Research Committee update: Pallets [redacted] – initial scoping

Key points

- [redacted]
- **Pallet shortages throughout 2021 and 2022 impacted the transport of food and groceries within Australia, with survey results indicating 91% of food and grocery businesses experienced significant additional costs directly associated with sourcing and transporting pallets.**
- **Most Australian food and grocery businesses use for-hire timber pallets under a pooling model. Only two companies provide these for-hire pallets – CHEP and Loscam, with approximately 70% and 30% of the market respectively.**
- **According to the pallet pooling companies, the major supermarkets began 'hoarding' pallets in 2021 in response to increased demand and limited additional supply of for-hire pallets, breaking the pooling model.**
- [redacted]
- **Other issues with pallets in supply chains raised prior to the COVID-19 pandemic will also be investigated. These include whether the diversity in pallet sizes (the Australian standard differing from the rest of the world) is a constraint on efficiency and uptake of new technologies.**

[redacted]

[redacted]

How are pallets used in Australia?

According to the Deakin University Centre for Supply Chain and Logistics, the Australian pallet market is the 'most mature' pallet market globally. From a 2017 survey of 81 businesses, the majority of pallets used in Australia (66%) were sourced by renting from a pool managed by a third party – also known as 'pallet pooling'. 14% of respondents re-used inbound pallets, 8% purchased new pallets, 3% purchased second-hand pallets and 6% purchased a mix of new and second-hand pallets. 8% used a mix of sources (Centre for Supply Chain and Logistics 2017, p. 11).

In Australia, two pallet pooling providers, CHEP and Loscam, provide the majority of for-hire pallets. These companies have large fleets of pallets that are available for rent to businesses across the country. A December 2022 survey by the Australian Food and Grocery Council found that CHEP was the primary pallet provider for 71% (and Loscam for 29%) of surveyed food and grocery businesses.

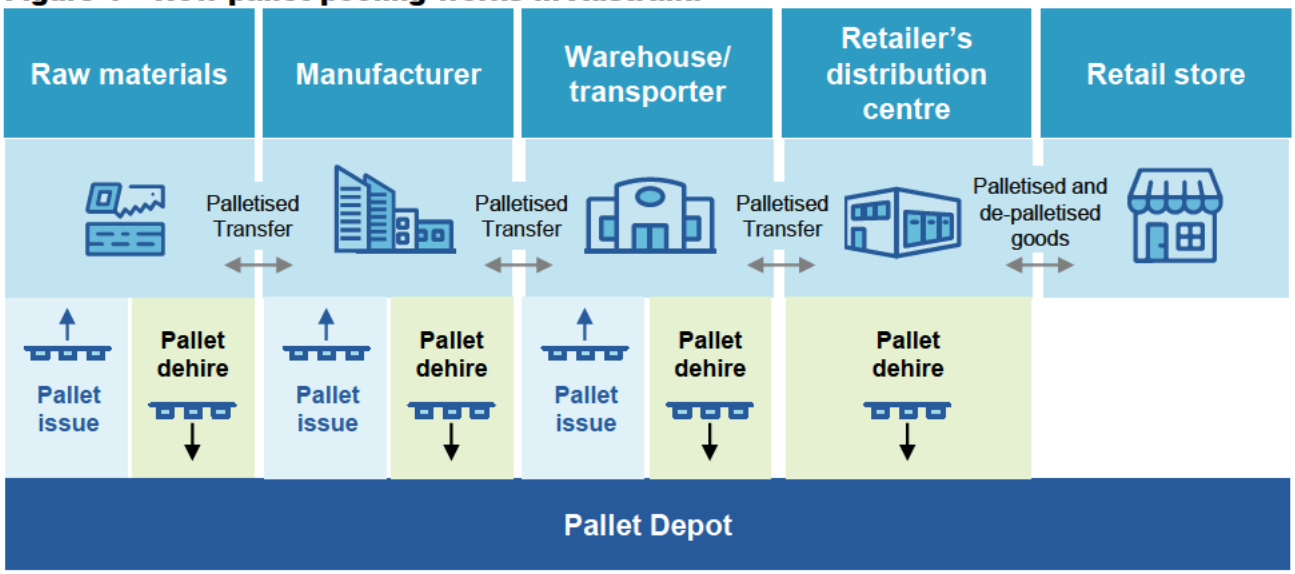
Australia's pallet demand was estimated to be 48.5 million units in 2019, of which 46.7 million units were wooden pallets. Plastic, corrugated and moulded pulp, and metal pallets only accounted for just under 4% of Australia's pallet demand (Freedonia Group 2020, p. 185).

How the pallet pooling system works in Australia

Pallet pooling is a system where businesses – manufacturers, distributers and retailers – share a common pool of pallets, rather than each business owning and managing its own pallets. Under this 'share and reuse' system, pallets are rented or leased from a pallet pooling provider, who is responsible for the collection, repair, and maintenance of the pallets.

