

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. Fresh cut salads

1.1 What is fresh cut salad mango?

In developed markets, supermarkets sell freshly cut mango as a ready-to-eat product. Typically, local vendors who ripen mangoes in Europe supply mangoes for fresh cut salads. Fruit that is frozen can also be used. A small number of suppliers, such as Blue Skies in Ghana, have set up a way to send fresh cut fruit to Europe by air.

Retailers then typically package the fruit in to small single-person packs. The retailer's own brand is then imprinted on the cartons.



Spears



Mixed with other fruit



Cheeks



Spirals



Salsa

Figure 1. Fresh cut mango options

2. Demand

In much of Africa, mango is cheap and readily available when in season. The low cost of labour makes it easy to source fresh mangoes and cutting these at home or in hotels and restaurants.

In developed countries this is not the case. Mango is already an expensive fruit. It is also not very portable and cannot be eaten “on the go”. As a result, fresh cut mango is a small, but premium segment. It also means that fresh cut mango is typically an export-oriented business, which services premium markets in Europe and the USA. For these shoppers, the sweet, sun-ripened fruit is superior to the fruit ripened locally in Europe and USA. This differentiator has in the past made the high price of this product somewhat more acceptable.

As a result, this niche has been a viable option for the few suppliers who have been able to develop the controlled logistics needed to deliver regular supplies to these key markets.

The consumption of mangoes in Europe is rising despite difficulties in sourcing and the preference for local seasonal fruit. The market prefers Kent and Keitt varieties and there is an increasing demand for ripened and freshly cut mangoes.

The market is unpredictable due to large fluctuations in supply volumes. There was also a shift in demand during COVID-19, but the market continues to grow (see Figure 2).

The short-term supply volumes and prices might be volatile, but with increasing global demand, mangoes with affordable prices will become accessible to European consumers. In Europe, the principal trade hub for mangoes is the Netherlands, followed by Germany, the UK, Spain, France and Portugal.

