any buyers may be willing to purchase at that price. Often, it is necessary for a new product to be priced close to or lower than the product it can substitute for in order to obtain a decent market size.

3.3.1 Foods

The closest substitutes for mango butter are shea butter and cocoa butter. Like mango butter, both can be used in cosmetics and food.

There are three types of shea butter:

- Artisanal butter for the regional West African market
- Artisanal and partly refined butter for the international cosmetics market; often organic and fair trade certified
- Shea butter that is industrially produced with the use of solvent extraction plants. This butter is often fractioned into olein, stearin and latex and can be considered equivalent to cocoa butter.



² <https://www.cbi.eu/market-information/natural-ingredients-cosmetics/mango-butter/market-potential>

As industrial shea butter is a substitute for cocoa butter used in chocolate, its market prices roughly follow cocoa butter prices and may therefore indicate competitive prices for mango butter suppliers aiming to establish themselves in this market.

Cocoa butter prices in are, on average, very close to cocoa bean prices. This is because about 50% of the bean is butter and the other 50% solids (cocoa powder). The 2022–2023 cocoa bean price is around €2 per kg, which also seems to be the average price over the past 5 years (Figure 2). This would be a competitive price for mango butter.

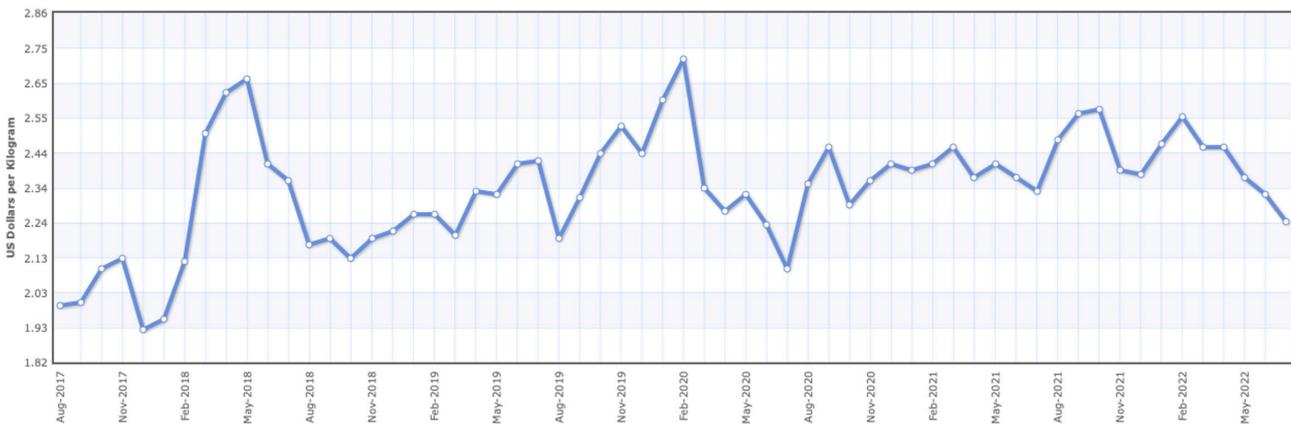


Figure 2. Global cocoa butter price: Aug 2017–May 2022
Source: www.Indexmundi.com

3.3.2 Cosmetics

Premium refined oils for cosmetics are purchased by cosmetics companies from fragrance and ingredients companies for as much as €32 per litre. Refined avocado oil, for example, which is a small premium market that is similar to the mango butter market, is sold for about €32 per litre to cosmetics companies.

These sales prices need to accommodate transport and logistics costs, as well as the processing costs (in the EU, USA, etc.). As a result, the prices of mango butter are likely to be 30–50% of this sales price. This suggests that mango butter will be priced at about €8–24 per litre in supplying countries, depending on the quality and the marketing story that can be developed for the product.

Table 1. Comparative oil prices

	Raw cocoa butter	Raw shea butter	Refined avocado oil
Price per litre	€2 per litre	€2 per litre	€32 per litre (to manufacturers)

The prices for cosmetic-grade mango butter could be high. However, even if this product can gain a foothold in the market, sales volumes may be limited and demand could be temporary.

3.3.3 Competitiveness

Foods and nutraceuticals

To compete in the foods sector, suppliers will need to offer cocoa butter buyers reliable volumes that can make a difference to their supply needs. At the same time, the product will need to be as affordable as shea butter, which is sold for about €2 per litre.

Cosmetics

About half of the mango butter traded globally, a value of around €16 million per year, is used in the cosmetics sector. If the final sales price is indeed €32 per litre, then roughly 25 twenty-foot containers of mango butter per year are sold for cosmetics. At half this price, 50 containers – or 4 per month – of mango butter are being shipped globally for cosmetics purposes per year. This suggests that this is a small but high-value market.