When a business needs pallets for the transport and storage of goods, it orders pallets from the pooling provider. The pallets are then delivered to the business and can be used as needed. Once the business is finished with the pallets, they can be returned to the pooling provider for repair and reuse. The pooling provider is responsible for collecting the pallets and transporting them to a repair facility, where they are inspected, repaired, and cleaned as needed. The responsibility for, and daily rental cost of, hired pallets is transferred between different businesses' accounts as the pallets move through the supply chain (figure 1).

Figure 1 – How pallet pooling works in Australia



Source: (Loscam nd)

The pallet pool providers generate their revenue from:

- an issue fee – the pallet customer gets charged a one-off fee per pallet of around $0.68
- a daily hire fee for each day the pallet customer uses the pallet (about $5 – $7 a month)
- other fees, including fees for lost pallets and transport (Andrew 2023).

According to CHEP, only 90% of the pallet pool is expected to survive through to the next year. The remaining 10% are 'irrecoverable', of which about 2% will reach the end of their useful life (about 10 years) and be scrapped, and 8–9% are considered lost. Of the lost pallets, half are compensable by the customer who had responsibility for the pallet. CHEP claims it absorbs losses on the other half (Andrew 2023).

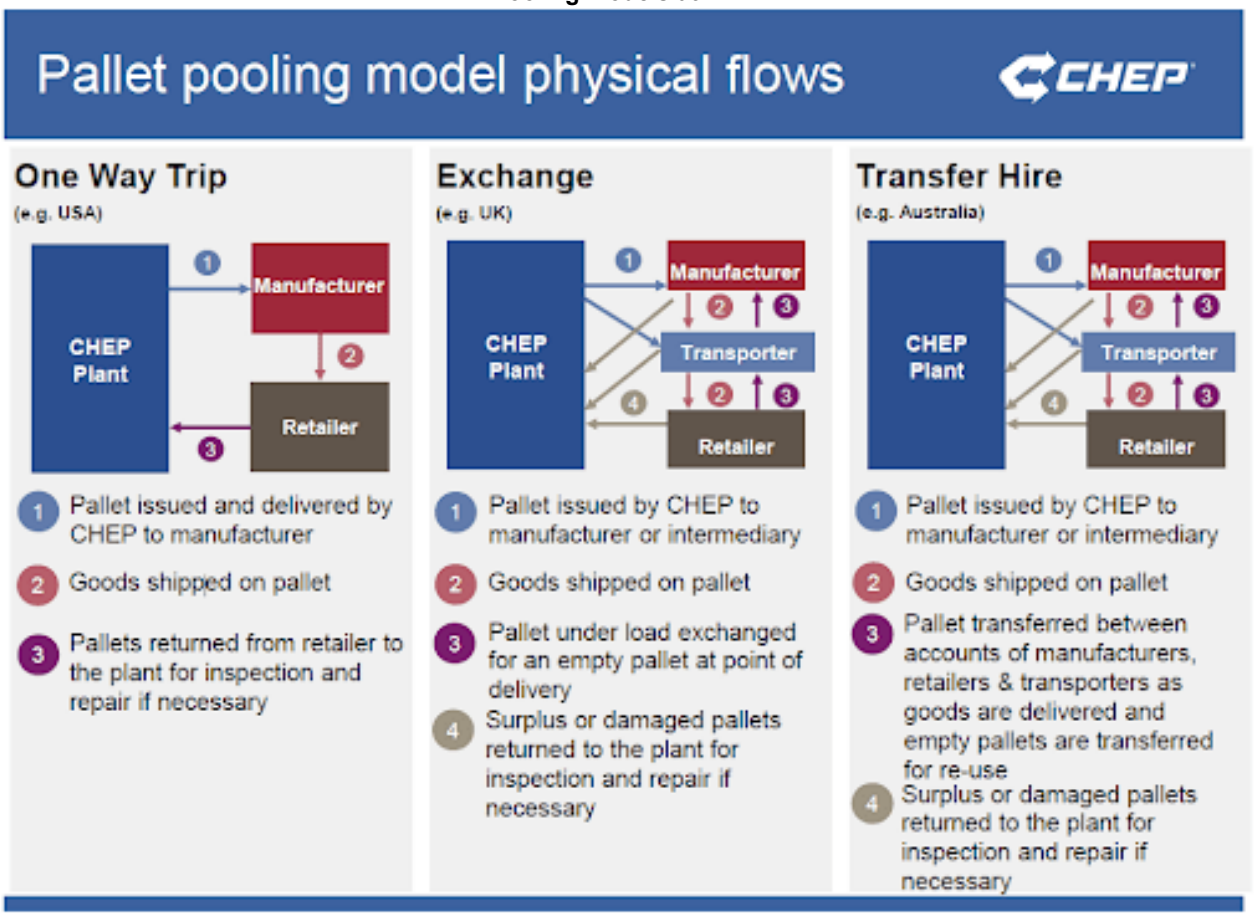
Some transporters also charge pallet-related fees to pallet customers – for example, to cover the possibility of pallets becoming lost (and the transport company being liable) when delivered to customers who have no pallet pool account.

