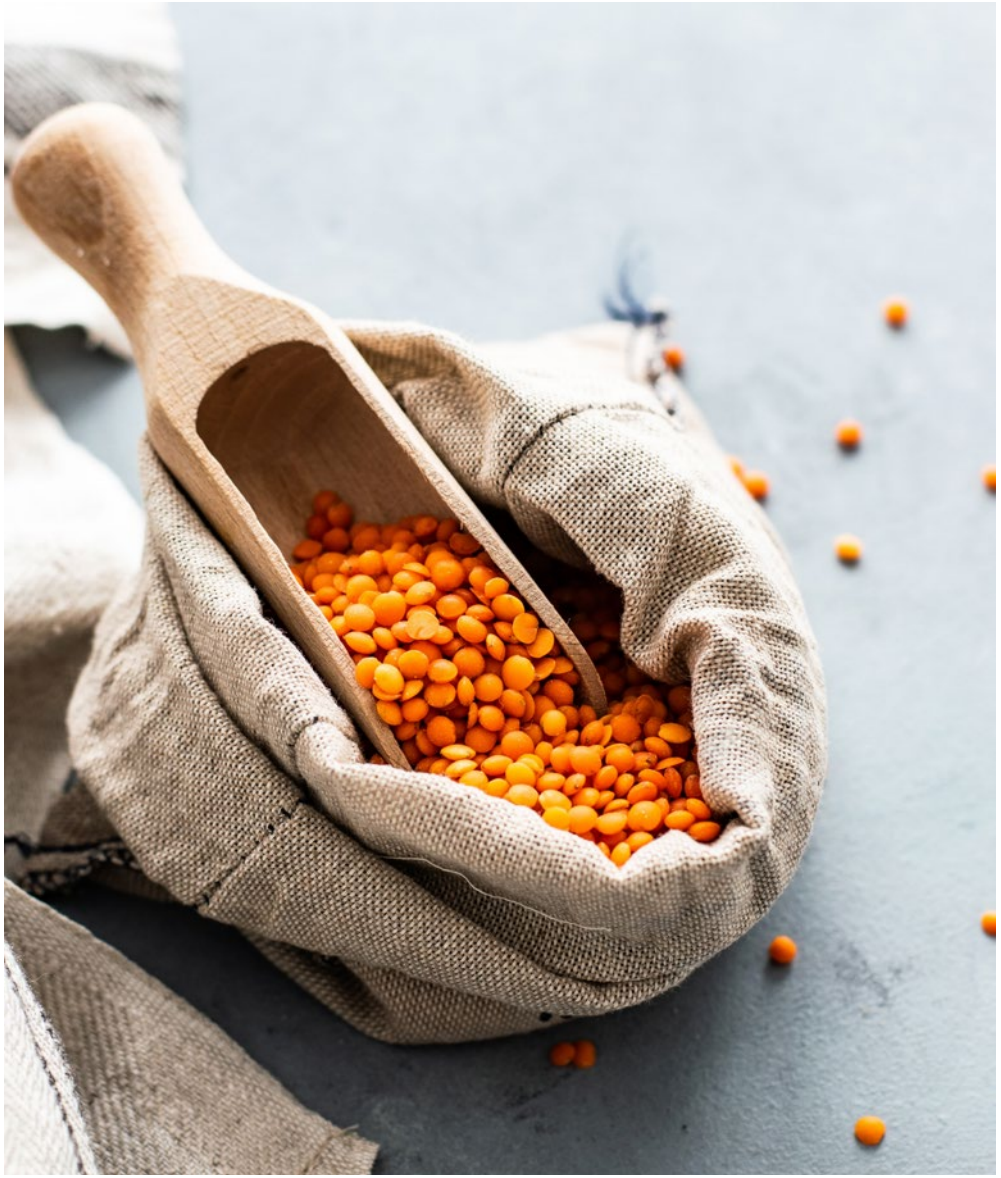
Australian Guide to Implementing Food Traceability

Organic Produce

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Introduction



Welcome message

The market for certified organic food is growing across Australia. It is a component of Australia's export food target value of 100 billion AUD by 2030. Consumers are increasingly requiring information about the conditions in which the product was grown, handled and delivered to them.

Certified organic food attracts a premium in domestic and international markets, with this value underpinned by natural resource management and preparation of the product under comprehensive organic principles that are audited annually.

Traceability will support the tremendous effort growers put into these premium products as they are delivered to end consumers.

Deakin University's recent analysis for AgriFutures shows the significant impact of counterfeiting in food supply chains. Traceability is a cornerstone of actions to curb the threats of substitution of inferior/non-organic produce, co-mingling or contamination in storage and distribution. Our research also addresses the need for supply chain partners to collaborate and share data amidst the threats to cybersecurity that target food businesses.

The Deakin Food Traceability Lab partners from industry, government and academia have supported the Implementing Food Traceability Program and the development of guides for industry. In addition, reviewers from the organics industry and members of the Solution Provider Reference Group have provided their expertise to develop the Guide. I wish to acknowledge their contributions.

We trust that this guide specific to fresh organic produce will contribute to the efforts of growers, packers, processors, freight transport, distribution, foodservice and retailers across Australia to achieve end-to-end traceability of produce from farm to consumer.

Terms of Use

About The Australian Guide To Implementing Food Traceability: Organic Produce

This Guide is one of a series of guides to be produced as part of the Implementing Food Traceability Program led by Deakin University.

The Implementing Food Traceability Program is an initiative of Deakin University's Food Traceability Lab, a grouping of businesses in food supply chains, peak bodies, government agencies and applied industry researchers.

The aim of each guide is to provide support for businesses in domestic and international supply chains to identify what information is required, how to structure that information to concord with global data standards, and how to safely share that data with others in that supply chain to create traceability and support value capture.

Organic produce in Australia

Produce is generally defined as food that remains largely unchanged from harvesting. It is considered a fresh product. Organic produce is grown without synthetic chemicals such as pesticides and artificial fertilizers or using techniques such as genetic modification or irradiation. Organic fruit, vegetables and herbs make up almost half the organic farming output across Australia.

The value of organic food is rising in Australia, with a retail value estimated to be around 2.6 billion AUD. A further 6.9 AUD of organic products is exported. In the past decade the industry has experienced 13% compound annual growth. Consumer demand for organic food is growing at an estimated 20-30 percent per annum. More than 6 in every 10 households now buy organic food, with fruit and vegetables a favoured category.[1]

The purpose of the Guide

Australian food businesses have a reputation for producing safe, quality food. These businesses put in place measures and systems that enable them to comply with a range of requirements covering food safety, biosecurity, food labelling, food transport as well as industry codes and buyer specifications.

Mandatory "one back: one forward" recording of the product details provides information on who sold or handled the product prior to arrival at a business and who the business is supplying next.

Heightened concern about health and the environmental and social impact of food production is driving a demand for more information – end consumers, enterprise to enterprise (E2E) buyers wishing to verify product claims now demand more information about the product and the circumstances of its production, formation and distribution.

The AGIFT Organic Produce provides a user-vfriendly "how to" for tackling traceability across a complete fresh produce supply chain. It means that partners working together to supply Australian food will be able to achieve end-to-end traceability at a pace and in priority processes and events along the chain that all agree are important to business success.

The aim of standardising what information is required and how that data is used to identify, capture and share traceable events, is to enable disparate enterprise systems to "talk" to each other with the minimum cost and maximum value capture.

The designers have adopted the following principles in preparing the Guide:

- The Guide is designed to work with varying scale of enterprise, from small growers selling at a local produce market to large scale operations and exporters
- The Guide is based on existing systems and technologies but also allows for the emergence of new technologies, networks and systems. It is technology-agnostic
- The Guide is designed to structure information so that data your business needs to share can flow through your supply chain seamlessly. Interoperability is the touchstone
- The Guide is standards-based, using GS1 global data standards and other international standards adopted by industry. Most are already ISO recognised.

The Guide has been deliberately structured in the form of modules chosen to cover common events and transactions in organic produce supply chains. Each module covers the typical participants, their roles, the Critical Tracking Events (CTEs) and Key Data Elements (KDEs) for traceability. Each module includes regulatory requirements that are associated with traceability and required record keeping.

Importantly, the Guide addresses protection of your data and best practices in cybersecurity, privacy and data sharing.

[1] Better Health Channel Organics
www.betterhealth.vic.gov.au

Who can use this Guide?

The Australian Organic Produce Traceability Guide covers on-farm production, packing, processing, distribution, transport, supply to retail, food service, import and export of fresh produce and end consumer information.

Some of the types of businesses this Guide has been prepared for are:

- Agricultural suppliers
- Water cartage operators
- Farm infrastructure and equipment suppliers
- Growers
- Pack houses
- Food processors
- Fresh Produce Wholesalers
- Packaging suppliers
- Food manufacturers
- Food safety technicians
- Quality assurance personnel
- Storage facilities
- Exporters
- Importers
- Transport operators
- Cargo Terminal Operators
- Shipping and air lines
- Warehouse operators
- Pallet and tub suppliers
- Container yards
- IT companies
- Food retailers
- Food service.

Tracking and tracing at the supply chain level

Food Standards Australia New Zealand (FSANZ) defines traceability as "the ability to track any food through all stages of production, processing and distribution (including importation and at retail). Traceability should mean that movements can be traced one step backwards and one step forward at any point in the supply chain. For food processing businesses, traceability should extend to being able to identify the source of all food inputs such as raw materials, additives, other ingredients, and packaging."[2]

Traceability is the ability to follow the movement of a product through stages of production, processing and distribution (ISO 2007).[3] It is the systematic ability to trace the path of food ingredients and/or finished products throughout their entire lifecycle, using previously captured and stored records. These records catalogue key data elements (KDEs) at critical tracking events (CTEs).[4]

Traceability may be achieved along a supply chain by combining the one-up/one down information from individual businesses. However, it may not constitute a visibility capability for that particular supply chain. The data may be required to be held for regulatory purposes but not necessarily shared with other businesses in the chain to create visibility of the product.

Gaining visibility along the entire supply chain can improve speed and accuracy of food recalls by having a complete set of information on where the product has been, who has handled the product, unique identification of the product (what) and when it was produced, transformed, aggregated and disaggregated as it is physically moved along the supply chain.

[2] FSANZ Food Traceability 2017 www.foodstandards.gov.au

[3] www.agriculture.gov.au

[4] Global Food Traceability Centre www.ift.org

What are Critical Tracking Events (CTEs) and Key Data Elements (KDEs)

A Critical Tracking Event (CTE) is any occurrence involving an item at a specific location and time associated with collection and storage of data useful for associating the item (or related items) to the specific occurrence at a later time and is determined to be necessary for identifying the actual path of an item through the supply chain.

The concept of Critical Tracking Events in an agrifood supply chain allows unique traceability data to remain separate from proprietary commercial data.

For each node, aggregation, de-aggregation, transfer and transformation of the product it will cover:

- A unique location – the "where"
- Unique identification of the parties involved - the "who"
- A unique item identification – the "what"
- A time and date stamp – the "when".

"The CTE approach is a bottom-up approach that is inherently secure in terms of data ownership, data access and proprietary information protection. The CTE approach recognizes that each operator knows their own operations best and provides complete latitude as to how to collect CTE traceability data. The CTE approach shifts focus from the food product itself to the events that manipulate the product in the supply chain. As each operator handles a food product (harvests, creates, receives, mingles, aggregates, palletises, depalletises, relocates, ships, etc.) its actions are viewed as events that occur at specific locations, dates and times. Some of these events are critical to the ultimate traceability of the product. Therefore, those events are deemed to be "critical tracking events." Since a CTE is essential to ultimately tracking the item in the supply chain, CTE traceability requires a commitment from operators to collect, store and make retrievable, CTE data from every CTE within their operation.

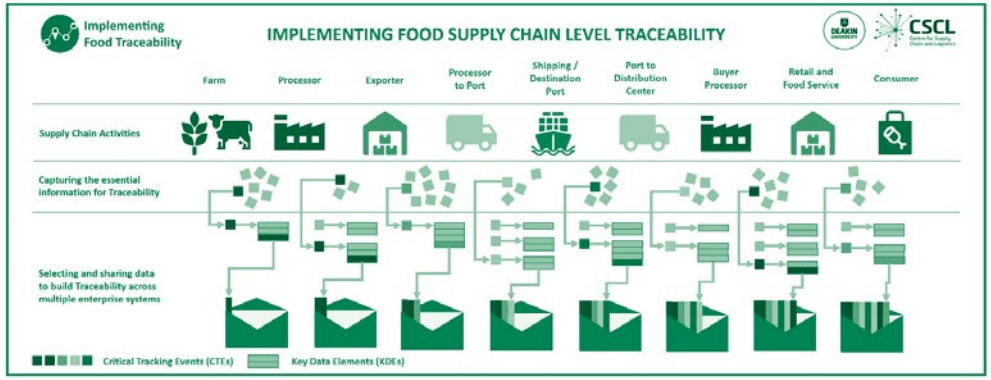
Implementation of CTE traceability does not interfere with any existing business processes. However, CTEs require a commitment by operators to collect, store and make available for retrieval a minimal set of data that is inherently secure through abstraction, separation and restricted accessibility. Operators can choose the most appropriate manner to collect data from manual entry to sophisticated automated scanners. Once CTE data are captured and available for query, investigators will no longer need to stop at each node in the supply chain in order to learn where to go next. CTE based traceability promises to greatly accelerate the rate of trace back investigations as well as the precision and speed of recalls."[5]

A Key Data Element (KDE) is a data input required to successfully trace a product and/or its ingredients through all relevant CTEs.