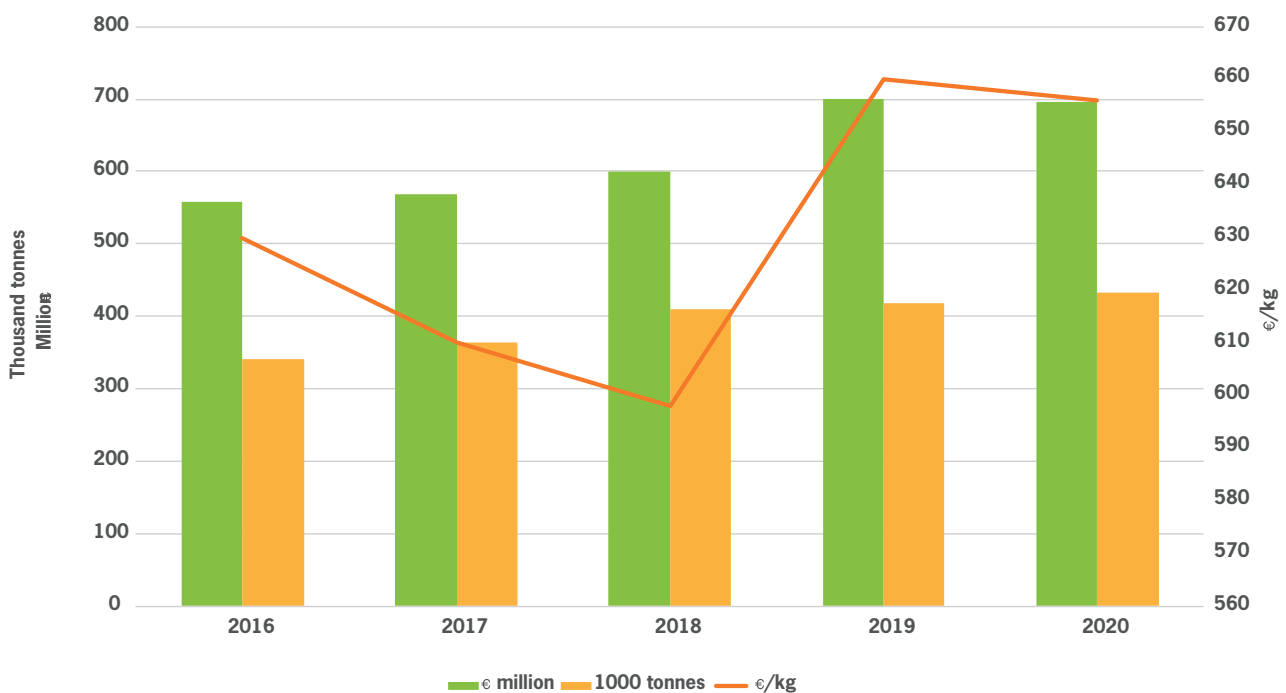


Figure 2. Imports of mangoes in the EU27+UK (including guavas and mangosteens). (Source: COLEAD based on Eurostat and UK Office for National Statistics)

2.1 Varieties

The main commercial varieties are:

- Kent (fibreless)
- Keitt (fibreless, productive)
- Palmer (minimal fibre)
- Osteen (typical variety in Spain)
- Tommy Atkins (long shelf life, fibrous but declining interest)
- Amelie (from Burkina Faso/West Africa)
- Shelly (from Israel)
- Kensington Pride (originated from Australia)

Minor commercial varieties are:

- Ataulfo (small Mexican variety)
- Nam Dok Mai (exotic variety from Thailand/South-East Asia)
- Alphonso (India, mainly ethnic market)
- Kesar (India, mainly ethnic market)

Each region has as specific preference for a variety. In the USA, Francine, Francis, Ataulfo, Haden, Keitt, Kent and Tommy Atkins are the most used varieties. These are mainly sourced from Mexico, Ecuador, Guatemala, Brazil and Peru. In the USA, 7-Eleven is a major importer of sliced mangoes.

Keitt, Kent, Amelie and Tommy Atkins are the most requested varieties in Europe. African producers also grow these varieties, making sourcing from Africa a viable option. Shorter airline routes and the cheaper logistics costs of air-freighted goods might make this a preferred option.

Developing countries are responsible for 88% of the total mango trade in Europe and supply 94% of European imports.



2.2. Market trends

This market segment is under severe pressure from several developments in the context of customers and retailers. These range from issues around rising prices and difficult logistics to sustainability issues. In the consumer world there are also some interesting trends around local sourcing that must be considered.

2.2.1 Convenience and “on the go”

However, eating a mango is not the most convenient thing to do, especially when you are on the move. Starbucks has created an on-the-go snack product that comprises pre-cut, ready-to-eat fruit, following the lead of merchants and restaurant chains such as Carrefour, Tesco, Albert Hein, Whole Foods, etc., as well as more health-conscious eateries and coffee shops such as Prêt a Manger.

2.2.2 Sun-ripened quality

Fruit that is typically sent to Europe is collected when it is still unripe, and then ripened locally in Europe. However, the sweetness and flavour intensity of sun-ripened fruit are indisputable advantages. Fresh cut salads that are air-freighted to Europe now have a market because of this.

2.2.3 Health and wellness

Mango is reputed to have numerous medicinal benefits, including boosting the immune system. Fresh fruit intake, including mango because of its high vitamin C content, has increased since COVID-19.

2.2.4 Rising prices of food

The complex logistics and the high price could, however, prove problematic in the current post-COVID, Ukraine–Russia conflict era. Will Europeans and Americans be able to afford this on-the-go snack? At the same time, concerns around the environment and the high carbon footprint of this product could also be a barrier.

Prior to COVID-19, fresh cut mango was in demand. However, disruptions to the supply chain became noticeable in retail stores, although this has now visibly reduced. There was a definite tendency to replace exotic air-freighted products with locally sourced fruits such as apples and berries. The demand for freshly cut fruit is anticipated to rise during the next few years in the USA. Since 2019, sales of freshly cut mangoes have climbed by 20% in the USA.

