

Investing in temperature monitoring of mango exports: A business case

Good temperature management in mango supply chains is essential. Low storage temperatures can cause chilling injury while warm storage temperatures can lead to unwelcome fruit ripeness. As such, storage outside of recommended temperatures will result in failure to meet importer and retail expectations for quality, including shelf-life.

From the perspective of an exporter

Scott Ledger, Quality and Export Manager at Manbulloo, recommends that, to really understand the benefits of temperature monitoring, exporters should compile a business case for investment in temperature monitoring, rather than only use benefit cost analysis. This is primarily because many of the benefits are just too hard to quantify and are usually specific to an individual business.



For Manbulloo, Scott identified that the benefits include:

- being able to deliver a product that is consistent in its' ripeness
- being predictable for your customer



- we want our customer to be able to anticipate what they'll get
- temperature monitoring highlights the variability in my chain
- we can help advise the customer what they'll get before it arrives
- a customer doesn't have to look at the product when it arrives, before deciding to whom s/he will sell it
- not having to guess whether the quality of fruit on the top of the pallet is the same throughout the pallet
- helping manage product quality through the chain
- helping to make decisions on what to do with the product.

Beyond a reduction in the number and size of dispute claims, these benefits can be summarised as:

- helping you to evaluate the temperature risks in existing or new supply chains (e.g. air versus sea or evaluating a new treatment protocol)
- poor temperature management can reduce quality at the retailer or consumer without incurring claims from the importer (i.e. the result will be reduced returns and loss of reputation and repeat sales)
- better systems for managing supply chain risks can substantially reduce the management time and effort required during the often stressful and time-poor harvest and marketing season.

Many of these benefits reduce the risks in the supply chain, not only for the exporter, but for all supply chain partners. It helps engage all partners to deliver long-term relationships and trust, continuous improvement and increase business volume and profitability.

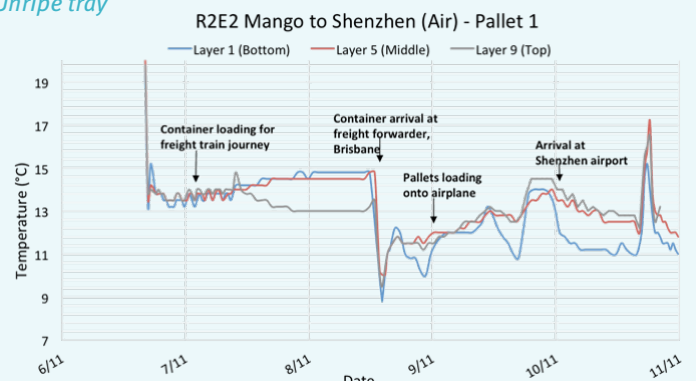
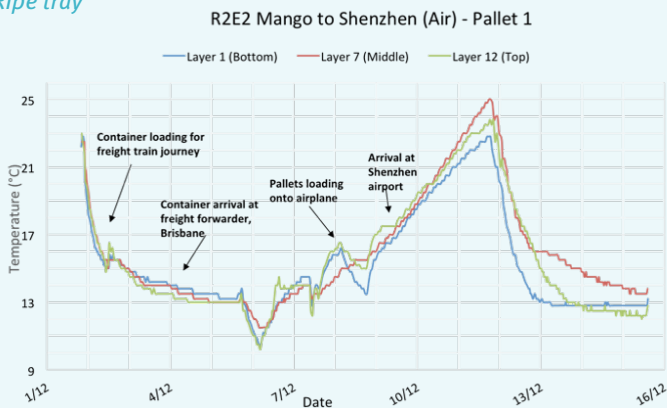
So for Manbulloo, it is about the risk of excessive time and temperature variability through the supply chain and being able to reliably predict their impacts on quality.



Ripe tray



Unripe tray



From a risk perspective, Scott says “every shipment is different” and “how do you know if you’re not monitoring”.

Every consignment is different, even using the same route and same supply chain partners, as most supply chains are complex and ever-changing.

Benefit cost

Key questions for quantifying the benefit cost include:

- How much do I have to spend?
- How soon will I get a return on that investment?

Benefits

The lost revenue from claims (costs) and exposure to risk associated with your supply chains and your business is influenced by:

- the knowledge, skills and practices used by the supply chain partners
- the variety exported and its sensitivity to variations in time and temperature during export
- the protocol treatment required by the targeted importing country
- the variation in temperature and time in transit is often different for air and sea-freight
- the complexity of transit (including transshipping and risks of hold-ups in quarantine) to the target destination market importer
- the risks of less-than-ideal in-country distribution from the importer to the retailers or through online distribution channels.

How much do I have to spend?

The costs of temperature monitoring will vary depending on several factors including:

- which monitoring technology you use. This is influenced by whether you can easily and reliably retrieve loggers, obtain the data, and whether you send most of your consignments to the one importer? Options include autonomous download loggers based on Radio Frequency Identification (RFID e.g. Xsense), or SIM cards uploads (e.g. Emerson), or manual download USB (e.g. Cryopak)



- the number of consignments you monitor depends on the risk including the variety of products, destinations, routes and reliability and trust within the chain members (e.g. for new products or markets you may want to monitor all consignments, but only say 10% for your frequent products and chains)
- the number of loggers used per consignment (i.e. products at risk of initiating ripening or containers)

with common temperature gradients, usually warrant using two or more loggers).

How soon will I get a return on that investment?