There are hundreds, if not thousands, of essential oils and butters on the market that can be used in cosmetics. While they are all unique, many can be substituted for another similar oil.

Most cosmetics products have a blend of cheaper functional base ingredients that remain more-or-less constant over time. Premium oils or fats are then blended into the base recipe for specific fragrances, hand-feel or other properties, and to create variety and new marketing stories. Premium oils such as shea, rose, rosehip, lavender extract, citrus oil, cocoa butter or mango butter are used sparingly. So, a single product – even one that is labelled as being mango butter lotion, for example – might only contain a small amount of mango butter. This is a common strategy for manufacturers who are attempting to keep the product affordable.

These premium ingredients also need to be swapped out to create new and interesting products and ranges year after year. Each cosmetics range will likely keep the best sellers or classics for a longer period, but about 70% of the assortment will be replaced every 2–3 years. This means that, for many oils, demand is likely to be very trend-driven – rising when the ingredient is popular and then quickly falling when the trend declines.

Mango butter is used sparingly due to its high price. If it does not become more popular, as is the case for many oils, it is likely to be swapped out for a new, more popular oil after a few years. The low volumes also put it at risk of range rationalisation. Most companies prefer to limit the number of ingredients they stock, as a large number of ingredients make supply chain management complex. After several years, companies tend to remove niche ingredients that are not very popular, or that can be replaced with a more standard ingredient. Mango butter would be a typical ingredient facing such a cut, if it does not become more valuable as a marketing tool.

Mango butter, when used in such small quantities, requires a major increase in demand for final products for it to earn its right to remain in a company's range of products. A container of raw mango butter can be used to create many units of final product, such as lotion or body butter. If a manufacturer such as the Body Shop purchased a 20-foot container of mango butter, they would receive about 20 tons of product. The Body Shop produces mango butter that is sold in 200 ml pots. If the recipe used 10% mango butter, they could produce 2 million units of mango butter from a single container. Hair products would use even less mango butter. If the recipe used 5% mango butter, 4 million units of final shampoo could be made from one 20-foot container.

A chain store such as the Body Shop has 3,000 stores globally. This means that each store, on average, would need to sell 666 units of body butter to use all the mango butter from a single container. Roughly 1,333 units of shampoo would need to be sold in their stores to use up a container of raw mango butter. Clearly, a very large amount of final product can be produced from a single container of mango butter. It is unsurprising, then, that most experts estimate that the cosmetics market buys only 5% of the export volume of shea butter. Most shea butter is used in foods. This is also likely to be the case for mango butter.

3.4 Production: processes and techniques

Mango butter can be extracted from the mango kernel using either mechanical or chemical (solvent) extraction, often with hexane. Solvent extraction is technically complex and requires far higher investments compared to mechanical extraction. However, chemical extraction produces far more oil than mechanical extraction from the same amount of mango seed.

Mechanical extraction is chemical-free, which has some advantages from a safety perspective. It also makes it easier to sell the product as a natural ingredient. Solvent-extracted product can probably not be sold as organic.



Figure 3. Production process for mango butter

3.4.1 Stage 1: Collection or reception of raw materials

There are two main models of sourcing: collection of waste at the village level and sourcing of waste from processors. The village collection model is used by the largest Indian processor of mango butter.

The mango seeds are received and washed at the factory. A fruit and vegetable bubble washer is recommended, along with chlorinated water. This machine allows for better washing and helps to kill bacteria that might contaminate the seeds. The water should be replaced every 3–4 hours.

3.4.2 Stage 2: Dehulling and grinding

After washing, the seeds are typically sun dried to reduce the moisture content to 12–15%. The seeds are then roasted in a drum roaster. The hull of the seed is removed either mechanically using a deshelling machine, or manually by beating the seeds with wooden clubs. The kernel is then ready for oil extraction.

3.4.3 Stage 3: Oil extraction

Oil extraction can be carried out mechanically or chemically.

Mechanical extraction

The kernels are put into a screw press, which presses the oil out of the kernel. The oil seeps through small openings that do not allow seed fibre solids to pass through. Between 4–5% of the original weight can be extracted, which is roughly 30–50% of the total oil content of the seed. A hydraulic press can also be used (see 3.5).

Next, the pressed seeds are formed into hardened cakes that are removed from the machine. The pressure involved in the expeller creates heat in the range of 60–99°C.