2.2.5 Rising cost of fuel and freight

Air-freighted fruit has always been a challenging model of production and distribution. In the past, suppliers relied on the lower cost of freight made possible by flights returning to Europe. Flight volumes are increasing, but they are not as numerous as in pre-COVID times. This has created some cost pressure on air freight and makes complex logistics even more complicated.

Rising global fuel prices are another significant issue, which might make air freight economically less feasible.

Sustainability and local sourcing

Shoppers in Europe and the USA have increased interest in sustainable production. For many of these responsible shoppers, air freight is an unnecessary luxury. The carbon footprint is just too high. As a result, everything from Peruvian asparagus to vegetables from Kenya is being questioned. Does it make sense to eat these vegetables all year? Or can European shoppers simply forgo these until they are in season locally?

For retailers, these products might be the simplest products to abandon when looking to improve their environmental credentials. It would improve their carbon footprints, while at the same time allowing them to focus on locally grown produce, which is increasingly in demand and on trend.

2.3. Case study: Fresh cut fruit, Woolworths



Figure 3. Fresh cut mango packaging from Woolworths

The smallest pack, 180 g, has a black sticker, stating “Ideal for lunchboxes”, prompting consumers to use this as a lunchbox or snacking option (Figure 3).

The next size up, 350 g, is perfect for home use, for a single or two-person family, but also enables a larger family to buy a selection of ready prepared fruit for the family’s various taste preferences. Here locally sourced, “in season” and fresh is printed on the pack (Figure 4).



Figure 4. Small packaging of fresh cut mango

For the largest value or family pack, 750 g, we selected the tropical fruit salad, to show the ingenuity in the labelling. Again, they put seasonal, but the label clearly states “Mango/ Papaya/ Pineapple/ Melon/ Banana/ Kiwi/ Grapes (seasonal)”, giving the packer the opportunity to use what is in season without changing the labels.

In a case study of fresh cut packed fruit at Woolworths South Africa, the three available pack sizes were purchased for study. All are packed using modified atmospheric packing with gas flushing for freshness and extended shelf life.

In the Woolworths fresh cut packed fruit range, the absorbent pad that lined the base of the pack to absorb excess moisture has now been removed to reduce waste and environmental impact.



Figure 5. Home use packaging



Figure 6. Bulk consumer packaging

2.4. Certifications, quality standards, etc.

Quality and food safety are crucial in supplying fresh cut salads to these markets – especially where this is air freighted.

It is crucial that processors deliver a quality product – for both taste and food safety. From the perspective of taste, retailers are looking for a perfectly ripe firm fruit that is flavoursome and has a bright yellow colour. For food safety, Hazard Analysis and Critical Control Point (HACCP) certification is a minimum standard.

Both conventional and organic fresh cut salads are sold in retail stores. But for most food services a conventional product is sufficient.

Growing interest in fair production means that social safeguards, labour safety regulations, etc., are all important for entry into this market. These should align to those desired by the retailers themselves. The leading supplier to Europe has several additional claims ranging from a programme to minimise waste to a foundation that invests in development of the local community.

Frozen product, which is more likely to be supplied to the food services sector, is slightly less challenging. While the specifications and quality standards are likely to be as stringent, but there is greater tolerance of lower social commitments, as the product is so rarely itself branded. This does not mean that these are not valued, but rather that they are a value-added offering that might provide more differentiation in a niche market.

2.5. Typical customers and end consumers

Fresh cut salads have two major outlets: retail stores and the food services sector.

Retail stores, especially premium urban stores, are the biggest market for fresh cut salads. They are the ultimate convenience fruit, offering a tidy, delicious, sun-ripened product within a day or two of picking. They are also a favourite at various motorway/highway convenience stores and other retailers supplying workers looking for healthy fresh lunch options.

The food services sector is another potential end market for fresh cut salads. Popular eateries that offer quick meals such as sandwiches and smoothies often also offer fresh cut salads that contain mango. Hotels and restaurants are more likely to offer fruit salad as dessert or at breakfast in fruit platters and salads. Bakeries are another potential end market for fresh cut salads. They use the fruit for fruit-filled pies and cakes. Finally, fruit salads are a popular item on the menu of airlines.