In terms of data content, these can be categorised into three distinct areas:

- Master data relates to locations, businesses, products (input materials, outputs) and their associated attribute data such as addresses, functions, descriptions, packaging configurations etc. These details will be stored in product master data files and retrieved each time a traceable item is scanned or looked up for ordering etc. or a location referenced.
- Transaction data that consist of trade transactions, triggering or confirming the execution of a function within a business process. Transaction data is usually captured and stored in internal systems.
- Visibility event data that captures the movement of a product through the supply chain detailing when and where a specific event occurred. Visibility data is usually made accessible across the whole supply chain. It makes it possible to track and trace goods with live data along the process.

[5] ISO 22000 Resource Center, Traceability in food supply chains: Critical Tracking Events, 2014



How does the Guide work?

This guide describes how to create supply chain traceability through using data standards for interoperability, with specific reference to organic produce.

We've taken a modular approach.

The Guide is developed in modules. This is to enable businesses along an organic produce supply chain to focus on achieving traceability within their area of responsibility, understanding what data is needed to complete supply chain level traceability. Supply chain partners can select a module related to priorities in their business strategy or where they wish to improve traceability in their supply chain e.g. export or freight transport.

Collaboration is the basis of supply chain level traceability, so partners working together will need to consider their resources and commitment to working through the modules to build the full capability.

The modules cover:

1. **Organic production**
2. **Organic packer**
3. **Freight transport**
4. **Processing and manufacturing organic produce**
5. **Wholesale and distribution of organic produce**
6. **Retail of organic produce**
7. **Food Service**
8. **Import**
9. **Export**
10. **Consumer information**
11. **Application of GS1 data standards**
12. **Cybersecurity, privacy and data sharing.**

In each module, you will find a description of the key processes and events that relate to supply chain level traceability. Within each of these processes, we identify tracking events that are considered critical or that are required by regulators related to traceability. For each critical tracking event, we then indicate what data points are relevant to be stored within enterprise systems and then separately, shared with supply chain partners.

For each of these sharable data, we show how to capture the data and how to format the data to standards that allow flow between systems of permissioned supply chain partners safely.

Each module contains useful links so you can quickly check regulatory requirements or the detail of a particular data standard for your solution provider or in-house IT team.

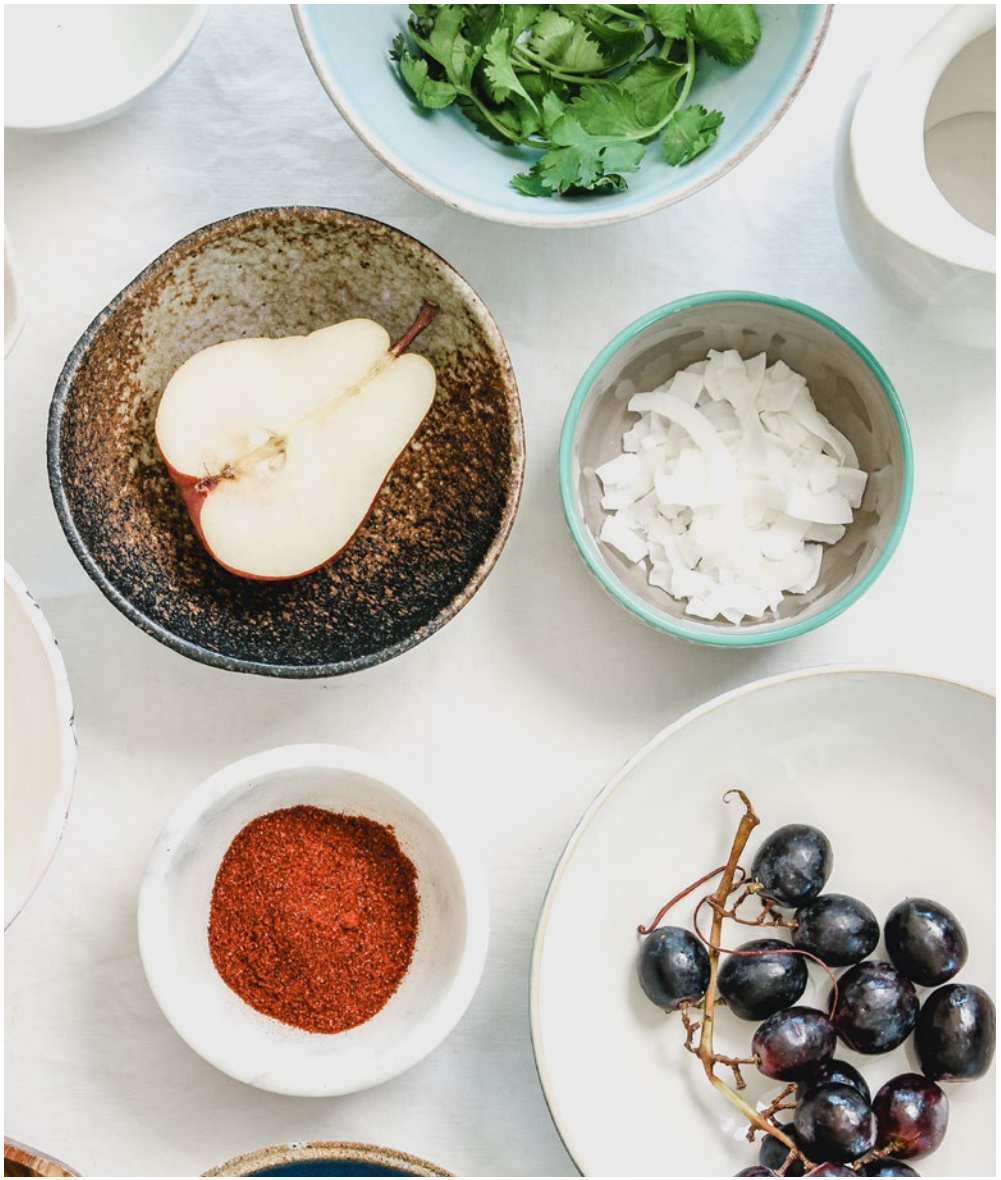
Focusing on the interoperability between technologies and IT systems.

You may be dealing with a range of technologies being used across the organic food supply chains your business interacts with, from suppliers of inputs, government and industry platforms, customer ordering and delivery systems, in addition to operational systems and messaging within your own enterprise.

Regardless of the technology or software used, the Guide's focus is on the data you will need to collect and share.

The Food traceability laboratory has a Solution Provider Reference Group experienced in food traceability advising it on how current and emerging technologies and software will use the data standards and framework. We are not developing a platform or software. Our interest is in the interoperability between systems through using common language for data.

GS1 is the global data standards body for supply chains. GS1 Australia is collaborating in this program to provide data standards for these guides. The standards are already used in Australian and international food supply chains to form the basis of interoperability. The GS1 supply chain standards are accredited as International Standards Organisation (ISO) standards.



The Deakin Food Traceability Laboratory partnership

The Australian Guides to Implementing Food Traceability (AGIFT) and the Implementing Food Traceability Program are initiatives of the Deakin University Food Traceability Lab. This Lab is a partnership of industry, government and academia developed and convened by the University, dedicated to improving Australian food supply chains and tackling issues that require partnership.

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Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Organic Production

Organic Production

What is organic production?

Organic agriculture is a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system.

An organic production system is designed to:

a. enhance biological diversity within the whole system
b. increase soil biological activity
c. maintain long-term soil fertility
d. recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources
e. rely on renewable resources in locally organized agricultural systems
f. promote the healthy use of soil, water and air as well as minimize all forms of pollution thereto that may result from agricultural practices
g. handle agricultural products with emphasis on careful processing methods in order to maintain the organic integrity and vital qualities of the product at all stages
h. become established on any existing farm through a period of conversion, the appropriate length of which is determined by site-specific factors such as the history of the land, and type of crops and livestock to be produced.

Codex Alimentarius: Guidelines for the production, processing, labelling and marketing of organically produced foods GL32 1999.

The principal objectives of the certified operator include:

- the production of food of high nutritional value
- the enhancement of biological cycles in farming systems
- maintaining or improving fertility of soils
- working as far as practicable within a closed system by minimising the use of non-renewable resources
- the avoidance of pollution resulting from agricultural practices and processing
- the co-existence with, and the protection of, the environment
- the aims and objectives outlined above are achieved through management.

Commonwealth of Australia National Standard for Organic and Bio-Dynamic Produce Edition 3.7, 2016.

This module covers activities that generally take place on the production site or farm. In this module, the following processes and activities are associated with organic production:

1. **Establishment and organic certification**
2. **Planning and preparation of grow sites**
3. **Planting**
4. **Farm inputs**
5. **Harvesting**
6. **Post-harvest handling**
7. **On-farm storage**
8. **Waste and by products**
9. **Dispatch of products**

Establishment and organic certification

Organic standards of production

Organic products intended for the Australian market are not required to be certified in order to be labelled 'organic'.

Businesses may choose to become certified by an organic certification body, which base their certification standards on the National Standard for Organic and Biodynamic Produce. This standard is owned by the Department of Agriculture, Water and the Environment and is mandatory for Australian organic products intended for export.

All organic claims, whether they reference a standard or not, should be able to be substantiated. If a business claims to meet a particular standard, it must ensure that this claim is true.

ACCC, 2021

Compliance with the National Standard for Organic and Biodynamic Production 2016 (mandatory for export) is required under the *Export Control Act 2020* and the *Export Control (Organic Goods) Rules 2021*. Under this Rule an **Organic Goods Certificate** is required. For further information on export requirements see the Organic Export module.

The National Standard is also used as a default domestic standard. There are currently six certification bodies approved by the Dept of Agriculture, Water and the Environment to accredit to the National Standard on behalf of the Commonwealth.

By being certified to the National Standard, operators can eliminate the risk of non-export compliant produce sold domestically inadvertently ending up in the export supply chain. By being certified to the National Standard, growers are also given greater market flexibility to access exports and food processing.

Currently the Commonwealth is assessing the impact of adoption of this National Standard for certification of organic production and distribution in Australia's domestic market.[1]

Formal organic certification covers the entire supply chain. On-farm production elements related to certification against organic standards cover:

- Fertility and soil
- Pest, disease and weeds
- Biodiversity and environment
- Water
- Contamination prevention
- Record keeping and monitoring practices
- Use of restricted products used in fertilizers, soil conditioners, crop production materials, food additives and processing aids.

The certified organic grower prepares an **Organic Farm Plan** or **Organic Management Plan** to guide management of these elements.

In relation to traceability, the standards require:

Inputs, processing aids and ingredients shall be traced back one step in the biological chain to the organism from which they were produced to verify that they are not derived from genetically modified organisms

Product recall, the capacity to retrieve goods from the supply chain in the event of mis-labelling, contamination or mixing is part of the Organic Management Plan.

[1] www.awe.gov.au

Creating Master Data

The establishment of *unique identifiers* for production location, its ownership and the production business entity, are fundamental to traceability. These identifiers provide the common link across the participants in the full supply chain and are collectively referred to as "Master Data" due to their frequency of use.

Master data relates to locations, businesses, products (input materials, outputs) and their associated attribute data such as addresses, functions, descriptions, packaging configurations etc. These details will be stored in product master data files and retrieved each time a traceable item is scanned or looked up for ordering etc. or a location is referenced.

Regulators often mandate Establishment Data. It can be required for local, state or national government responsibilities, such as ensuring the property can be located in the circumstance of a biosecurity threat such as a disease outbreak, or that on-farm facilities are fit for purpose and maintain safe food systems.

Growers benefit from being able to identify sites where products are grown, in order to gain a better assessment of productivity, such as matching the site to inputs and yields. The ability to distinguish specific growing sites such as vineyards, greenhouses or orchards can support provenance values and tell the story of the product to end consumers.

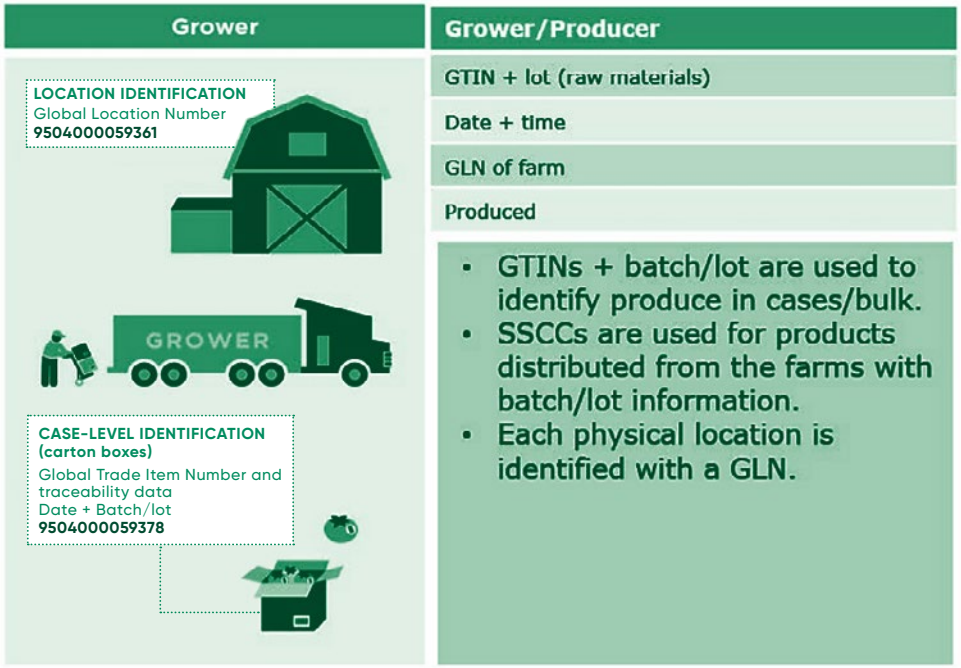
Property Identification Codes

Some crops are prescribed under Plant Biosecurity legislation or rules in each state. This requires growers to apply and receive a Property Identification Code (PIC) from state agencies. For example, in Victoria, vineyards and chestnuts require a PIC to identify growing sites.