The gains you can make by improving temperature management in your supply chain will depend on:

- your current level of disputes, risk or other benefits sought
- your relationships with your supply chain partners.

Improving the management in those supply chain stages identified as posing a risk to the final quality of the product will be much easier if you have good supply chain relationships. Alternately, consider using a different supply chain partner who can demonstrate better temperature management. Either way, the quicker the improvement, the quicker the return on your investment, and the sooner that you can reduce the proportion of consignments that you monitor.

A case study examining Manbulloo mango exports to South Korea

In partnership with the Serviced Supply Chains project, Manbulloo is investing in improved temperature monitoring of their R2E2 mango exports to improve out-turn quality and build in-country confidence and trust. Some fruit are sent by sea-freight, but most consignments are transported using air-freight to South Korea. Fruit were disinfested using Vapour Heat Treatment and the importer expected at least 5 days shelf-life upon arrival in-country.

About 50% of the air-freight consignments during the 2017-19 seasons were monitored using the Xsense (RFID)-based platform. As a result, three key improvement opportunities in their supply chain were identified and implemented. The following graph shows that, within four years, temperature monitoring is expected to:

- reduce the cost of disputes by 80%
- reduce the need for extensive monitoring by 60%
- provide a net benefit to the company's profitability and reputation
- double sales volumes to the South Korean importer.

It also means that the Quality and Export Manager can sleep a whole lot easier during export season.

Some advice to help decide the most suitable temperature monitoring system

With three years' experience in temperature monitoring in the Serviced Supply Chains project, staff from the Department of Agriculture and Fisheries and AgVic have gained some insights that may be useful:

- **Choice of logger:** If you want automatic, cloud-based access to the data and don't want to retrieve the logger, use a SIM or RFID logger. If you're using

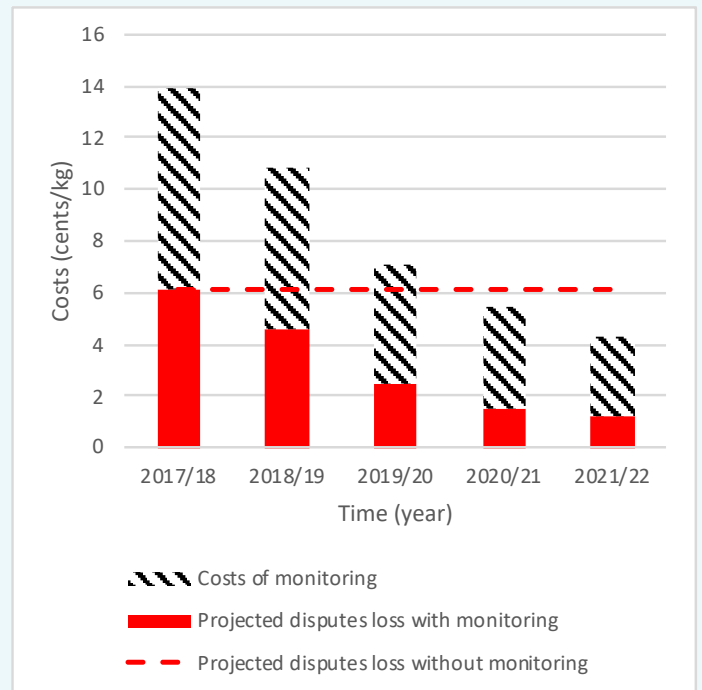


Figure 1: Actual (2017-19) and projected (2019-22) costs associated with disputes and temperature monitoring of 'R2E2' mangoes exported to South Korea.

Notes about sensitivity in relation to Figure 1:

- given the infrequent and small disputes associated with air-freighting mangoes to South Korea (average 6c/kg for 2017/18), the gains were not all realised in the first two years after investment
- the RFID system was used due to a lack of SIM loggers approved for airfreight in the first two seasons
- this assessment does not account for the reduced Manbulloo time and cost associated with having to travel to South Korea to help resolve significant disputes
- greater and quicker return on investment were made by Manbulloo in 'riskier' supply chains (sea-freight and other destinations) where disputes were more common and larger
- the graph takes no account of additional sales and income earnings through additional export orders.

airfreight, you will have to ensure the SIM logger you choose is approved for use on your airline. If, in the event of an odd dispute, you can arrange for someone to reliably retrieve the logger and send you the downloads, the cheaper USB loggers are fine but they won't offer location data.

- **Pulp or air:** Pulp temperature monitoring is more appropriate if the product is subjected to rapid changes in air temperature, but the cheaper air loggers are fine for most export supply chain monitoring.

- **Number of loggers per load and positioning the loggers:** At least two loggers per consignment are required to record the common temperature gradients across a consignment. Placing one in each of two pallets, choose one pallet second from the rear and one in the centre of the load. Position loggers in both pallets two layers from the top of a pallet, on the pallet side away from the load edge.
- **Size of claims/disputes:** It is not uncommon to see claims of 20c/kg or more where quality is suspected to be negatively affected by poor temperature management.
- **Making use of the data:** Cold chain improvement opportunities are easier to identify if the temperature graph includes the location (critical supply chain stages) at which the temperatures were recorded. SIM-based loggers estimate location using mobile tower locations.
- **The power of out-turn quality assessment:** Using independent out-turn assessors to check the quality (including shelf life) on monitored loads can help determine the threshold of temperature abuse that leads to quality loss.



More information is available at: <https://www.daf.qld.gov.au/business-priorities/agriculture/plants/fruit-vegetable/supply-chain-innovation>