These outlets can use fresh cut salads (imported pre-cut or cut locally), but they are more likely to source frozen goods since they can be kept for longer periods of time and have less waste.

3. Supply

3.1. How do these products reach the market, what is the structure of the value chain?

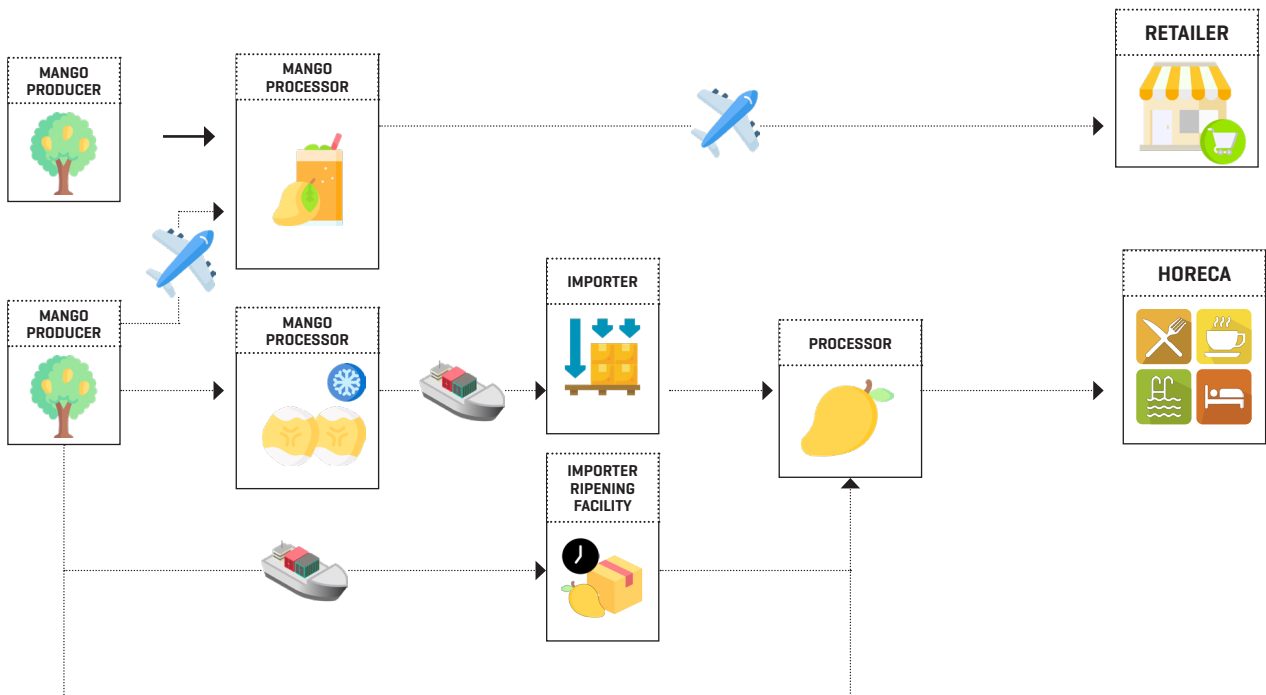


Figure 7. Value chain structure
HORECA: hotels, restaurants and cafes.

Fresh cut salad mangoes from Ghana to Europe or Mexico to the USA allow for processors to benefit from excellent transport links to the end market. Mangoes that are cut today can be in retail depots tomorrow.

In the case of Africa, fruit is sourced from a network of farmers and brought to the processing facility. This is located next to the airport, in fact kerbside, allowing for rapid dispatch and transport of packed product to Europe.

The processing model involves working closely with the retailers, especially as products need to be packaged in retailer packaging and in the desired pack sizes. Consequently, the processor is closely connected to the retailer and works alongside them to plan and satisfy orders.

3.2. Seasonality and availability

While fresh cut mangoes are always in demand in supermarkets, their supply varies by region depending on when they are harvested. Nevertheless, for retailers this can be solved by working with a supplier who is able to access fruit globally or regionally.