In 2019, the Commonwealth Department of Agriculture, Water and the Environment commenced consultation on the application of PICs to horticulture. Draft Principals and Business Rules that will inform legislation in 2022 include specific information related to organic growers that may be linked to a PIC, such as:

- industry quality assurance accreditations
- government organic or sustainability status
- origin or provenance markers.[2]

[2] DAWE 2019-2020, Plant sector property identification reforms— draft principles and business rules, haveyoursay.awe.gov.au



GS1 data standards enabling traceability – Fresh Fruit & Vegetable Traceability Guideline 2021

Export of organic produce

Organic produce is a "prescribed" product and therefore requires that the grower be certified to the National Standard for Organic and Biodynamic Produce and undertakes an annual audit by an approved certification body.

The grower is also required to register the premises with the Department of Agriculture, Water and the Environment.[3] The premises may be a packing shed where sorting, grading and packing takes place.

Traceability for registered organic produce export establishments means the business must:

- Ensure the integrity of goods being prepared at the registered establishment by putting measures in place to minimise the risk of infestation and contamination
- Have a documented system for traceability and integrity through the establishment including receival and dispatch records
- Keep goods that have passed inspection and goods that have not been inspected or failed inspection separate
- Have systems in place to minimise the risk of substitution (switching of goods) or tampering
- Complete transfer records for any incoming or dispatched horticulture goods with a phytosanitary status.

Tasks related to traceability

- Register the property with the State Property Identification Code (PIC) issuing agency (this is voluntary for most plant growers)
- Apply for a Global Location Number (GLN) for the whole property or specific grow sites
- Collate GPS coordinates for property, boundaries or grow sites
- For growers of organic produce for export, certify the growing area for organic production against the National Standard for Organic and Biodynamic Production 2016
- Register on-farm facilities used for packing or processing as Export Establishments with Approved Arrangements for Organic production.

Key participants

- Property owner
- Farm manager, who may be leasing land for production
- Property Identification Code (PIC) Issuing Agency in each state (see Useful Links section in this module)
- Global Location Number (GLN) Issuing Agency – in this case GS1 Australia
- Food Safety Agency
- Department of Agriculture, Water and the Environment (AWE) for on-farm premises for export produce/Micor requirements
- Approved Organic Certification body.

Planning and preparation

Growers able to demonstrate how they manage risk in the growing environment can readily respond to end consumer information requests and support certification and audit requirements. The existence of plans and operating procedures (including certification and audit details) underpin product assurance and consumer trust in the organic status of the product.

These include a **Farm Biosecurity Plan, Property Risk Management Plan, Food Safety Plan** to enable hazard identification, risk management planning and training of staff.

For organic production, in addition to these plans and management systems, an **Organic Farm Plan, Organic Management Plan or Organic Handling Plan** outlines how the grower is complying with the National Standard for Organic and Biodynamic Produce 2016[4] in on-farm activities for export markets.

Food Safety

For organic operators, the Hazard and Critical Control Point (HACCP) risk identification method is recommended as a part of the Organic Farm/Management Plan. Management implies a system of identification of all the significant hazards that may compromise an ability to conform to this Standard for organic production. It requires identifying critical control points, putting in place management practices that help eliminate or reduce risks associated with those hazards, and then maintaining verification processes to ensure that management practices are effective. A hazard for some organic producers may be the potential for chemical overspray from neighbouring farming activities or the cross-pollination potential from GMO crops. Other hazards may include old dip sites or other potentially contaminated areas which may require fencing off, or the management of stock to ensure access is restricted. All significant food safety risks also require HACCP-based management to be implemented in organic operations.[5]

Tasks related to traceability

- Prepare a property risk assessment
- Prepare a Farm Biosecurity Plan
- Prepare a Food Safety - HACCP Plan
- Prepare an Organic Farm Plan, Organic Management Plan and Organic Handling Plan for produce
- Conduct regular audit/inspection to update operating procedures (organic certification audit is typically annual)
- Record application of water, fertilizer, chemicals and supplements to the grow area/s e.g. spray diaries.

Key participants

- Property owner
- Production Manager
- Approved Organic Certification body
- Environmental Health & Safety Manager
- Quality Manager
- Quality Specialist
- Compliance Specialist
- Administrative staff
- Operations staff
- Risk Auditor/Inspector
- Farm Biosecurity Auditor/Inspector
- Soil Auditor/Inspector
- Natural Resource Management Agency
- Environmental Protection Agency
- Biosecurity Agency.

[3] DAWE Export Establishment Registration for organic export product ablis.business.gov.au

[4] DAWE, 2016, National Standard for Organic and Bio-dynamic Produce www.agriculture.gov.au

[5] ACOS 2021 Australian Certified Organic Standard, austorganic.com

Planting

Identification of organic produce commences at purchase of seeds, root stock and individual plantings or punnets/lots. Identification of an agricultural produce from sowing or planting creates a unique identity that can be associated with the growing location. It can move with the product along the food supply chain, allowing it to be tracked at various points, including when it is further transformed through to consumption.

This process provides the identification of variety, quantity and date of planting for plants/seeds/grains. Where it is unrealistic for individual products to be uniquely identified, batch numbers or tray/pot, identification may be used. Once planting out occurs, the product batch can be associated with specific rows in grow sites.

For organic certified produce, the source of seeds, plants, trees, vines are identified and recorded alongside the grow area details.

Care is taken around sourcing of planting materials, so that no prohibited seed or root treatments are used. Planting materials must be approved for use by the organic certification body prior to planting and recorded in the Certifier's client file.

Tasks related to traceability

- Identification of source/ origin variety, quantity and date of planting for plants/seeds/grains
- Identification of sites where introduced plant stock is located.

Key participants

- Property owner
- Producer
- Production Manager
- State biosecurity agency
- Approved Organic certification body.

Farm inputs and monitoring

Records for monitoring and managing the growth of the seeds, plants, trees, rootstock in the production site/property are held in farm records, which may be kept in electronic farm management systems or paper-based records. Recording inputs to grow areas and produce growth includes materials such as chemicals, manures, water, and organic pesticides.

Organic certification requires detailed documentation in order to provide an audit trail, enabling the tracking of produce to the certified farm or paddock and describing the processes and products used in the course of production.

A complete audit trail is made up of documents such as input records, harvest records, transport documents, storage invoices and sales records that track the crop from a specific paddock (and its production practices) to sales.

For example, according to the *Australian Certified Organic Standard 2021:*

3.4.2 Records of production activities shall enable the identification and verification of the nature and quantity of all products arriving on, stored at, and leaving the operation and all significant processes of modification to products or stock. Records should be kept in a manner that allows tracing of all finished products back to inputs or ingredients, and also a reconciliation of output of organic products against inputs or ingredients used. Records of sales shall include details of the buyer or consignee (other than for final retail sales).

3.4.3 Records shall be maintained to enable prior season audit of the operation's sales and certified operators are required to retain all records relating to certification for five years after their creation. Such records shall form the basis for verification of compliance with this Standard.

3.4.4 The operator shall put in place procedures and operations that shall establish full control of certified products and stock on farm, in storage and during transport, and that shall enable the traceability of all batches or consignments of certified materials or stock to the point of sale. Such traceability shall enable the operator to enact a product recall from the marketplace at any time for a specified group of products or stock produced or sold on any day or production run. Prior to resale or dispatch of certified products, an operator shall ensure that the packaging integrity has been maintained, with no seals broken or other tampering evident. The operator shall also crosscheck and confirm that the labelling referring to organic status properly correlates with the transaction documents (invoice) relating to that product. Where an operator considers or suspects that a product that they have produced, prepared, imported or been delivered from another operator is not in compliance with this Standard, they shall initiate procedures either to remove from this product any reference to Australian Certified Organic Standard 2021 the organic production method or to separate and identify the product. Operators may only process, pack or market such product after elimination of that doubt, unless it is placed on the market without reference to organic status. In case of such doubt, the operator shall immediately inform the Certifying Body (CB).

The CB may require that the product cannot be placed on the market with indications referring to the organic production method until it is satisfied, by the information received from the operator or from other sources, that the doubt has been eliminated.

3.4.6 Traceability procedures shall include consideration of aspects such as packaging, labelling and transport as well as all relevant documentation that may accompany certified products/stock, so as to maintain the authenticity of the certified product through to the end consumer.[6]

Tasks related to traceability

- Record the supply and usage of services and inputs, including the organic certification of farm inputs and suppliers.

Key participants

- Property owner/Producer
- Production Manager
- Environmental Health & Safety Manager
- Quality Manager/Quality Specialist
- Compliance Specialist
- Administrative staff
- Operations staff
- Water Company
- Fertilizer Supplier
- Chemicals Supplier
- Supplements Supplier.

Harvesting

Harvesting involves amassing the mature product once it has reached specified standards for sale. Growers wishing to record yields from specific grow sites e.g. orchards, vineyards, individual paddocks or rows, may wish to relate that yield to regimes applied or variety planted. Recording the harvest yield from each grow site, which in turn is linked to the planting records, enables this level of internal traceability.

For some products, individual identification is already enabled through tagging and readers. For other products, identification may be via tubs, bins, or trays linking grow sites, harvested product and these containers. For bulk products such as grains and pulses, harvesters will generally record the yield and GPS coordinates of the site.

Tasks related to traceability

- Harvest plant or grain
- Undertake sampling of product for origin verification and product integrity testing
- Relocate the product to on-farm harvest agglomeration site e.g. packing sheds, bunkers, silos
- Record harvest labour.

Key participants

- Property owner
- Producer
- Production Manager
- Production Engineer
- Quality Manager
- Administrative staff
- Operations staff - permanent and casual harvest workers.

[6] Australian Organic Ltd, Australian Certified Organic Standard 2021 V.1 austorganic.com

Post-harvest handling

Activities included in post-harvest handling are inspection, grading, cleaning and preparation/packing of the product, initial processing and on-farm storage, preparation of the product for off-farm processing or storage and preparation for transport loading and distribution.

Organic post-harvest handling standards that relate to traceability are:

> *"To ensure a clear and auditable trail is established and maintained for all certified product arriving, being prepared, stored and leaving the certified preparation facilities. This includes the ability for ready identification of all stored and in-process products."*[7]

Receiving product from other growers

Bulk organic product is sourced for grading, sorting packing and storage. Growers deliver product in bulk using various containers or logistics units for transport. Common examples of logistics units include totes, bins and trailers. Each Logistic Unit must be individually traceable. For this reason, each Logistic Unit carries a tag or label that shows a unique identification number. This is a GS1 Serial Shipping Container Code (SSCC) number and is assigned by the Grower.

Use of the SSCC number ensures not only distinct identification from any of the Grower's other shipping containers but also guarantees uniqueness across all growing companies providing product.

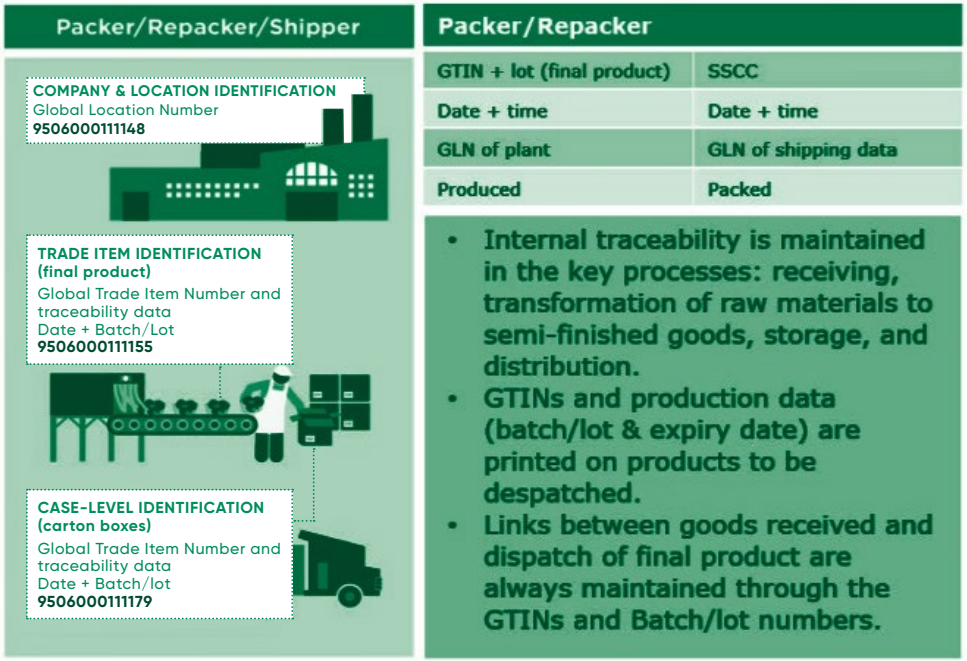
The tag or label provides other important information including commodity name and, where applicable, variety name; additional grower/harvest information; the grower's unique company identification (GLN).

Recording post-harvest inputs

Products used for pest control, cleaning and sanitizing spaces and produce items (e.g. alkali carbonates, natural acids), packaging materials used and storage and transport assets need to be recorded as post-harvest inputs. This includes their source, product identification, receipt, usage date and application rate.