How pallet pooling works overseas

CHEP and Loscam operate globally (CHEP in 60 countries and Loscam in 12), but not all pallet pooling models operate like Australia's. The pooling model described above for Australia – where hired pallets are transferred between different businesses' accounts as the pallets move through the supply chain – is more generically known as the 'transfer hire' or 'modern pooling' model. In the US, the 'one way trip' is more common. In Europe the more common model is the 'exchange model', in which businesses own their own pallets and exchange them with others (say, swapping the same number of empty pallets when receiving loaded pallets from a supplier). The exchange model requires businesses to manage their own pallet inventory and ensure their pallets meet industry standards (figure 2).

Figure 2 – Pallet pooling models differ overseas

Pooling models at CHEP



Source: (Andrew 2023).

Pallets are used in many industries, but the grocery supply chain is the main focus [redacted]

The majority of demand for pallets in Australia is for warehousing (47%), followed by 'other manufacturing' (28%)[1], food and beverage manufacturing (23%), and construction (2%) (Freedonia Group 2020, p. 185). The share of pallet demand for warehousing is high relative to other countries – for example, across the Asia-Pacific region warehousing accounts for 15% of pallet demand compared to 63% for 'other manufacturing' (Freedonia Group 2020, p. 163). This might reflect Australia's lower level of manufacturing activity relative to other countries in the region, or Australia's greater use of pallet management firms, which are classified under 'warehousing' rather than the hirer's industry.

OSCR's understanding is that the pallet hire shortage disproportionately affects the food and grocery sector. We do not have data yet on use of CHEP and Loscam hire pallets in other sectors, but will seek this through our initial meetings with industry organisations and through direct approach to CHEP and Loscam.

[1] Although we do not have a breakdown of the data for Australia, globally the 'other manufacturing' category is composed of transportation equipment, chemicals, electronic products, metal products and machinery (Freedonia Group 2020, p. 68).

Pallets come in different sizes and materials (and that's part of the problem)

The value of pallets is their standardisation, which speeds up (and can also improve the safety of) the handling of goods through supply chains. Pallets enable optimisation of space in warehouses and during transportation, as well as consistency in handling approaches. Diversity in pallet sizes and materials lead to inefficiencies in logistics and supply chain operations, which can result in higher costs and lower productivity. When pallet sizes vary:

- it becomes difficult to optimise the use of space in warehouses and during transportation. If some pallets are larger than others, it is challenging to stack them efficiently
- different handling methods are needed, which can slow down operations
- different forklifts or pallet jacks may be required, increasing equipment costs and maintenance and operator skills.

The International Organisation for Standardisation (ISO) sanctions six pallet dimensions in *ISO Standard 6780:2003 Flat pallets for intercontinental materials handling – Principal dimensions and tolerances* (table 1). The Australian standard pallet is only used for freight within Australia. Its design (1165mm by 1165mm) fits perfectly in the standard containers used on Australian railways (Railways of Australia Container Express (RACE)) which were designed to accommodate 20 standard Australian pallets stacked two wide and in two levels. This is slightly wider than the standard ISO shipping container used in Australian road freight and to export goods overseas. The typical export pallet is 1100mm by 1100mm, which is a more reliable fit in the standard ISO shipping container.

Table 1 – ISO flat pallet dimensions

Dimensions (W x L) mm	Region most used in
1016 x 1219	North America
1000 x 1200	Europe, Asia
1165 x 1165	Australia
1067 x 1067	North America, Europe, Asia
1100 x 1100	Asia
800 x 1200	Europe

Source: Author (year); Author (year, year).

Timber and plastic are the most common materials used for pallets, although cardboard and metal pallets are used for some products. Timber pallets are cheaper to purchase than plastic pallets, can be repaired easily, and have a high friction surface, which can help prevent load slippage. On the downside, timber pallets are susceptible to damage from moisture and pests, require more maintenance and need to be replaced more frequently than plastic pallets. The main advantage of plastic pallets is their lighter weight, which can reduce transport costs, and their ease of cleaning.

The pool of CHEP and Loscam pallets is predominantly timber pallets. The dominant player in the market, CHEP, offers hardwood pallets, which are more resistant to decay and damage, while Loscam offers softwood pallets which are lighter in weight (and cheaper to purchase).

The shortage problem

How hoarding broke the pooling system in 2021

In response to supply chain disruptions since the COVID-19 pandemic in 2020, manufacturers, producers and importers have been de-risking their supply chains by increasing levels of 'just in case' inventory (CHEP Australia 2022). This inventory is largely being held on pallets in warehouses, which has increased the demand for pallets.

Over the two years to December 2022, the main pallet pool provider, CHEP, invested over $100 million to bring new pallets into the system (CHEP Australia 2022). CHEP noted in December 2022 that they had added more new pallets to their pool in six months than their historic annual purchase volumes (CHEP Australia 2022).