In Africa, sourcing to meet the fresh cut salad market happens regionally. Fruit is sourced first from Ghana, then from Côte d'Ivoire, Mali and Burkina Faso to fill in the rest of the annual calendar. This enables a consistent supply of fruit for fresh cut salads.

It is important for potential competitors, or those companies looking to ally with existing suppliers, to be aware of this sourcing calendar.

3.3. Technology, processes and techniques

The processing of fresh cut salads is a shorter process than that for dried fruit. In fact, some of the first few stages of production are shared (see Figure 8).

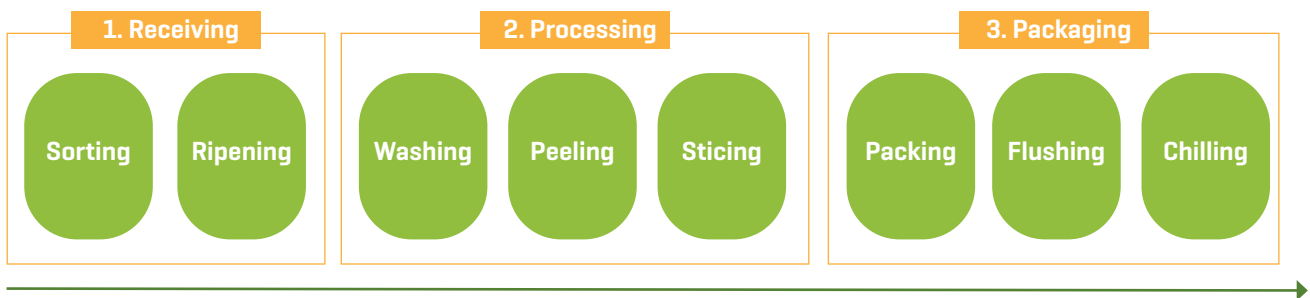


Figure 8. Processing and techniques



3. Supply

Stage 1: Receiving involves sorting the fresh mangoes so that you are certain of quality and that this mango is ready for cutting or ripening. Any unripened fruit enters the ripening programme, where it is allowed to ripen under controlled conditions.

Stage 2: In the processing stage, the ripe fruit is washed, peeled and then sliced. The fruit is conveyed to workers who are seated along a production belt. They then manually peel the product and slice or dice it depending on the specifications of the client.

Stage 3: In this stage the fruit is packaged in trays. The product is then flushed with nitrogen using a nitrogen-flushing machine. This removes carbon dioxide and oxygen from the packages. The packaged fresh cut fruit can then be sealed and blast chilled. This extends the shelf life and ensures the product can withstand transportation.

Stage 4: In this final stage the product is dispatched. It transported to the airport and is packed for onward distribution (see Figure 9, which includes temperatures).