Tasks related to traceability

- Maintain identification of the product from grow site to post-harvest facilities
- Maintain an Approved Supplier Program register with organic certificate number, certification level, currency and certifying body for suppliers
- Record harvested product quantity, variety and quality
- Clean, trim, weigh, count and pack product into sales item packs, punnets, trays, cartons or larger units for wholesale/processing
- Chill to required temperature
- Load onto storage or transport assets e.g. on-farm silos, sheds, pallets, tubs, bins, trucks
- Record post-harvest handling personnel
- Record post-harvest waste.



GS1 data standards enabling traceability – Fresh Fruit & Vegetable Traceability Guideline 2021

Key participants

- Property owner
- Producer
- Production Manager
- Administrative staff
- Operations staff.

[7] austorganic.com

On-farm storage

This process involves storage of the product in on-farm facilities e.g. silo, cool store, packing shed, barrel room on farm.

On-farm storage applications can enable record keeping for each storage facility, to record product quantity, variety, paddock source and product monitoring actions such as aeration, cooling or drying of the product. Monitoring of temperature, CO2 levels, pests located and treatments are also required. Monitoring product may also involve recording weight and count of product to compare with harvested volumes.

For organic certified produce, harvest records include the crop variety, paddock identification, date of harvest, and quantity harvested. In some cases, sales records may be the equivalent of harvest records if produce is harvested and sold within a short period of time.

Tasks related to traceability

- Put away in on-farm storage
- Record the time and date, and location of storage
- Take samples from each harvest lot prior to product co-mingling from different sources
- Record best-before/use- by/expiry dates on product batches or product lots
- Weigh and count to monitor product.

Key participants

- Property owner
- Producer
- Production Manager
- Environmental Health & Safety Manager
- Quality Manager
- Quality Specialist
- Compliance Specialist
- Administrative staff
- Operations staff.

By-product and waste disposal

This process involves disposal or dispatch of by-product and product waste, or diseased plants. While product is generally disposed of on-site, there may be a need to remove materials off-site.

Tasks related to traceability

- Record details of product disposal on-farm
- Arrange transport or removal to approved disposal/waste facilities.
- Disposal site notifies receival of product as required.

Key participants

- Property owner
- Producer
- Environmental Health & Safety Manager
- Administrative staff
- Operations staff
- Transport contractor
- Licensed landfill operation.

Dispatch of product

Product dispatch is usually triggered by a sales contract or for transfer to storage or processing facilities.

Tasks related to traceability

- Receive Purchase Order from buyer
- Confirm product availability in inventory
- Validate Purchase Order
- Create Sales Order
- Create picking list
- Pick order
- Pack product
- Label product (item, punnet, tray, pallet, tub)
- Complete outbound documentation e.g. product inspection and health declarations e.g. phytosanitary certificate, Vendor Declarations
- Complete transport documentation e.g. Advance Shipping Notice, Transport Instruction, Delivery Order, Bill of Lading, Consignment Note
- Record outbound product in inventory balance
- Move product to load out area
- Load product (if loading a shipping container for export, affix seal and record seal number on Bill of Lading).

Key participants

- Producer
- Production Manager
- Administrative staff
- Operations staff
- Inspection and compliance staff
- Customer
- Buyer
- Transport company
- Driver.

Critical Tracking Events

For each of the identified on-farm production activities, *critical tracking events* (CTEs) establish identity and enable traceability and compliance with traceability-related regulation. CTEs are events that relate to the identity, movement and transformation of the food product.

On-farm activity	CTE code	Critical Tracking Events (CTEs)
Establishment	OP CTE1	Property Identification
	OP CTE2	Organic status and provenance verification
	OP CTE3	Registration of premises for export
Planning & preparation	OP CTE4	Organic Management/Farm Plan
	OP CTE5	Food Safety Plan
Farm inputs and monitoring	OP CTE6.1	Water Receipt
	OP CTE6.2	Water usage
	OP CTE7.1	Fertiliser receipt
	OP CTE7.2	Fertiliser application
	OP CTE8.1	Chemicals Receipt
	OP CTE8.2	Chemicals application
Product sowing, planting, birth, stocking	OP CTE9.1	Seed/plant stock receipt
	OP CTE9.2	Product sowing, planting
Growth	OP CTE10.1	Monitoring growth
	OP CTE10.2	Equipment maintenance/cleaning
Harvest	OP CTE11	Product selected and harvested
Post-harvest handling	OP CTE12.1	Product inspected and graded/weight/count
	OP CTE12.2	Product washed/weight/count
	OP CTE12.3	Product packed and labelled on-farm
On-farm storage	OP CTE13.1	Product storage location
	OP CTE13.2	Product received/weighed and counted
	OP CTE13.3	Product monitored in storage
Product end of life	OP CTE14	Waste/by-product removal
Dispatch – product prepared to leave property	OP CTE15	Prepare shipping documentation
	OP CTE16	Product dispatch

Key data elements

Key Data Elements (KDEs) ensure that captured and recorded data can be interpreted and used as relevant and required by all supply chain partners. Key Data Elements define Who, What, When, Where and Why for each Critical Tracking Event.

Event Code	CTE	Key data Inputs and Outputs
OP CTE1	**Property Identification**	**Property Identification Code (PIC)** The PIC is a unique 8-digit code issued by State authorities, developed for biosecurity traceability. While it is the mandated property ID for livestock production properties and some vineyards and nut trees, it is effective for all farm property identification. • Applicant name • Trading name • Business address • name of property • property address • property area in hectares • Lot and DP# (rates notice) • Property owner • Name • Address • Contact details. **Global Location Number** The Global Location Number (GLN) is used to identify locations and legal entities. This unique identifier is comprised of a GS1 Company Prefix, Location Reference, and Check Digit. GLNs are used to identify parties to business transactions; functional groups within a company; or real, physical "places" that might ship, receive, process, or hold the product. Examples include orchards, growing tunnels or hothouses, vineyards, and cropping areas. The GLN number can be used in combination with the PIC. Note: GLN assignment can also be completed by the Farm/Grower based on their existing GS1 membership and allocated number range. In such cases, record of allocated GLNs will need to be shared accordingly for traceability and trading purposes **Global Positioning System Geocoding** An additional means to identify the overall property or to geocode specific sites is the use of GPS coordinates, e.g. geotagging of property satellite imagery. GPS geocode data may be recorded as an attribute of the Global Location Number.

Event Code	CTE	Key data Inputs and Outputs
		Key Data Element examples/guidance
		Request for PIC number
		Who Farm/Grower, Issuing Agency
		What Property, Address Details
		When Date/Time of Registration and Issuance of the PIC
		Where Issuing Agency
		Why Registration of property with state agency
		Request for GLN
		Who Farm/Grower Issuing Agency
		What Property/Field/area/Legal entity
		When Date/Time of issuance of Global Location Number (GLN)
		Where Issuing Agency
		Why Physical Location set up and identification
		Information to be shared to a traceability platform • Property Identification Code (PIC) • Global Location Number (GLN) • Geocode data – standalone or incorporated into Global Location Number
OP CTE2	**Organic certification and Provenance verification**	**Organic Certification** Organic certification and status of the land under organic production and the associated Organic Farm Plan. Soil and product samples are taken on inspection by the certifying body each year as part of audit. **Provenance verification** e.g. analytical test results. A unique document code can be applied and shared. **Information to be shared to a traceability platform** • Organic status of land • Organic certification number • Audit completion date • Provenance verification/analytical testing document code
OP CTE3	**Registration of facilities**	**Export Registered Establishment Number** Organic produce for export is a prescribed product (DAWE) and requires an Organic Goods Certificate to be issued prior to departure Where exporting from on-farm packing or processing facilities, the Department of Agriculture, Water & the Environment (DAWE) (Commonwealth) requires export premises to be registered and in some cases, licensed, for export. The purpose of registering an establishment is to ensure that: • the facilities available are fit for the purpose of preparing, handling, storing and/or inspecting product for export • appropriate hygiene and the necessary measures to produce the goods according to trade description and other requirements applicable to a given commodity are maintained • the goods comply with importing country requirements. **The application for registration must include:** • the name of the occupier (must be a legal entity). An occupier may nominate one or more registered business names to be approved as an alternate trading name. A registered business name is not a legal entity and it is not acceptable as the name of the occupier of an establishment • the business address of the occupier and the physical location of the premises • the particulars of proposed export operations to be conducted in the establishment and other operations likely to affect the export operations • any other information required in the particular case by the relevant Export Control Order. A copy of the certificate of registration must be prominently displayed at the establishment. **The certificate must contain:** • the name and address of the occupier • the ACN and ABN number of the occupier • the alternate trading names (if applicable) of the occupier • the number allocated to the export registered establishment • the limited period for which the establishment is registered (if applicable) • the export registered operations for the establishment • the eligible country listing for the establishment which has been registered • persons who manage and control the registered establishment • conditions of registration if any. **Key Data Element examples/guidance** **Export Establishment Registration** **Who** Farm/Grower Export Establishment Agency (DAWE **What** Facility/location associated with export supply chain **When** Date/Time of request **Where** Dept of Agriculture, Water & the Environment (Commonwealth) **Why** Export registration Export Registration Establishment Number **Business Licence and food safety program** Each state and territory have food safety and business licencing requirements for primary producers in seafood, dairy, meat and meat products, eggs and seed sprouts.

Event Code	CTE	Key data Inputs and Outputs
		Identification of on-farm storage facilities On-farm post-harvest storage facilities such as silos may be used for short or long-term storage of the product. Linking the product to the unique identification of these storage sites can assist in tracing where a product may have been contaminated, avoiding all storage units needing to be tested. **Information to be shared to a traceability platform** • Export Registered Establishment Number • Business Licence Number issued by state agencies • Global Location Number (GLN) of premises and facilities • Geocode data – standalone or incorporated into Global Location Number
OP CTE4	**Organic Management Plan/Organic Farm Plan**	An Organic management plan (OMP) outlines production plans to achieve ongoing conformance with the organic standards. This may include identification of key management personnel, fertility, pest and disease management plans, documented recording systems and future on-site plans. For primary production this is known as an organic farm plan (OFP). The OFP may outline buffer zone establishment in relation to containing neighbouring chemical overspray risk or potential contamination from GMO crops. Other identified risks may be brought-in manures or other materials that may require residue testing or composting, which would be outlined in such a plan. Such a plan forms the basis of certification and auditing. Information to be shared to a traceability platform Organic Farm Plan unique document code Date of preparation
OP CTE5	**Food Safety Plan**	For farms that store or undertake on-farm processing there is a requirement to prepare a Food Safety Plan and institute a Food Safety Program which is regularly audited by state and local government agencies. Organic production hazards may include: • microbiological contamination from compost or fish emulsion fertilisers • quality of water used for processing or washing produce • pest control methods • contamination from outside sources, such as transport providers • clean-down procedures.
	Farm Inputs	Records must be kept of all inputs used on the farm and all outputs including sales, wastage and any produce that might be withheld from sale such as seed and feed. Dates, volumes, destination, unit descriptions and application rates need to be recorded. Farmers are expected to keep a diary of day-to-day farming activities and to report any changes to the site or to the nature of the enterprise to the certification agency.

Event Code	CTE	Key data Inputs and Outputs
OP CTE6.1	**Water receipt**	Farm water has a number of sources – irrigation supplied through an irrigation scheme entity; dams; surface water in streams and rivers; water transported into the production site; underground water accessed through bores and general rainfall absorption. Water license holders are required to record water usage.
OP CTE6.2	**Water application**	Data elements held on farm management systems/farm water records Water received • Water source e.g. rainfall records – date and mms • Date received and applied Water applied • Amount used – mm/hectare • Area watered – hectares **Key Data Element examples/guidance**

Water receipt

Who	Supplier of Water Farm/Grower
What	Water
When	Date/Time of delivery
Where	Specific Receipt location
Why	Receipt of water References: Farm Purchase Order number; Supplier Delivery Note

Water application

Who	Farm/Grower
What	Water consumed, quantity
When	Date/Time of water application
Where	Property/location where water applied
Why	Consumption of water References: Consumption record number

Key data elements to be shared to a traceability platform
- Water receipt date, quantity, supplier ID
- Water consumption per hectare – annual

OP CTE7.1	**Farm inputs** **Fertiliser receipt**	Fertiliser receipt • date received • supplier ID • product ID • batch # • expiry date

Event Code	CTE	Key data Inputs and Outputs
OP CTE7.2	**Fertiliser application**	Fertiliser application • application date • purpose and application rate **Key Data Element examples/guidance** **Fertiliser receipt** **Who** Supplier of Fertiliser Farm/Grower **What** Fertiliser – Product ID, Batch, Production date, quantity received **When** Date/Time of fertiliser receipt **Where** Specific Receipt location **Why** Receipt Goods References: Farm Purchase Order number, Supplier Delivery Note **Fertiliser application** **Who** Farm/Grower Fertiliser applicator (if outsourced) **What** Fertiliser – Product ID, Batch, Production date, quantity used, other **When** Date/Time of fertiliser usage **Where** Property/Field where fertiliser applied **Why** Application of Fertiliser Usage record number/farm ID record/spray diary **Key data elements to be shared to a traceability platform** • Fertiliser ID, Batch Number, Receipt Date, qty, supplier • Fertiliser ID, Batch Number, Usage data, qty
	Farm inputs	
OP CTE8.1	**Chemical receipt**	By law, a person who uses an agricultural or veterinary chemical product must ensure that their chemical use is recorded. Data elements held in farm management systems/farm records • Date received • Supplier ID containing company name, contact and location • Product ID • Batch and lot # • Expiry date
OP CTE8.2	**Chemical application**	• Date of applications • Application rate • Withholding period commencement and completion dates

Event Code	CTE	Key data Inputs and Outputs
		Key Data Element examples/guidance **Chemical receipt** **Who** Supplier of Chemicals Farm/Grower **What** Chemical – Product Identifier, Batch number, Serial Number (if applicable) Production Date, quantity delivered **When** Date/Time of delivery **Where** Specific Receipt location **Why** Receipt Goods References: Farm PO number, Supplier Delivery Note, **Chemical application** **Who** Farm/Grower If applied to specific animal, then Animal Identification **What** Chemical – Product Identifier, Batch number, Serial number (if applicable) Production Date, quantity used **When** Date/Time of chemical usage **Where** Property/Location where chemical used **Why** Chemical usage Transaction records **Key data elements to be shared to a traceability platform** • Chemicals received, batch, qty, supplier • Farm chemicals application record document code
	Product sowing, planting, birth, stocking	
OP CTE 9.1	**Seed, seedling, plant, receipt**	• Supplier ID and location • Batch, lot or item level ID • Quantity and variety • Date of arrival/receipt.
OP CTE 9.2	**Unique identification of plant or punnet/tray of plants**	Unique identification code (plant tag number; seed batch number; tray number plus unique identifier- Commodity name/AHECC code • Date/time of sowing or birth • Variety • Quantity • Seed batch number.