Despite the increased supply into the pool, and other actions by the pooling companies to assist pallet returns[2], there were insufficient pallets to meet demand in 2021 and 2022. According to CHEP, hirers began 'hoarding' pallets and circumventing the 'share and reuse' pallet pooling systems (CHEP Australia 2022).

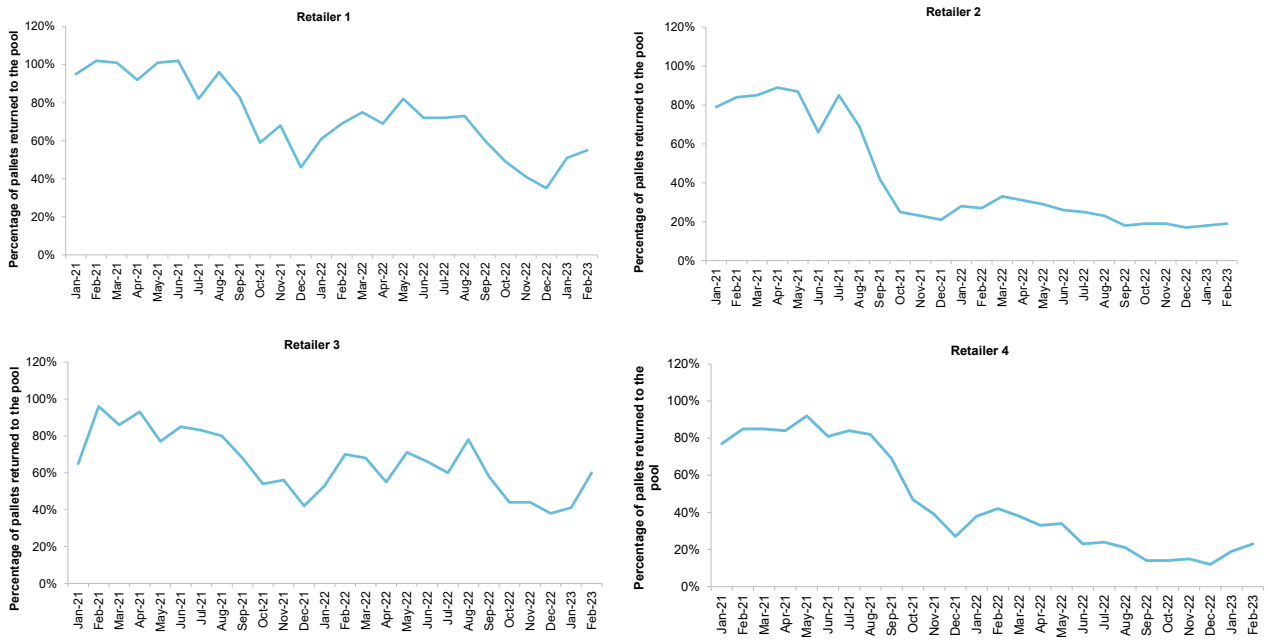
- The Office of Supply Chain Resilience (OSCR) met with pallet poolers and supermarket retailers throughout 2021 and 2022, and told us the same story.

OSCR provided data on the de-hiring rates (the proportion of pallets returned to the pool when no longer needed) at Loscam for Australia's four major supermarket retailers (figure 2). The percentage of pallets returned to the pool fell sharply during the second half of 2021 for the two largest supermarket retailers (Retailers 2 and 4) and remained low throughout 2022.

[2] These include: enhancing asset recovery processes to increase pallet collections and returns; managing critical supplies through allocation protocols; working collaboratively with de-hirers to increase returns; upgrading online ordering systems, making it easier for customers to manage their orders and enabling CHEP to provide the most up to date supply information; and increasing capacity to condition returned pallets with new 'state of the art' pallet plants recently commissioned in Melbourne, Perth, and Sydney (CHEP Australia 2022).

Figure 2 – De-hiring rates at Loscam have fallen since the start of 2021

Supermarket retailers[a]



a. Retailers are de-identified on Loscam's request but represent the four major supermarket retailers in Australia.

Source: Loscam (unpublished – commercial-in-confidence).

Direct impacts of the pallet shortage

The pallet shortage problem has been raised directly with Government by the food and grocery industry. We have not yet found information on how pallet shortages are affecting other industries, nor is there public information on what proportion of the pallet market the food and grocery industry represents, but will seek this information through our call for submissions and early meetings.