3. Supply

Chemical (solvent) extraction

The separated kernel pieces are crushed into small pieces in a hammer mill. The pieces are then fed through a pelletising machine, where pellets are created. The pellets are cooled in a chiller until they reach room temperature. The pellets then undergo solvent extraction with hexane. This method removes two to three times as much oil as mechanical extraction.

3.4.4 Stage 4: Storage and shipping

The oil is then poured into a high-quality, insulated, edible-oil storage tank. This is sealed and stored ready for shipping.

3.5 Technology



A hydraulic press is a machine that generates a compressive force. The pressure throughout the closed system is constant. One part of the system is a piston acting as a pump, with a modest mechanical force acting on a small cross-sectional area; the other part is a piston with a larger area that generates a correspondingly large mechanical force.

Source: India Mart website

High-quality, insulated, edible oil storage tank for storing the end product.

Source: <https://gusumachinery.en.made-in-china.com/product/keywordSearch?word=edible+oil+tank&org=top&searchType=3>



Image Source: <https://gusumachinery.en>

Dehulling machine: Used for separating the kernel from the shell.



3.6 Production economics

The mango seed is about 20–25% of the total weight of the mango. The kernel inside the seed is then 45–75% of the total weight of the seed. Just 12% of the kernel is oil, so processing 10,000 kg of mango seeds would result in 40.5–45 kg of oil (Table 2). There are also some losses in the process, which could make the resulting volume of oil produced lower than this estimate.

Table 2. Conversion from mango seed to oil using mechanical extraction

Item	Mechanical extraction	Chemical extraction
Initial mango weight	10,000 kg	10,000 kg
Seed weight	2,000 kg	2,000 kg
Kernel weight	900 kg	900 kg
% of oil recovered	4.5–5%	12%
Total oil weight	40.5–45kg	108 kg
Price per litre	€2.00–2.75 (shea-cocoa prices, for large sales volumes) €8.79–12.00 (current market price with limited volumes)	€8.79–12.00
Revenue from oil sales	€80–540	€216–1,296

As mango seeds are relatively light, sun drying this volume of seeds is time consuming and requires a significant amount of space and organisation.

In much of Africa, the harvest time for mango is also during the rainy season. This means processors need to dry large quantities of seeds in driers, adding additional cost to the oil production process. However, only €395–540 of revenue can be earned for processing the original 10,000 kg of seeds. This is likely too costly, as it would make an expensive, niche product uncompetitive in all but the rarest circumstances.

4. Ingredients for success

4.1 Sun drying

Machine drying the seed increases costs and makes the process expensive. Being able to sundry the seeds is thus an important ingredient for success.

4.2 Economic and logistical challenges

The logistics and economics of production make mango butter a difficult investment opportunity. From a logistics perspective, drying seeds in the rainy season is challenging and requires costly equipment such as continuous belt driers. Mango kernels also have a relatively low oil content. Oil processors thus need to process large volumes of seeds to extract relatively little oil. Even with high prices of mango butter, there are real questions about the ability of this type of business to support the necessary staff, equipment and drying costs.

4.3 Issues and opportunities

Table 3. Issues and opportunities

Opportunities	Issues
<ul style="list-style-type: none">▪ Growing demand for mango butter for cosmetics, as a cacao butter replacement and for pharmaceuticals▪ A trend-driven cosmetics market creates opportunities▪ Demand for cocoa butter replacements in the EU and other parts of the world▪ High revenue per kg of mango butter in the best circumstances.	<ul style="list-style-type: none">▪ Unreliable demand from season to season▪ Processing of oil likely to be during the wet season▪ Costly drying equipment is needed for reliable drying of the seeds in the wet season▪ Mango seed delivers a low volume of oil for very high volumes of raw material (seeds)▪ Added cost of drying using dryers would make this uncompetitive▪ A trend-driven cosmetics market- creates opportunities, but also means that demand can suddenly disappear.

5. Conclusion

Although mango butter is a premium product, with some existing demand in western markets, entering the mango butter market could be too challenging for most African investors. While the raw material – mango seed – is a waste product, and therefore inexpensive, the necessary investment to successfully produce mango butter requires a company to answer several critical questions: how can the seeds be economically dried during what is likely to be the rainy season? How can the company efficiently process the tons of waste required to produce relatively small volumes of mango butter? Will the relatively high price of mango butter on the global market justify the logistics, drying and investment costs? And will mango butter withstand the up and down trends that are a common feature of cosmetics and personal care products?

SECTOR STUDY: PROCESSED MANGO

1. Fresh cut mango
2. Dried mango
3. Mango puree
4. IQF mango
5. Mango pickle
6. Mango vinegar
- 7. Mango butter**
8. Mango briquettes
9. Mango based compost



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