Event Code	CTE	Key data Inputs and Outputs
		Key Data Element examples/guidance
		Planting/sowing/birthing
		Who Farm/Grower Contract Labour
		What Product planted, batch number, quantity
		When Date/Time of plantation
		Where Planting location
		Why Planting/Sowing References: Farm Records, labour records
		Key data elements to be shared to a traceability platform • Product unique identification code • Product batch number, quantity, planting date
	Growth period	
OP CTE10.1	**Tests and growth monitoring**	**Key Data Element examples/guidance**
		Monitoring Growth
		Who Farm/Grower
		What Product planted, batch number, quantity, weight
		When Date/Time of observation
		Where Location
		Why Observation/Monitoring growth References: Farm Records
		Key data elements to be shared to a traceability platform • Testing Date, Test record number, type of test conducted • Observation data e.g. temperature, water quality, weight and size
OP CTE10.2	**Equipment cleaning and maintenance**	Cleaning substances allowed in organic production are listed in the organic standards. Traceability involves recording the supply and usage of substances used for cleaning of machinery and work areas. Cleaning and sanitising programs should encompass transport equipment used in the field or packing house and between the field and packing house; containers or bins used for transfer or storage of fruit at any stage of the operations; the packing shed, including floors, walls, drains, door and window screens; cool rooms and storage rooms; air conditioning units; staff facilities (toilets, lunch rooms, etc); packing lines including bin tippers, conveyors, tanks and water flumes, dryers, grading belts/cups/chutes; storage areas. **Key Data Element examples/guidance** **Equipment Cleaning/Maintenance** **Who** Farm/Grower Contractor **What** Equipment ID, cleaning agents used, batch number, qty **When** Date/Time cleaning/maintenance **Where** Equipment Location **Why** Equipment Maintenance/Cleaning References: Farm Records, log book **Key data elements to be shared to a traceability platform** • Produce received • Date of receipt • Cleaning date, chemical used, batch and quantity applied.
OP CTE11	**Product selected/ harvest**	Harvest • Harvest date and time • grow site ID • Product ID/Tag • Product commodity name and variety • Product yield quantity/weight • Harvest crew name and ID number. **Key Data Element examples/guidance** **Example/Guidance – Harvesting** **Who** Farm/Grower Harvester/picker/contract labour **What** Product harvested, batch number, quantity **When** Date/Time of harvest **Where** Harvest location **Why** Harvesting References: Farm records contract labour IDs/visa status **Key data elements to be shared to a traceability platform** • Harvest date • Product ID, Batch, Quantity, location
	Post-harvest handling	
OP CTE12.1	**Organic Handling Plan**	The **Organic Handling Plan** covers management control, audit trail recording systems and related management systems to be implemented or currently practised to ensure maintenance of certified product authenticity and full conformance with the National Organic Standard
OP CTE12.2	**Product inspection, grading**	For product inspection/grading on-farm/in-field/on vessel • Tray/tub ID • Pallet ID • Product ID • Quality grading per batch • Weight and count.

Event Code	CTE	Key data Inputs and Outputs
OP CTE12.3	**Product washing**	Farm and pack house records • Water source and treatment regime • Chemicals and sanitisers used in wash • Chemical supplier ID and location • Chemical application rate • Water test results. **Key Data Element examples/guidance** **Example/Guidance – packing** **Who** Farm/Grower **What** Product, batch number, quantity **When** Date/Time of packing **Where** Inspection/sorting location **Why** Inspection and grading References: **Key data elements to be shared to a traceability platform** • Product ID, Batch, quantity (weight and count) • Wash, inspection date, location
	Post-harvest handling	
OP CTE12.4	**Product packed and labelled**	Where product is packed on-farm, organic product labels require • The name and address of the producer/grower • Organic certification status (organic, in conversion, biodynamic) • Export Establishment approved arrangement number • Operator/packer number issued by organic certification body • Organic certifying body names • Certifier logo • Date packed • Lot number • country of origin • weight and count. **Key Data Element examples/guidance** **Packing** **Who** Farm/Grower, Organic status, organic certfication number and certifying body and logo **What** Product, batch number, quantity **When** Date/Time of packing **Where** Packing location **Why** Packing Reference: Supplie Delivery Note, Pallet ID

Event Code	CTE	Key data Inputs and Outputs
		Key data elements to be shared to a traceability platform • Date packed • Best before date • Licence premises number/approved arrangement number for export • Producer name and address • Organic certification number and certifying body • Lot number, item code and pallet ID • Product QR code/digital barcode for consumer information • Link to farm business website/test certificates/provenance verification
	On-farm storage	
OP CTE13.1	**Site of on-farm storage**	• On-farm storage site location ID – (also see OP CTE2) • Inventory location in storage • Record of pest management.
OP CTE13.2	**Product received at on-farm storage**	• Time and date stamp on product arrival at storage • Product ID – tag number; lot number; batch number • Product Variety • Product Quantity received e.g. weight, units.
OFP CTE13.3	**Inventory and facility monitoring**	As required - • Temperature Records • Humidity Records • Product sample results • Product salvage/ disposal. **Key Data Element examples/guidance** **Move product to storage** **Who** Farm/Grower **What** Product packed, batch number, quantity, pallet ID **When** Date/Time of movement to storage **Where** Storage location **Why** Packing References: Farm Work Order number, Pallet ID **Receipt into/dispatch from on-site storage** **Who** Farm/Grower **What** Product packed, batch number, pallet ID, weight, count **When** Date/Time of storage **Where** Storage location **Why** Receipt Goods to storage location References: Farm Purchase Order number, Supplier Delivery Note, Pallet ID

Event Code	CTE	Key data Inputs and Outputs
		Monitoring product inventory
		Who Farm/Grower
		What Product packed, batch number, pallet ID, qty
		When Date/Time of observation
		Where Storage location
		Why Observation event (temp, humidity, testing) References:
		Key data elements to be shared to a traceability platform • On-farm storage site location ID • Time and date stamp on product arrival/dispatch at storage • Outbound shipment date and time stamp • Product ID – tag number; lot number • Product Variety • Product Quantity received e.g. weight, units.
	Product end-of-life	
OP CTE14	**Waste/ by-product removal**	• Off-farm disposal carrier ID • waste facility receival ID • time and date of product leaving the farm • time and date of product received at waste facility • product ID and quantity.
		Key Data Element examples/guidance
		Product Disposal
		Who Farm/Grower Disposal Company Receiving Company
		What Product disposed, batch number, quantity
		When Date/Time of disposal
		Where location
		Why Disposal References: Off-farm disposal carrier ID Receiving ID
		Key data elements to be shared to a traceability platform • Off-farm disposal carrier ID • waste facility receival ID • time and date of product leaving the farm • time and date of product received at waste facility • product ID and quantity disposed.

Event Code	CTE	Key data Inputs and Outputs
		Preparation for product dispatch from the property
OP CTE15	**Inspection and clearance by authorised officer**	**Biosecurity** For plants being exported direct from the farm, an inspection will need to be booked. www.agriculture.gov.au For plant products being moved interstate • Plant quarantine entry conditions apply to the movement of plant goods, including fruit, vegetables, nursery stock, flowers, plants, and seeds. You can either get a government inspector to certify that your goods to be moved within or across state or territory borders meet specified quarantine conditions. To do this, contact your local state or territory **quarantine regulator**. • Alternatively, you can accredit your business under the **Interstate Certification Assurance (ICA) Scheme** to certify that your goods to be moved within or across state or territory borders meet specified quarantine conditions. • Some industry certification schemes cover specific commodities e.g. nursery products For restricted plant goods moving across state borders • Plant Health Certificate • Plant Health Assurance Certificate • Biosecure HACCP Biosecurity Certificate • Click here to go to the Certification page • Click here to go to the Industry Certification Schemes page www.interstatequarantine.org.au **Food safety** The FSANZ Food Safety Code sets a standard for all primary producers to maintain traceability systems and to produce food that is safe for consumption. The food Standards Code is enforced by state and territory agencies. www.foodstandards.gov.au
		Key Data Element examples/guidance
		Move product to storage
		Who Farm/Grower Biosecurity agency/quarantine regulator
		What Product to be inspected, batch number, serial number, quantity
		When Date/Time of assessment
		Where Storage location
		Why Biosecurity assessment Food Safety Assessment Preventing the spread of fruit fly References: Inspection certificate number, Commodity Vendor Declaration preparation

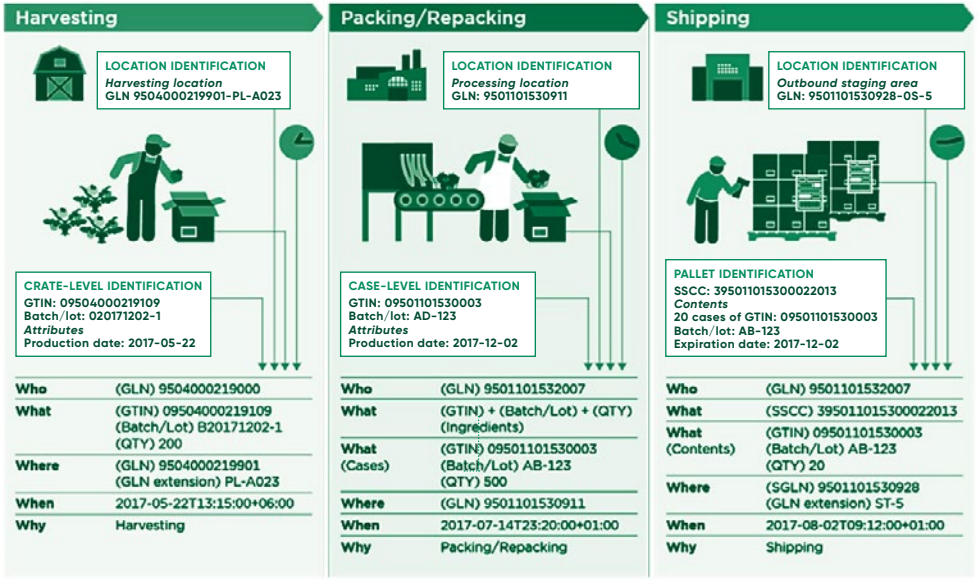
Event Code	CTE	Key data Inputs and Outputs
		Key data elements to be shared to a traceability platform • Inspection certificate number for the consignment • Plant Health Declaration Number • Commodity Vendor Declaration number
OP CTE16	**Prepare shipping documentation**	For Commodity Vendor Declaration e.g. grains, hay • Variety • Chemical treatment • Residue status • Genetic modification status • Name of person completing the declaration • Date of completing the declaration.
		Advance Shipping Notice (ASN) Some fresh product is sent direct to retail from the farm. The ASN contains a full record of all relevant details of the consignment including products, quantities and SSCC numbers attached to the load. ASNs are typically sent from a supplier to a retailer (who use the ASN to expedite receipt) but can also be used at other points of the chain e.g. between two of a supplier's facilities, or between a distribution centre or retail outlet. **Consignment note** For producers who may ship direct to consumers a consignment note instructs the transport company on the pickup and delivery details and the items contained in the delivery. • Consignor ID • Consignee ID • Consignee address • Item quantity, transport unit (carton, pallet) mass, weight. **Key Data Element examples/guidance**

Delivery creation	
Who	Farm/Grower
What	Product, batch number, serial number, quantity, PO number
When	Date/Time of delivery creation
Where	Dispatch location
Why	Delivery preparation References: Order Number, Picking slips, farm records

Event Code	CTE	Key data Inputs and Outputs
		Key data elements to be shared to a traceability platform • Sale e-invoice number • Advance Shipping Notice number • Signed consignment note number • Commodity Vendor Declaration number • Sanitary and Phytosanitary certificates (exports) • National Plant Health Declaration number.
OP CTE17	**Product Dispatched**	Product leaves the farm

Delivery dispatch	
Who	Farm/Grower Transport Company
What	Product dispatched, batch number, serial number, quantity, pallet ID's Consignment note number, packing number
When	Date/Time of dispatch
Where	Dispatch location
Why	Dispatch Reference: Consignment Number, Bill of Lading

Application of GS1 global data standards



GS1 has recently released a Guide to data standards for fresh produce. This Guide can be accessed from the link www.gs1.org

Data standards that apply to key data elements and shared information are identified in this section.