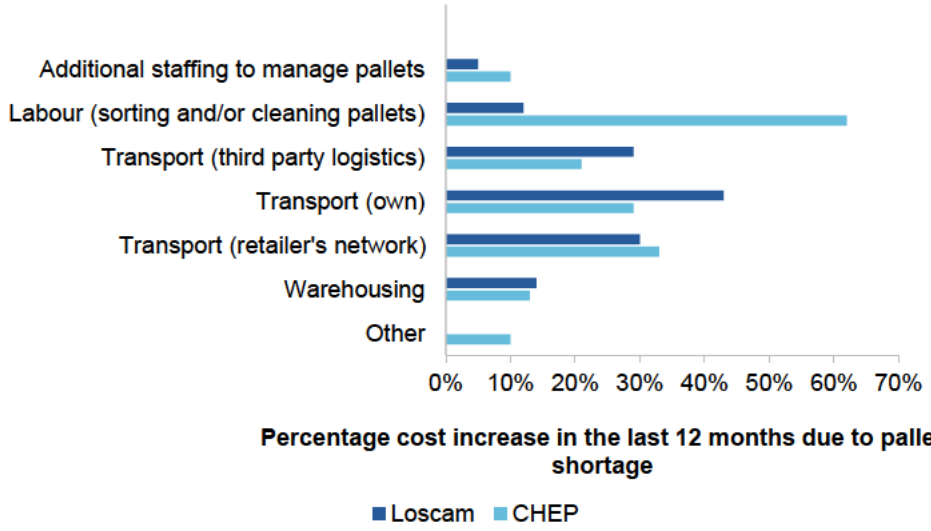
A survey of food and grocery businesses by the Australian Food and Grocery Council (AFGC) in December 2022 (unpublished, p. 7) asked whether organisations had experienced significant additional costs directly associated with sourcing and transporting pallets in the past 12 months. Most organisations (91%) responded 'yes', with only 6% responding 'no' and 3% 'not sure'. The largest percentage cost increase in the past 12 months for CHEP pallet hirers was from additional labour costs to sort and clean pallets, and for Loscam pallet hirers to transport pallets (figure 3).

A follow-up survey in March 2023 found that 95% of organisations had experienced significant additional costs directly associated with sourcing and transporting pallets in the past 12 months (AFGC 2023 unpublished, p. 9). These estimates are likely based on the number of respondents, without adjustment for their size (their demand for pallets).

The December 2022 survey also identified pallet-associated downtime of 40 hours per month for CHEP pallet users and 10 hours per month for Loscam pallet users in November 2022 (AFGC 2022 unpublished, p. 8). A majority of respondents (55%) also identified that pallet shortages had impacted their imports of products and/or materials (AFGC 2022 unpublished, p. 11).

Figure 3 – Cost increase due to pallet shortage

Survey results, December 2022



Source: AFGC 2022 (unpublished, p. 7).

Indirect impacts of pallet shortage

According to OSCR, the impact of hoarding by the major supermarket retailers is being felt by SME retailers who do not have the ability to stockpile pallets. This could have implications for competition in some retail markets. And supermarkets are potentially passing some costs onto their suppliers.

We also understand CHEP and Loscam have closed their books to new accounts, which means that new businesses are unable to participate in the pallet pooling system. We will seek information in our call for submissions paper about whether this issue – which may be symptomatic of limited contestability – predates the pallet hoarding problem of 2021.

Timber pallets need to be repaired and reconditioned after approximately every 20-30 uses. But when pallets are hoarded and not returned to CHEP and Loscam for servicing, the quality of the pallet pool degrades. This has other impacts, including potential safety hazards to workers from damaged pallets that break or collapse[3], and potential damage to products as degraded pallets are less able to support the weight of products being transported.

The AFGC's *Perfect Delivery Report 2022* found that both ambient and cold-chain distribution centres reported pallet quality issues as their most prevalent and impactful concern throughout 2022 (AFGC 2023, p. 11).

We heard from OSCR that some retailers have attempted to address the pallet quality issue by repairing in-house the pallets they kept back from the pool, but the in-house repairs were below the quality of reconditioning provided by CHEP and Loscam within their dedicated facilities.

[3] The Australian Food and Grocery Council's December 2022 survey (unpublished) found that 24% of respondent businesses had experienced a Work, Health and Safety incident due to poor pallet quality.

Policy questions

Is the pallet pooling problem transitory — will it resolve itself?

If the increase in demand for pallets is temporary, and businesses revert to 'just-in-time' inventories in the near future as global supply chain problems are resolved, then the number of pallets in the system may be sufficient – or more than sufficient – to return the pallet pool to functioning as it was prior to the hoarding problem.

The AFGC surveyed food and grocery businesses in the first quarters of 2022 and 2023, and found that inventory levels of raw and packaging materials had largely returned to pre-COVID levels in quarter 1, 2023. However, inventory levels of finished goods remain higher than pre-COVID levels, with almost 40% of respondents holding 0-20% more stock than prior to the pandemic (AFGC 2023 unpublished, p. 4). That is, food and grocery businesses are holding just-in-case inventories.

If businesses continue to hold just-in-case inventories of finished goods, the market could still resolve the pallet pooling shortage by a number of means:

- CHEP and/or Loscam could add more pallets to the pool to meet demand
- new entrants to pallet pooling could hire out pallets to meet demand
- businesses may find substitutes for pallet hire, such as purchasing pallets themselves.

These situations are considered below. A key question is why the market *wouldn't* resolve the pallet shortage on its own. This could be due to market power by the two companies in the pallet hire business, or if companies are expecting government to solve the problem.

Why can't CHEP and Loscam just add more pallets to their pools?