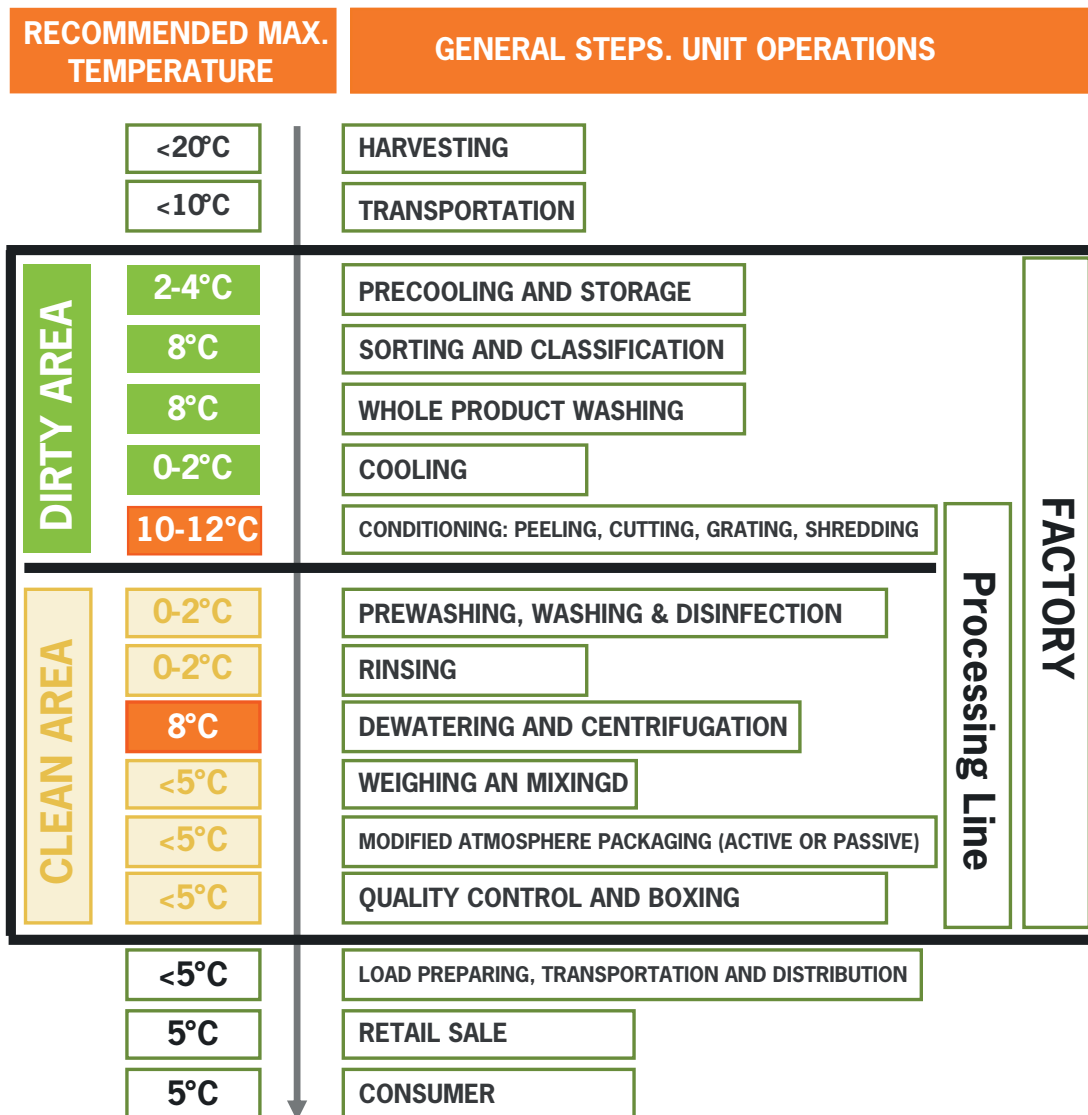


Figure 9. Flow chart of process with temperatures (Source: www.intechopen.com/chapters/56159)

3.4. Technology



Figure 10. MAP packing using nitrogen flushing
Source: Allbetter via www.Alibaba.com

The process of Modified Atmospheric Packing (MAP) or gas flushing has been practised since the 20th century to extend the shelf life of fruit and vegetables.

MAP technology consists of a collection of packaging line modifications that work to maintain a specific atmosphere inside the packaging. This controls and slows down the rate of oxidation of fresh food. Cut fresh fruit, when exposed to oxygen, turns brown and spoils, resulting in off-odours and loss of texture. By flushing the packages with harmless nitrogen gas (N₂) just before sealing, to displace the oxygen in the pack, the shelf life of the fruit and vegetables can be extended without the use of preservatives. This combined with chilled storage can result in cut fruit remaining in optimal condition for 5–7 days.

The packaging materials present a strong barrier to oxygen with low oxygen transfer rates to maintain the correct balance in the packaging. This technology allows consumers to maintain a healthy diet in a convenient manner, stocking up on fruit for a week, and having less waste.

The average cost for an in-line nitrogen gas flushing, continuous band sealing machine for punnets averages €3,500 from various manufacturers in China. The added cost would be the nitrogen gas used in flushing, which would vary according to pack sizes and quantities packed per day.