Data Element	Examples	Valid Values	Data Type /Format	Further information
Location	Farm location, Field location	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	Date of registration, Date of planting, Date of harvest Date of processing	Year -Month-Date	**YYMMDD**	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD,
Product Identifiers	Input materials such as Chemicals, Fertilisers, Seeds, Outputs such as harvested grains, fruits, vegetables Animal	Global Trace Item Number (GTIN)	**N14**	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN: www.gs1.org
Traceability Attributes	Batch, Serial Number, Production Date		**AN20**	Traceability Attributes, such as Batch or Lot Number, Serial Number, Production Date etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	Shipment of Grain, Pallet of fertiliser		**N18**	**Logistic unit** is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. **Logistic units** take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org

Useful links

Organic product claims

Australian Competition and Consumer Commission www.accc.gov.au

Organic Certification

www.agriculture.gov.au

Organic Standards

Australian Certified Organic Standards austorganic.com

Department of Agriculture, Water and the Environment www.agriculture.gov.au

Food Safety

Food Safety Australia and New Zealand Food Standards for Primary Production and Processing. Chapters 3 and 4 of the Food Safety Standards.

www.foodstandards.gov.au

www2.health.vic.gov.au

www.dairysafe.vic.gov.au

www.foodauthority.nsw.gov.au

hwww.pir.sa.gov.au

www.health.qld.gov.au

Retailer HARPS assurance scheme
harpsonline.com.au

Biosecurity

Farm biosecurity for plants and animals. Toolkit and resources to manage farm biosecurity

www.farmbiosecurity.com.au

www.dpi.nsw.gov.au

www.pir.sa.gov.au

www.daf.qld.gov.au

www.farmbiosecurity.com.au

nrmsouth.org.au

www.interstatequarantine.org.au

Farm records

Water usage - dpipwe.tas.gov.au

Department of Agriculture, Water and the Environment Property Identification Reforms haveyoursay.awe.gov.au

VIC agriculture.vic.gov.au

Global Location Number Application
www.gs1au.org

Property Identification

Department of Agriculture, Water and the Environment Property Identification Reforms haveyoursay.awe.gov.au

VIC agriculture.vic.gov.au

Global Location Number Application
www.gs1au.org

Glossary

Approved Organic Certification Body

The Export Control (Organic Goods) Rules 2021 enable the Department of Agriculture, Water and the Environment (the department) to assess an organic certifier and recognise it as an approved certifying body. Once an organic certifier is recognised as an approved certifying body, it may perform the following functions on behalf of the department:

- assess organic and bio-dynamic operators to determine compliance to the National Standard for Organic and Bio-Dynamic Produce and importing country requirements
- certify organic/bio-dynamic operators/ exporters as compliant with Australia's export requirements
- issue organic goods certificates, prior to export, for consignments of organic and bio-dynamic goods exported from Australia.

The department has several approved certifying bodies that manage the certification process of organic and bio-dynamic operators and exporters.

All approved certifying bodies are assessed by the department for both initial recognition and at least annually thereafter to verify compliance with all requirements.
www.awe.gov.au

Fresh produce/fruit and vegetables

The following excerpt is from the Food and Agriculture Organisation (FAO) of the United Nations International Year of Fruit and Vegetables 2021.

What are fruit and vegetables? There is no widely accepted definition for either fruit or vegetables. The definition agreed to for the International Year of Fruits and Vegetables is as follows.

Fruit and vegetables are considered edible parts of plants (e.g., seedbearing structures, flowers, buds, leaves, stems, shoots and roots), either cultivated or harvested wild, in their raw state or in a minimally processed form.

Excluded are the following:

- Starchy roots and tubers such as cassava, potato, sweet potato and yams (although leaves of these plants are consumed as vegetables)
- Dry grain legumes (pulses) unless harvested when immature
- Cereals including maize (corn), unless harvested when immature
- Nuts, seeds and oilseeds such as coconuts, walnuts and sunflower seeds
- Medicinal or herbal plants and spices, unless used as vegetables
- Stimulants such as tea, cacao and coffee
- Processed and ultra-processed products made from fruit and vegetables such as alcoholic beverages (e.g. wine, spirits), plant-based meat substitutes, or fruit and vegetable products with added ingredients (e.g., packed fruit juices, ketchup).

Minimally processed fruit and vegetables have undergone procedures such as washing, sorting, trimming, peeling, slicing or chopping that do not affect their fresh-like quality (Gil and Kader, 2008). Minimally processed food retains most of its inherent physical, chemical, sensory and nutritional properties. Many such foods are as nutritious as the food in its unprocessed form (Parrish, 2014). Examples include sliced fruit, bagged fruit, vegetable salads, and frozen and dried fruit and vegetables.

Fresh versus processed

Unlike most other categories of food, fruit are normally eaten raw (uncooked form): either whole (berries) or after peeling them (oranges, bananas, papayas and mangosteens). Many types of vegetables are also often eaten uncooked, as in salads. Some (such as green beans) must be cooked before they are eaten.

The International Year of Fruits and Vegetables focuses on fresh produce or minimally processed products. It nonetheless recognizes that the processed forms of fruit and vegetables are important for farmers' livelihoods and incomes, trade, food security and nutrition. Some varieties are grown specifically to be sold as fresh produce, others are destined from the start for the processing plant. Still others may go either way: they are sorted and graded before sale; the best items are sold fresh (which typically fetches the highest prices), while the rest goes for processing.

Many types of fruit and vegetables are processed to increase their shelf-life, year-round availability, or to increase their value. Minimal processing (see above) retains the inherent properties of the produce. Full processing, on the other hand, may include juicing, fermentation, pickling, or canning in brine, juices or syrups.

HACCP

HACCP is a food safety and risk assessment plan originally developed in the 1960s by NASA and a group of food safety specialists. It stands for Hazard Analysis and Critical Control Points (HACCP) and outlines seven key principles in food safety:

1. Hazard Analysis
2. Critical Control Points
3. Critical Limits
4. Critical Control Monitoring
5. Corrective Action
6. Procedures
7. Record Keeping.

HACCP can be applied to all processes throughout each and every stage of the food supply chain. This includes production, preparation, packaging and distribution. www.foodsafety.com.au

PIC

A Property Identification Code is an eight-character code allocated by the Department of Primary Industries (DPI) or an equivalent authority in each state or territory to identify a livestock-producing property.

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Organic Packer

Organic Produce Packing Operations

This module covers activities that may take place at an off-farm packing shed or cool store. This facility may service multiple growers, who may share the costs of operating the facility, or be operated by a wholesaler accumulating volumes of produce to sell. In this module, the following processes and activities are associated with packing shed post-harvest handling of organic fresh produce.

- *Establishment and organic certification*
- *Post-harvest handling*
- *Storage*
- *Waste and by product*
- *Sale and dispatch.*

Establishment and organic certification

Organic standards of production

If the Packer is handling produce for export, the Australian Government requires compliance with the *National Standard for Organic and Biodynamic Production 2016* under the *Export Control Act 2020* and the *Export Control (Organic Goods) Rules 2021*.

For produce supplied for domestic consumption, the National Standard is currently a non-mandatory standard for domestic production, handling and sale of certified organic produce.

As a certified organic wholesaler, packer, exporter or importer of organic produce, the standards cover responsibilities that include:

- Organic Goods Certification (exports)
- Clear designation of dedicated areas for organic goods e.g. physical dividers, clearly marked areas with signage
- Staff trained in handling certified products
- Documentation of suppliers and their product received
- A traceable audit trail recording traded product is readily traced back to the currently certified supplier
- Correct labelling of the product incoming and outgoing, including the certifying body, certification number and organic status (e g "in-conversion")
- Pest control and cleaning practices compliant with the Standard
- Treatments are not using prohibited substances as defined in the Standard
- Access for inspection by authorised organic certification bodies
- Record keeping required as part of the Organic Management Plan.

Establishment

The establishment of *unique identifiers* for packing facility location and business entities creates the basis for traceability, as this can be incorporated in supply chain level tracking. These identifiers provide the common link across the participants in the full supply chain and are collectively referred to as "Master Data" due to their frequency of use.

Master Data relates to locations, businesses, products (input materials, outputs) and their associated attribute data such as addresses, functions, descriptions, packaging configurations etc. These details will be stored in product Master Data files and retrieved each time a traceable item is scanned or looked up for ordering etc. or a location is referenced.

The creation of Master Data for the Packer and growers supplying produce is critical to seamless data sharing to maintain traceability from the grow sites and the downstream events in the produce's journey to the consumer.

Regulators often mandate Establishment Data. It can be required for local, state or national government responsibilities, such as ensuring a business can be located in the circumstance of a biosecurity threat such as a disease outbreak, or to verify the packing facility is fit for purpose and maintains safe food systems.

Property Identification Codes

Some crops are prescribed under Plant Biosecurity legislation or rules in each state. This requires growers to apply and receive a Property Identification Code (PIC) from state agencies. For example, in Victoria, vineyards and chestnuts require a PIC to identify growing sites.

In 2019, the Department of Agriculture, Water and the Environment (AWE) commenced consultation on the application of PICs to horticulture. Draft Principles and Business Rules that will inform legislation in 2022 include specific information related to organic growers that may be linked to a PIC, such as:

- industry quality assurance accreditations
- government organic or sustainability status
- origin or provenance markers.[1]

[1] DAWE 2019-2020, Plant sector property identification reforms— draft principles and business rules, haveyoursay.awe.gov.au

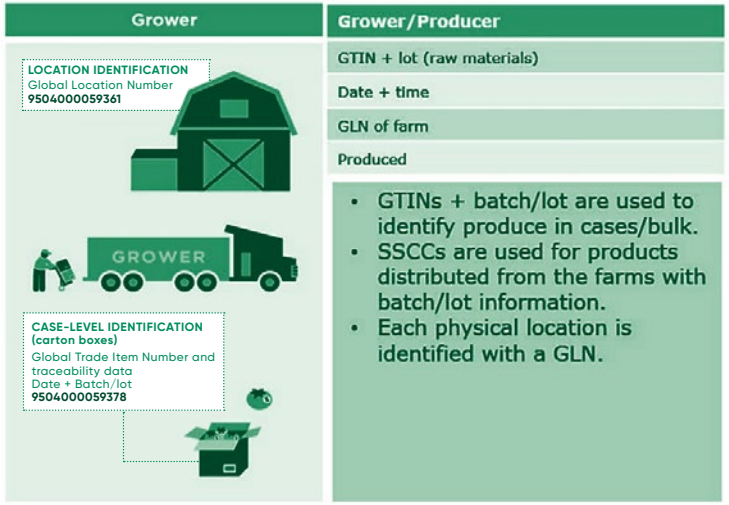


Figure 1: GS1 data standards enabling traceability
Source: GS1 Fresh Fruit & Vegetable Traceability Guideline 2021

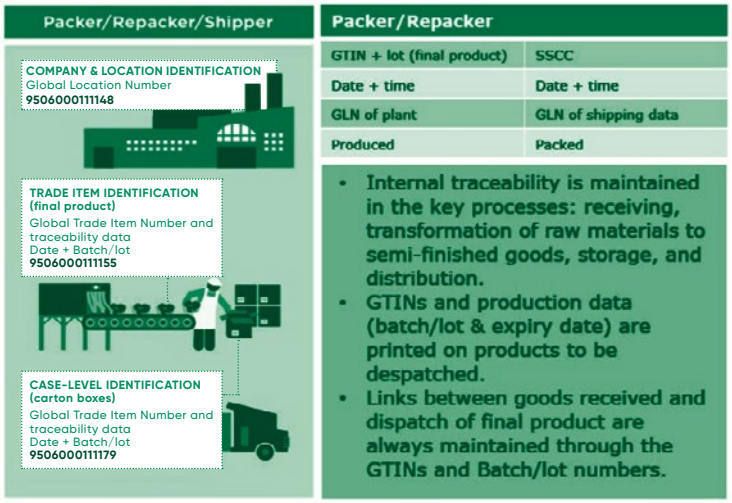
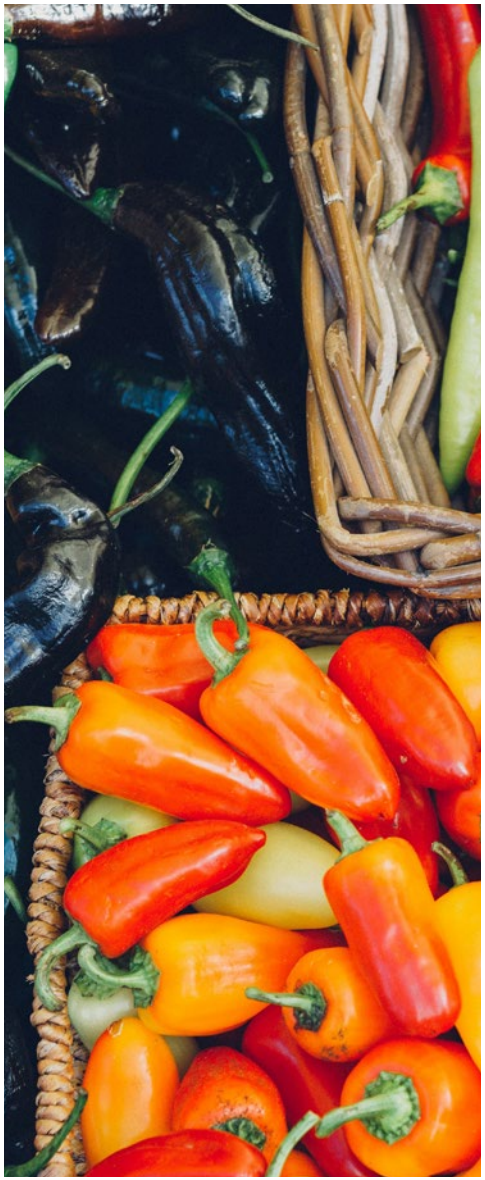


Figure 2: Packer use of global data standards
Source: GS1 Fresh Fruit & Vegetable Traceability Guideline 2021



Export of organic produce

Organic produce is a "prescribed" product and therefore requires the grower to register the premises with the Department of Agriculture, Water and the Environment.[2] The premises may be a packing shed where sorting, grading and packing takes place.