Adding more pallets to the pool would solve the hoarding problem, but the main input – timber – is expensive (figure 4). In addition, flooding in 2022 led to shortages in sawn softwood timber, and recent government policy changes have reduced access to native forest hardwood in some states (Forest & Wood Products Australia 2022).

Additional timber could be imported to make pallets in Australia – CHEP Australia (August 2022 update) noted that:

> Suitable grades of sustainably grown timber are being imported into Australia, to supplement our contracted local supplies, and are shipping weekly into pallet manufacturers across the country.

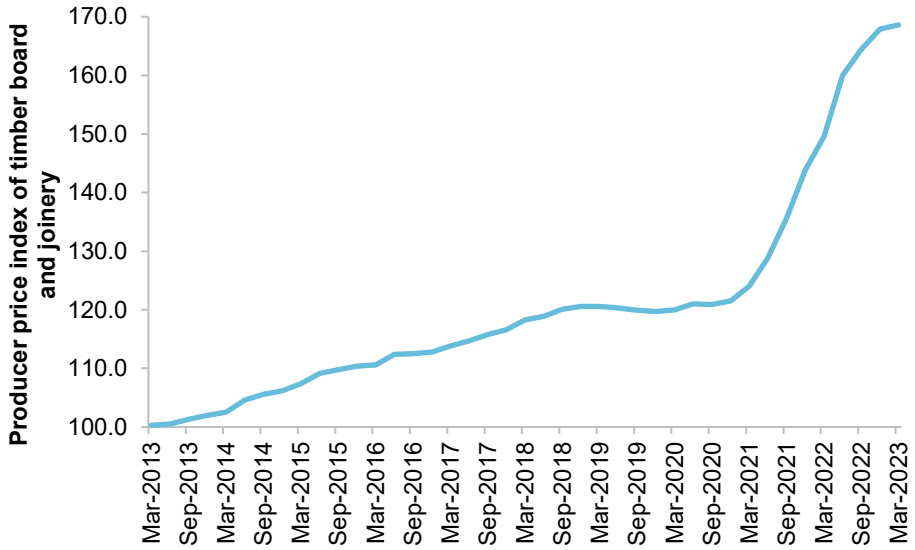
Finished timber pallets can also be imported, although the bulk and weight of timber pallets makes them an economically unattractive product to import (Freedonia Group 2020, p. 24). Despite this, Forest and Wood Products Australia reported that Australia's imports of wooden pallets were valued at $4.34 million for the year ended September 2022, 22% higher than a year earlier (Forest & Wood Products Australia 2022). Our assumption, without seeing the underlying (subscription) data from IndustryEdge, is that these wooden pallets are Australian Standard pallets being purchased by pallet users or logistics companies for the one-third of the market that does not use pallet pooling. We do not yet know whether CHEP or Loscam import finished pallets for their pools.

Plastic pallets cost about three times more than wooden pallets, which may explain why CHEP and Loscam have not switched to plastic to make up the shortfall in their pallet pool. (Both CHEP and Loscam do offer a

range of plastic pallets to customers for specific uses, presumably at different prices to their standard timber pallets.)

Figure 4 – Timber, board and joinery prices have increased substantially in recent years

Producer price index of timber, board and joinery, March 2013 to March 2023[a]



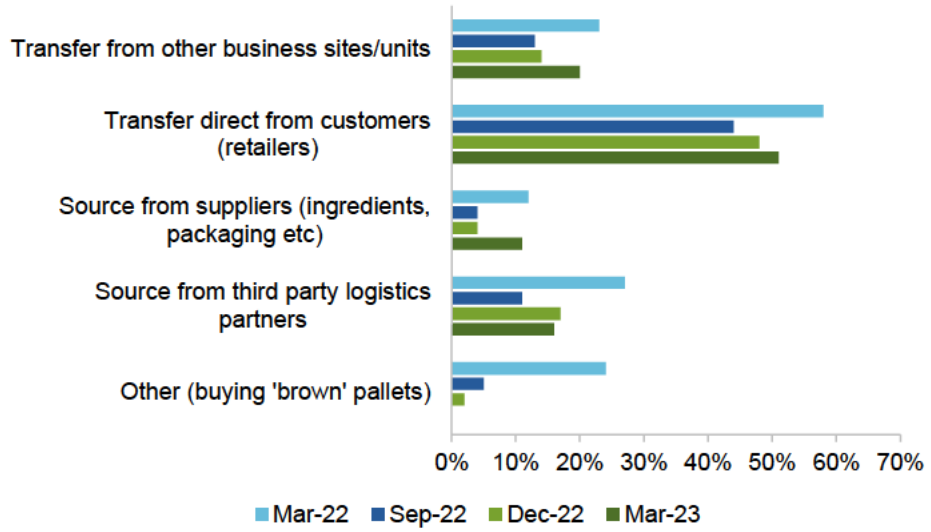
a. Weighted average across six capital cities.

Source: ABS 6427.0 Producer Price Indexes, Australia

If businesses who hire from CHEP and Loscam can't get enough pallets, can't they get pallets from somewhere else?