3.5. Ingredients for success

It is important to realise that success in running a fresh cut mango business involves management of a complex logistical puzzle. It requires speed of handling, good quality controls and access to a market that can afford the resulting high price of the fruit. As so much of the product is produced for retail brands, some degree of integration is needed with retailers. Developing capabilities to deliver product reliably all year is also essential.

3.5.1 Regional Sourcing Network

Processors that supply fresh cut salad mangoes must be experts at local sourcing and logistics because of the seasonality and requirement to fill the annual supply calendar. To make sure that export-quality mangoes are shipped safely, they will need to buy them from several countries and work with suppliers and logistics.

3.5.2 Operational excellence

Fresh cut mangoes have a short shelf life, so fruit quality must be good, handling must be swift but gentle, measures must be taken to protect and enhance shelf life, and integration with outbound logistics must be excellent. The best possible management of a cold product and swift air delivery to Europe is also needed. Companies that would succeed should ensure that they build the technical know-how for reliable sourcing. They need to secure a production location near an airport and ensure that they have good integration with airlines so that they can access outbound flights. Cancellations and delayed flights matter. Cold chain

management and mastering modified atmospheric packing is crucial. Finally, if packing at source, the factory should be skilled at smoothly changing over packaging so that they are not limited to packing for one client per day.

3.5.3 Variable profit management

Being able to sell year-round to retailers involves a regional sourcing strategy. However, this has an impact on profit margins throughout the year.

When the processor can source fruit locally the supply chain is shorter, logistics costs are lower and the mango is more affordable – especially in season. Out of season, they must source from further away. But they can benefit by sourcing from countries where mango is more available and sometimes cheaper. For example, mango is cheaper in Côte d'Ivoire than in Ghana.

Those companies that are better able to track and respond to these changes are better able to succeed. Those that fail to anticipate the changes to underlying profitability could miss opportunities for lower sourcing costs.

3.5.4 Reduction and valorisation of waste

Fresh cut fruit is a business with a great deal of waste. But, even with airports being industrial locations, there is some resistance to companies storing mountains of smelly waste nearby. This alone demands that companies find practical solutions to minimising and responsibly disposing of waste. Some companies already have extensive compost production programmes, while others use waste in biodigesters to produce biogas.

This is a high-risk model, with fluctuating profitability. But it allows those companies with good systems for transforming waste into value to benefit. First, they can make better use of second and third grade fruit: manufacturers of dried fruits or juices and the local fresh market could all be valuable outlets for rejected fruit. Second, they can sell waste from peelings to compost manufacturers.

This also allows these processors to develop marketing stories around sustainability that can make a difference in marketing efforts to retailers and shoppers in end markets.

3.5.5 World class account management and planning

Getting fresh cut fruit onto retailers' shelves within 48 hours makes integrated operations with retailers essential. This is only possible with a professional account management team and excellent supply chain management.

The teams managing retailer accounts should be close retailers – both geographically and in terms of professional skills. They should ideally be skilled at relationship building and show a good understanding of the fresh food business, especially for products that need good cold chain management, quality control and rapid distribution.

Outbound logistics need to be able to integrate into the supply chain systems of retailers. They should be able to integrate seamlessly into the supply chain and distribution centres allowing for improved planning of supply.



4. Issues and opportunities summary

Table 1. Issues and opportunities

Issues	Opportunities
<ul style="list-style-type: none">▪ Technically and operationally difficult. It requires absolute precision.▪ Entry-level technical obstacles.▪ Account management is needed close to customers. This is a challenging skill and is costly too.▪ CO2 emissions are high, which is not seen favourably by European consumers. In future, this type of product might be removed from product ranges for public relations reasons.▪ Regional sourcing raises prices and complicates things.▪ The model relies on stable, affordable transport. COVID restrictions on travel created a total freeze on air-freighted goods, which revealed the vulnerability of the business to changes in the airline industry.	<ul style="list-style-type: none">▪ Few competitors.▪ Regional sourcing to fill a yearly supply calendar.▪ Maximising value by converting waste.

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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