Traceability for registered organic produce export establishments means the business must:

- Ensure the integrity of goods being prepared at the registered establishment by putting measures in place to minimise the risk of infestation and contamination
- Have a documented system for traceability and integrity through the establishment including receival and dispatch records
- Keep goods that have passed inspection and goods that have not been inspected or failed inspection separate
- Have systems in place to minimise the risk of substitution (switching of goods) or tampering
- Complete transfer records for any incoming or dispatched horticulture goods with a phytosanitary status.

Tasks related to traceability

- Apply for a Global Location Number (GLN) for the packing facility
- For Packers of organic produce for export, ensure all certified organic suppliers have current certification against the *National Standard for Organic and Biodynamic Production 2016*
- Register facilities used for packing or processing as Export Establishments with Approved Arrangements for Certified Organic produce.

Key participants

- Global Location Number (GLN) Issuing Agency – in this case GS1 Australia
- Food Safety agency
- Department of Agriculture, Water and the Environment (AWE) for premises for export produce/Micor requirements
- Organic Certifying Body.

Planning and preparation

Growers able to demonstrate how they manage risk in the growing environment can readily respond to end consumer information requests and support certification and audit requirements. The existence of plans and operating procedures (including certification and audit details) underpin product assurance and consumer trust in the organic status of the product. These include a **Food Safety Plan** to enable hazard identification, risk management planning and training of staff.

For organic produce Packers, an **Organic Handling Plan**, which incorporates management of food safety, is developed as part of the organic certification process.

Food Safety

For organic operators, Hazard and Critical Control Point (HACCP) risk identification method is recommended as a part of the Organic Handling Plan. The Plan contains a system of identification and risk management for all significant hazards that may compromise an ability to conform to this Standard for organic handling, identifying control points, putting in place management practices that help eliminate or reduce risks associated with those hazards, and then maintaining verification processes to ensure that management practices are effective.

Tasks related to traceability

- Prepare an Organic Handling Plan for produce, incorporating HACCP
- Conduct regular audit/inspection to update operating procedures (organic certification audit is typically annual).

Key participants

- Packing shed/cool store manager
- Organic Certifying bodies
- Quality Manager
- Quality Specialist
- Compliance Specialist
- Administrative staff.

[2] DAWE Export Establishment Registration for organic export product ablis.business.gov.au

Post-harvest handling

Activities included in post-harvest handling are receival, inspection, grading, cleaning and preparation/packing of the product, initial processing and storage, preparation of the product for off-farm processing or storage and preparation for transport loading and distribution.

Organic post-harvest handling standards associated with packing operations and traceability are as follows:

- Inputs, processing aids and ingredients shall be traced back one step in the biological chain to the organism from which they were produced to verify that they are not derived from genetically modified organisms.
- Operators must provide accurate and up to date records of the enterprise concerned including but not limited to those records pertaining to all production, processing, handling, transport, storage and sales. These records will include inputs, description of quantities and sources, and management actions including treatments, fertilisation, spraying and other significant events; and outputs including description, quantities and consignees; and crop quality and environmental management outcomes.[3]

Receiving product from growers

Bulk organic product is sourced for grading, sorting, packing and storage prior to sale and dispatch. Growers deliver product in bulk using various containers or logistics units for transport. Common examples of logistics units include totes, bins and trailers. Each Logistic Unit must be individually traceable. For this reason, each Logistic Unit carries a tag or label that shows a unique identification number. This is a GS1 Serial Shipping Container Code (SSCC) number and is assigned by the Grower.

Use of the SSCC number ensures not only distinct identification from any of the Grower's other shipping containers but also guarantees uniqueness across all growing companies providing product.

The tag or label provides other important information including:

- Commodity name, where applicable, variety name
- Additional grower/harvest information
- The grower's unique company identification (GLN).

Recording post-harvest inputs

Products used for pest control, cleaning and sanitising spaces and produce items (e.g. alkali carbonates, natural acids), packaging materials used and storage and transport assets need to be recorded as post-harvest inputs. This includes their source, product identification, receipt, usage date and application rate.

Tasks related to traceability

- Maintain identification of the product from grow site to post-harvest facilities
- Maintain an Approved Supplier Program register with organic certificate number, certification level, currency and certifying body for suppliers
- Record harvested product quantity, variety and quality
- Clean, trim, weigh, count and pack product into sales item packs, punnets, trays, cartons or larger units for wholesale/processing
- Chill to required temperature
- Load onto storage or transport assets e.g. on-farm silos, sheds, pallets, tubs, bins, trucks
- Record post-harvest handling personnel.

Key participants

- Grower/supplier
- Packing shed/cool store manager
- Administrative staff
- Operations staff.

[3] National Standard for Organic and Bio-Dynamic Produce V3.7

Packer storage

This process involves storage of the product in off-farm facilities e.g. silo, cool store, packing facility, barrel room.

Operating systems at the facility enable record keeping for each storage room, to record product quantity, variety, paddock source and product monitoring actions such as aeration, cooling or drying of the product. Monitoring of temperature, CO_2 levels, pests located, and treatments are also required. Monitoring product may also involve recording weight and count of product to compare with harvested volumes.

For organic certified produce, harvest records from the grower will include the produce variety, paddock identification, date of harvest, and quantity harvested. In some cases, sales records may be the equivalent of harvest records if produce is harvested and sold within a short period of time.

Tasks related to traceability

- Put away in cool storage
- Record the time and date, and location of storage
- Take samples from each harvest lot prior to product co-mingling from different sources
- Record best-before/use- by/expiry dates on product batches or product lots
- Weigh and count to monitor product.

Key participants

- Packing shed/Cool store manager
- Quality Specialist
- Compliance Specialist
- Administrative staff
- Operations staff.

By-product and waste disposal

This process involves disposal or dispatch of by-product and product waste. While product is generally disposed of on-site, there may be a need to remove materials off-site. The by-product of a packing operation may yield useful materials for composting, bioenergy production or animal feed.

Tasks related to traceability

- Record details of product disposal on-farm
- Arrange transport or removal to approved disposal/waste facilities or by-product recycling facilities
- Disposal site notifies receival of product as required.

Key participants

- Packing shed/cool store manager
- Environmental Health & Safety manager
- Administrative staff
- Operations staff
- Transport contractor
- Waste or recycling facility operator

Dispatch of product

Product dispatch is usually triggered by a sales contract. The process is described in Figure 3.

Key participants

- Packing shed/cool store manager
- Administrative staff
- Operations staff
- Inspection and compliance staff
- Customer/Buyer
- Transport company
- Driver.

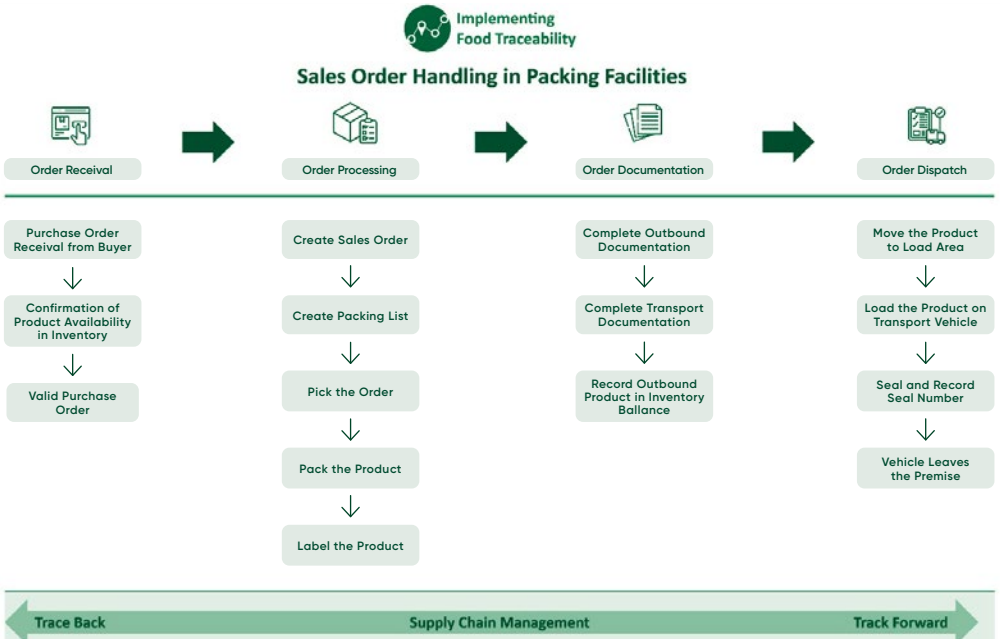


Figure 3: Sales Order Handling in Packing Facilities
Source: Deakin University, 2022

Critical Tracking Events

For each of the identified on-farm production activities, *critical tracking events* (CTEs) establish identity and enable traceability and compliance with traceability-related regulation.

CTEs are events that relate to the identity, movement and transformation of the food product.

On-farm activity	CTE code	Critical Tracking Events (CTEs)
Establishment	**OPK CTE1**	Certify as Organic Handler
	OPK CTE2	Create business Master Data
	OPK CTE3	Record identity and organic status of suppliers
	OPK CTE4	Register export facility in an Approved Arrangement
Planning & preparation	**OPK CTE5A**	Organic Handling Plan
	OPK CTE5B	Food Safety Plan
Produce receival	**OPK CTE6**	Produce received from growers
Post-harvest handling	**OPK CTE7**	Produce inspected, graded, washed, weighed and packed
Cool storage	**OPK CTE8**	Produce lot/bin/tray/punnet labelled for storage
Pack orders	**OPK CTE9**	Pack produce to buyer specifications, label lot/batch, pack on load unit
Prepare for dispatch	**OPK CTE10**	Shipment documentation prepared
Load transport	**OPK CTE11**	Produce loaded and transport departs site
Waste Produce disposal	**OPK CTE12**	Record waste/by-product removal

Key data elements

Key Data Elements (KDEs) ensure that captured and recorded data can be interpreted and used as relevant and required by all supply chain partners. Key Data Elements define Who, What, When, Where and Why for each Critical Tracking Event.

Event Code	CTE	Key data Inputs and Outputs
OPK CTE1	**Certify as Organic Handler**	• Certified Organic Handler number • Certifying Body name • Expiry date **Information to be shared to a traceability platform** • Certified Organic Handler number
OPK CTE2	**Create business Master Data**	**Global Location Number** The Global Location Number (GLN) is used to identify locations and legal entities. This unique identifier is comprised of a GS1 Company Prefix, Location Reference, and Check Digit. **Company asset ID** • Vehicle ID • Returnable asset ID (pallets) • Company owned equipment (bins, tubs, trays) **Information to be shared to a traceability platform** • GLN of packing shed/cool store • Unique Identity number of assets (usually a Serialised Shipping Container Code - SSCC number)
OPK CTE3	**Record identity and organic status of suppliers**	• GLN of growers/origin of produce • GLN of non-produce supplies • Certified Organic number and status of growers • Certifying body name • Expiry date **Information to be shared to a traceability platform** • Produce Grower GLN • Supplier GLN (cleaning products, packaging, pest control) • Certified organic number and status of suppliers

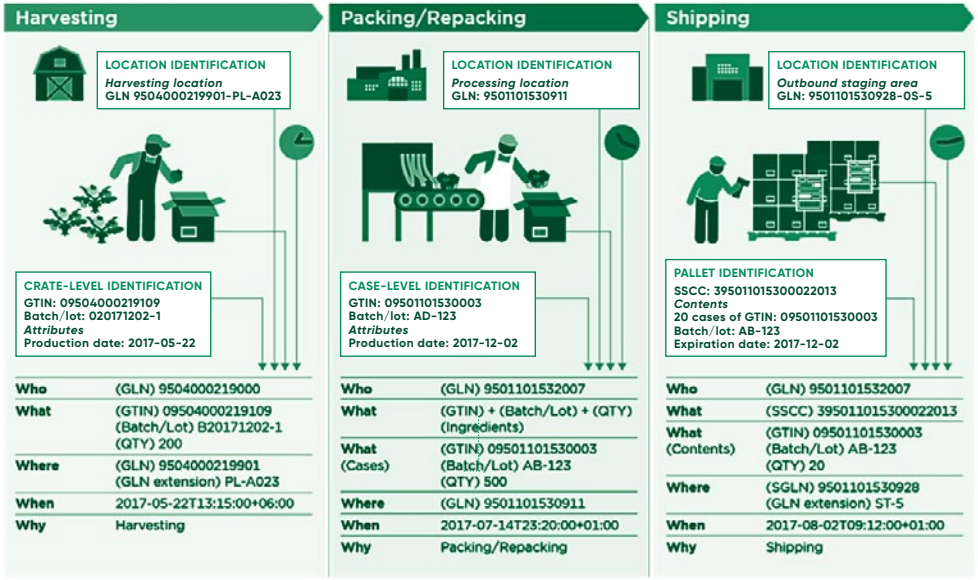
Event Code	CTE	Key data Inputs and Outputs
OPK CTE4	**Registration of facility for export operations**	A copy of the certificate of registration must be prominently displayed at the establishment. The certificate must contain: • the name and address of the occupier • the ACN and ABN number of the occupier • the alternate trading names (if applicable) of the occupier • the number allocated to the export registered establishment • the limited period for which the establishment is registered (if applicable) • the export registered operations for the establishment • the eligible country listing for the establishment which has been registered • persons who manage and control the registered establishment • conditions of registration if any. **Key Data Element examples/guidance** **Export Establishment Registration** **Who** Farm/Grower Export Establishment Agency (AWE) **What** Facility/location associated with export supply chain **When** Date/Time of request **Where** Dept of Agriculture, Water & the Environment (Commonwealth) **Why** Export registration Export Registration Establishment Number **Information to be shared to a traceability platform** • Export Registered Establishment Number • Business Licence Number issued by state agencies • Organic Handling Plan document code
OPK CTE5A	**Organic Handling Plan**	**Information to be shared to a traceability platform** • Organic Handling Plan unique document code • Date of preparation.
OPK CTE5B	**Food Safety Plan**	For businesses that store or undertake processing of certified organic produce there is a requirement to prepare a Food Safety Plan and institute a Food Safety Program which is regularly audited by state and local government agencies and organic certifying bodies as part of the annual audit. Organic production hazards may include: • Separation of organic produce from non-organic • Quality of water used for processing or washing produce • Pest control methods • Contamination from outside sources, such as transport providers • Clean-down procedures.[4]