The AFGC survey asked food and grocery businesses about alternative sources of pallets. Direct transfer from retailers was the main alternative source of pallets for suppliers in 2022 (AFGC 2022 unpublished, p. 6) (figure 5).

Figure 5 – Alternative sources of pallets to CHEP/Loscam hire for food and grocery businesses



Source: AFGC 2023 (unpublished, p. 8).

The alternative to using hired pallets from CHEP and Loscam is for businesses to purchase 'brown' timber pallets[4] – or plastic pallets – themselves. When a business purchases a pallet themselves, ownership of the pallet transfers through the supply chain, after which the end user (such as a retailer who has removed the goods off the pallet at their store) sends the pallet to a recycler, who repairs and resells it back to manufacturers or onto the second-hand market.

This alternative can be less cost-effective for some businesses as they have less flexibility in maintaining the right number of pallets for their needs, and means they must invest in pallet storage and maintenance infrastructure (and labour). Hiring pallets allows businesses to adjust their requirements as needed and only pay for what they use. CHEP and Loscam pallets are said to be of higher quality than brown pallets, although brown pallets could presumably be manufactured to the same quality as hire pallets if needed.

Once we are able to talk to stakeholders in the pallet sector, we will investigate the extent to which pallets used for food and groceries are interchangeable with pallets used in other parts of the economy.

Are there barriers to entry in pallet pooling?

With CHEP and Loscam providing all the pooled pallets, a question is whether other companies could enter the market as providers of for-hire pallets. The need to operate at scale seems to be the main reason we have not seen entry into the market.[5]

Our desktop research indicates transportation and third-party logistics companies are starting to provide for-hire pallets (Toll and Linfox, for example) but there is no public data on the scale of their operations.

[4] Sometimes called 'white wood' pallets, brown pallets are distinguishable from hire pallets by being unpainted. CHEP and Loscam hire pallets are painted blue and red respectively in order to be easily located on a site.

[5] CHEP was started in 1946 and Loscam in 1942, diversifying from ammunition boxes into pallets following the end of the Second World War.)

What other issues with pallets are relevant?

A study of pallets in 2017 by the Centre for Supply Chain and Logistics at Deakin University – predating the breakdown in the pallet pool model after COVID-19 – identified a number of issues associated with pallets in supply chains.

- **Cost** – and anticipated **future cost increases** due to hardwood supply gaps – was the prevailing concern of pallet users who rent or buy pallets (Centre for Supply Chain and Logistics 2017, p. 19). As sector-specific alternatives to hardwood pallets increase, the increased diversity in pallets may lower the efficiency benefits initially derived from use of pallets.
- **Pallet control** was a significant challenge for pallet owners, renters and suppliers – that is, management of pallet inventory and loss of pallets. Businesses without accounts with CHEP and Loscam were benefiting from a supply of pallets that accrued daily rental fees for *other* businesses (generally the previous business in the supply chain – the transporter or supplier) (Centre for Supply Chain and Logistics 2017, p. 14).
- **Diversity in pallet sizes** were causing challenges for logistics service providers in transporting and storing pallets. Warehouse racking in Australia is designed for the CHEP/Loscam 1165x1165mm pallet, but imported Asian standard (1100x1100mm) and European standard (1000x1200mm) pallets for imported product were creating inefficiencies in warehousing and inhibiting uptake of automation and smart technology (p. 17). Double handling of imported products that need to be moved off their incoming pallets and onto Australian sized pallets is inefficient and costly (Centre for Supply Chain and Logistics 2017, p. 16).
- **Safe working loads** on pallets and **work, health and safety concerns** were also identified (Centre for Supply Chain and Logistics 2017, pp. 13, 18).

[redacted]

Environmental concerns may also be raised [redacted] due to CHEP's reliance on native hardwood in manufacturing their pallets. Some analytical considerations include:

- environmental impacts of hiring (pooling) pallets versus single-use pallets. For example, imported Asian standard pallets are commonly recycled or discarded rather than reused
- hardwood versus softwood over the life cycle of the pallet (hardwood pallets are more durable than softwood, but are made from non-plantation native timber)
- plastic or cardboard versus timber or wood composite over the pallet life cycle (see for example Khan et al. (2021)).

Is there a role for government?

The threshold questions in relation to the role for government is whether there is a market failure in the pallet pooling market, or areas in which government action might assist in improving market outcomes. Sources of market failure could include:

- exercise of market power (duopoly) and barriers to entry for pallet suppliers in the pallet pooling market, including variations in this in regional Australia
- exercise of market power in the grocery retail market (with two major retailers' refusal to return pallets impacting the pooling system and smaller retailers' access to pallets)
- lack of information on supply, location and pricing of pallets to the pooling market (there is no public information in Australia on the number of pallets or their pricing)
- barriers to entry for new businesses who cannot join the pallet pooling system as customers

- externalities, where individual businesses' solutions to pallet access in one part of the market – such as using non-standard size pallets, or repairing pallets in-house – impact on the overall efficiency of supply chains
- externalities in the environmental impact of pallets – for example, if landfill pricing does not take account of the full costs of disposing of pallets into landfill (similarly for carbon dioxide emissions in pallet manufacture and use, and the environmental impacts of logging native and plantation timber).

The market may resolve the pallet pooling problem and achieve more efficient outcomes without government intervention. For example, some transporters now charge additional fees to cover the risk of pallets lost to businesses not in a pool, and other businesses have emerged that offer tracking and pallet management services.

[redacted].

Historically, government's role in the pallet pooling industry has been mainly in facilitating collaboration, supporting innovation/managing forestry industry transition, and maintaining standards:

- OSCR meets regularly with the two pallet providers and four supermarket retailers, acts as a go-between to encourage supermarkets to return pallets to the pool, and attempts to get pallet providers to share information about availability and pricing.
- The Victorian Government's Timber Innovation Fund provides grants for innovation to support transition from native timber to plantation fibre.
- Standards Australia maintains the Australian standard for pallets.

Industry self-regulates through encouraging adherence to common delivery requirements for pallets.

- The *Common Delivery Guidelines for Industry* were developed collaboratively between three of the four major food and grocery retailers in Australia (Coles, Metcash and Woolworths) to align non-competitive requirements for deliveries wherever practical. Compliance is reported on annually.

We remain uncertain, at this point, as to what justification, if any, there might be for government intervention in the pallet market.

[redacted]

[redacted]

[redacted]

[redacted]

Data needs and approach

[redacted]

Table 2 – Data wishlist

Empirical evidence	Datapoints	Possible data sources
Description of market for hiring standard pallets and single use/reuse of pallets	• Number of pallets in pool • Market share in hire pallet supply • Market share in hire pallet use • Industries using hired and owned pallets • Forecast pallet demand (hired and owned; timber and plastic) • Regional differences in access to or cost of hire pallets, use of pallets more generally in regional areas • International comparison of pooling systems and pallet usage • Market prices for pallet hire and purchase; price discrimination/differentiation • Entry and exit	• **OSCR** does not have total numbers nor market shares. • **CHEP and Loscam** should provide us with information about their service • Database from **Freedonia** contains estimates of pallet market size, supply and demand for Australia and globally from 2009 to 2019 and forecasts up to 2024. While we are still considering the reliability of these estimates, the data has been used in previous studies of pallet pooling (e.g. Deakin University). • More detailed info likely could only be sourced from **businesses** – pallet suppliers, retailers, warehouse / suppliers, and transport and logistics.
Pooling shortage problem	• Return rates over time by supplier and major retailer • Numbers of pallet stocks and flows in the pooling system • Number of pallets hired and dehired outside of CHEP and Loscam (eg third party logistics) • Trends in the supply of, and demand for, for-purchase pallets	• **OSCR** can provide limited high-level data — return rates for four major supermarkets, separately for CHEP and Loscam • Further data could be requested from **businesses** CHEP, Loscam, or supermarkets, regarding the numbers of pallets involved (as opposed to rates alone) • Data could be requested from **third party logistics**/transport businesses (eg Toll) • **Victorian Government** may have some data on pallet production sourced from timber mills

Empirical evidence	Datapoints	Possible data sources
	• Estimates of timber shortages and prices; prices of plastic pallets as substitute	• [redacted] source timber supply and pricing data from **ABARES** and/or **businesses** in the timber industry
Impacts of pallet pooling shortage on different parties	• The extent of costs borne by different parties – the extent to which the incidence of costs fall on major supermarkets or other businesses (which could indicate incentives for behaviour) – the extent to which costs are passed on to consumers	• **AFGC survey** provides a simple estimate of respondents' downtime caused by pallet shortage. Further data can be sought from AFGC on costs for grocery businesses, especially by size. • Data is needed on impacts on non-grocery businesses – likely only sourced directly from **businesses or from industry bodies** • Info needed on cost impacts on consumers – possibly **ABS data**
Secondary data needs		
Potential impacts of Australia's unique standard size	• Number of pallets that are repalletised following import and the cost of repalletisation • Foregone economy-wide benefits from warehousing and transporting efficiencies • Incidence of impacts on different parties	• A **2007 World Bank paper** (Raballand and Aldaz-Carroll 2007) estimated the effect of differing standard sizes globally. We will need to critically analyse and potentially update the estimates • The potential for warehousing efficiencies from standardised pallets is likely to have increased significantly in recent years. We need to **further investigate existing literature** on estimating benefits that can be foregone due to shortage or mismatch.
Environmental impacts	• Environmental comparison of materials including new composites; comparison of pooling versus single use pallets • Waste associated with imported pallets being disposed	• Investigate **existing literature** further. • Speak with **pallet recyclers** and **producers**.
Innovation and technological change	• Substitutes for timber pallets • Comparison of innovation in international markets (pallets and pooling systems)	• Data is needed to understand whether there are potential gains from innovation or new technology that are not yet being applied in Australia.

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