Event Code	CTE	Key data Inputs and Outputs
		Information to be shared to a traceability platform • Food Safety Plan unique document code • Date of preparation.
OPK CTE6	**Produce receival**	• Time and Date • Grower ID (GLN/PIC) • Produce ID (variety) • Bin, tub, tray ID **Information to be shared to a traceability platform** • Licence premises number/approved arrangement number for export • Harvest date • Time and Date received • Grower ID (GLN/PIC) • Produce ID (variety) • Bin, tub, tray ID.
OPK CTE7	**Post-harvest handling**	• Produce grade • Wash water source and water test report number • Item/pack/lot weight • Item/pack/punnet/batch/bulk bag/bin ID • Packaging supplier ID and receipt date • Chemical product supplier ID and receipt date. **Information to be shared to a traceability platform** • Inventory report - quantity of produce by ID and grade.
OPK CTE8	**Cool storage**	• Storage allocation slot/area in cool store • Storage condition monitoring record (temperature; pest control) • Produce shrinkage in storage.
OPK CTE9	**Pack order to buyer specifications and label**	• Produce ID • Weight • Grower or wholesaler ID (readable name and address) • Licence premises number/approved arrangement number for export • Retailer/grower brand • Batch number • Best-before or use-by date • Country of Origin • Certified Organic status (organic, in conversion) • Certifying body • Load Unit SSCC ID • Product QR code/digital barcode for consumer information • Link to farm business website/test/certificates/provenance verification.

Event Code	CTE	Key data Inputs and Outputs
		Information to be shared to a traceability platform • Licence premises number/approved arrangement number for export of organic produce • Purchase Order number • Load Unit SSCC ID **Key data elements to be shared to a traceability platform** • Sale e-invoice number • Advance Shipping Notice number • Signed consignment note number • Commodity Vendor Declaration number • Sanitary and Phytosanitary certificates (exports) • Inspection certificate number for the consignment • National Plant Health Declaration Number
OPK CTE10	**Pre-shipment inspections and clearances**	**Biosecurity/quarantine inspections and cross-border certification** • Plant Health Certificate • Plant Health Assurance Certificate • Biosecure HACCP Biosecurity Certificate **Commodity Vendor Declaration** • Variety • Chemical treatment • Residue status • Genetic modification status • Name of person completing the declaration • Date of completing the declaration **Key data elements to be shared to a traceability platform** • Biosecurity Inspection certificate number for the consignment • Plant Health Declaration Number • Commodity Vendor Declaration number • Biosecure HACCP Biosecurity Certificate
OPK CTE11	**Shipment documentation prepared**	**Consignment note** • Consignor ID • Consignee ID • Consignee address • Item quantity, transport unit (carton, pallet) mass, weight.

Event Code	CTE	Key data Inputs and Outputs
		Advance Shipping Notice (ASN) • ASN contains data sourced from the Purchase Order and Packing List: • Consignor/supplier identity description • Contact person at supplier • Shipment date and time • Transport company identification and booking reference number • Special handling instructions • Item level list including item description, quantity and purchase order number • Number and type of units e.g. cartons • Packing List Reference number • "Ship to" consignee identity and location • Gross weight of shipment (including packaging) • Waybill/Bill of Lading number • Transport label serial shipping container code on unit load • Phytosanitary certificate (export) • Organic Goods Certificate (Export). **Information to be shared to a traceability platform** • Consignment Note/ Delivery Order number • Advance Shipping Notice number • Waybill/Bill of Lading number • SSCC numbers • Required certificates (usually for export).
OPK CTE11	**Produce loaded and transport departs site**	• Vehicle registration • Transport company • Consignment number/Delivery order number • Gate out time and date. **Information to be shared to a traceability platform** • Consignment Note/Delivery Order number • Gate out time and date stamp.
OPK CTE12	**Record waste/ by-product removal**	• Disposal transport supplier ID • Waste/recycling facility receival ID • Time and date of produce gate out • Time and date of product received at waste facility • Produce ID and quantity • Vehicle registration number. **Information to be shared to a traceability platform** • Produce ID and quantity • Time and date of produce gate out.

Application of GS1 global data standards



GS1 has recently released a Guide to data standards for fresh produce. This Guide can be accessed from the link www.gs1.org

Data standards that apply to key data elements and shared information are identified in this section.

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Location	Farm location, Field location	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
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Organic Standards
Australian Certified Organic Standards austorganic.com

Department of Agriculture, Water and the Environment www.agriculture.gov.au

Food Safety
Food Safety Australia and New Zealand Food Standards for Primary Production and Processing. Chapters 3 and 4 of the Food Safety Standards.

www.foodstandards.gov.au

www2.health.vic.gov.au

www.dairysafe.vic.gov.au

www.foodauthority.nsw.gov.au

www.pir.sa.gov.au

https://www.health.qld.gov.au

Retailer HARPS assurance scheme harpsonline.com.au

Biosecurity
Farm biosecurity for plants and animals. Toolkit and resources to manage farm biosecurity

www.farmbiosecurity.com.au

www.dpi.nsw.gov.au

www.pir.sa.gov.au

www.daf.qld.gov.au

www.farmbiosecurity.com.au

www.nrmsouth.org.au

www.interstatequarantine.org.au

Farm records
Water usage www.dpipwe.tas.gov.au

Property Identification
Department of Agriculture, Water and the Environment Property Identification Reforms

www.haveyoursay.awe.gov.au

VIC www.agriculture.vic.gov.au

Global Location Number Application
www.gs1au.org

Glossary

Air Waybill (AWB)

An AWB is a document that controls the routing of an exporter's cargo while it is in the hands of the air carrier or a consolidator. It is a contract for carriage, however, it cannot be negotiated.

Advance Shipping Notice

An advance ship notice or advance shipping notice (ASN) is a notification of pending deliveries, similar to a packing list. It is usually sent in an electronic format and is a common EDI document. The ASN contains a full record of all relevant details of the consignment including produce variety, quantities and SSCC numbers attached to the load. ASNs are typically sent from a supplier to a retailer (who use the ASN to expedite receipt) but can also be used at other points of the chain e.g. between two of a supplier's facilities, or between a distribution centre or retail outlet.

Bill of Lading (BL/BOL)

A bill of lading is a document issued by a carrier to acknowledge receipt of cargo for shipment. Although the term historically related only to carriage by sea, a bill of lading may today be used for any type of carriage of goods.

The bill of lading is a legally binding document that provides the carrier and shipper with all of the necessary details to accurately process a shipment. It has three main functions. First, it is a document of title to the goods described in the bill of lading. Secondly, it is a receipt for the shipped products. Finally, the bill of lading represents the agreed terms and conditions for the transportation of the goods.

Biosecurity - domestic and international

For plants being exported direct from the Packer, an inspection will need to be booked. www.agriculture.gov.au

For plant products being moved interstate

- Plant quarantine entry conditions apply to the movement of plant goods, including fruit, vegetables, nursery stock, flowers, plants, and seeds. You can either get a government inspector to certify that your goods to be moved within or across state or territory borders meet specified quarantine conditions. To do this, contact your local state or territory quarantine regulator
- Alternatively, you can accredit your business under the Interstate Certification Assurance (ICA) Scheme to certify that your goods to be moved within or across state or territory borders meet specified quarantine conditions
- Some industry certification schemes cover specific commodities e.g. nursery products.

For restricted plant goods moving across state borders

- Plant Health Certificate
- Plant Health Assurance Certificate
- Biosecure HACCP Biosecurity Certificate
- Click here to go to the Certification page.
- Click here to go to the Industry Certification Schemes page.
- www.interstatequarantine.org.au

Consignment Note

The consignment note is a key document used in transporting freight within domestic supply and in the landside logistics of import and export.

The goods are deemed to be "on consignment" until they reach the consignee.

The document is prepared by the consignor and countersigned by the transport carrier as a proof of receipt of the consignment for delivery at the destination.

Phytosanitary Certificate

A Phytosanitary (plant health) certificate provides evidence that plants and plant products for export:

- have passed a phytosanitary inspection
- comply with importing country requirements and with the Export Control Act 2020, and subordinate legislation

Purchase Order (PO)

A commercial document issued by a buyer to a supplier. This is a legally binding offer to buy product in return for payment. The terms and conditions for delivery and payment are detailed in this document, which also details the product quantity, price, terms and conditions, product quality.

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Freight Transport

Freight Transport of Organic Produce

This module covers activities that generally take place in the transport segments of the food supply chain, with specific requirements for organic fresh produce. In this module, we cover domestic/inland transport activities, and the additional requirements associated with freight transport for international shipments related to documentation and port access. These are also detailed in the Organic Export and Organic Import modules.

Transport may be owned by a food business (own transport), contracted via a transport company, or be supplied as part of an integrated offering by a supply chain/logistics service provider company.

Road transport accounts for the largest proportion of freight movement of food in Australia, however rail and coastal shipping are transport modes also deployed in food distribution.

Transport is used on multiple occasions in food supply chains, given that food is typically grown in different locations from consumers and at a distance from international gateways. Agricultural equipment is transported to grow areas for planting and harvest, with the product transported from the production site to processing and/or manufacture, to wholesaling sites (e.g. markets and saleyards), from manufacturing to storage sites , and in distribution to retail/food service outlets. For many fresh food products, half of the produce post-harvest shelf life is spent in transit.[1] Multiple transits elevate the risk of product value being lost through shrinkage due to tampering, lost stock, temperature incursions and carton damage in transit, or from delays impacting best-before dates and shelf life.

Retail food logistics is evolving at a rapid pace from a replenishment model to new models including direct-to-store bypasses of distribution centres, fresh produce centres dealing solely with perishables, direct supply to food service bypassing wholesale and the growth of home delivery direct to consumer. All require tailored freight transport solutions. Supplier standards can mandate the transport company to be able to trace all vehicles and trailers used to deliver and collect product and the location of the vehicle in transit.

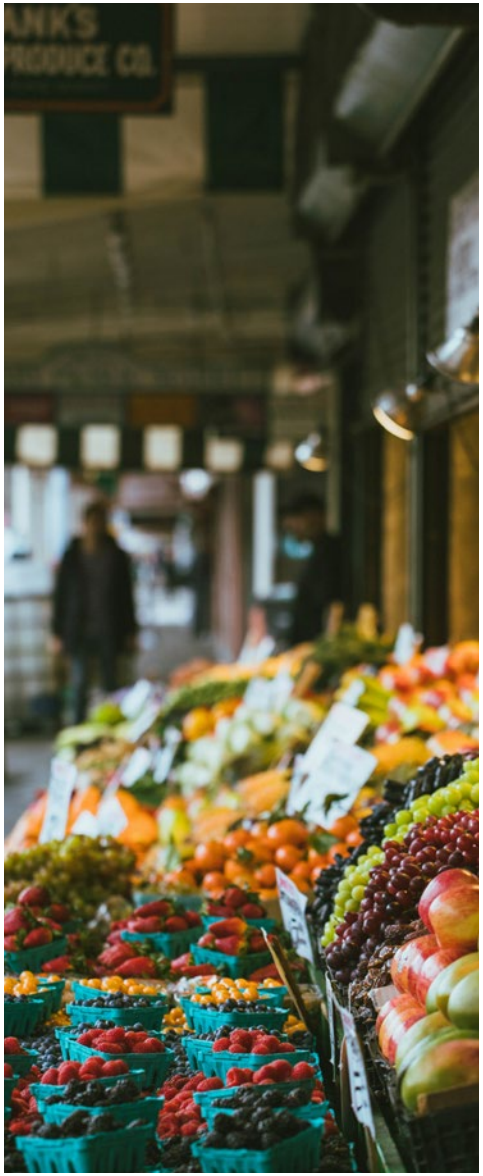
For an approved arrangement for certified organic produce that is traded internationally, transport operations are traced using transport declarations, transaction certificates and Organic Goods Certificates (OGCs)

In this module, processes and activities are associated with freight transport track and trace in general. Additionally, transport operator requirements for organic produce in domestic and international supply chains are included.

A further element related to intermodal and multimodal freight transport indicates variations related to these operations that relate to traceability:

- Establishment
- Transport requirements for certified organic produce
- Transport booking
- Pick up
- In transit
- Cross-docking
- Delivery
- Returns and salvage
- Transport asset/load unit traceability
- Intermodal and multimodal operations.

[1] PMA-ANZ State of the Industry 2020 www.pma.com



Establishment

Transport companies need to create unique identifiers to establish traceability of their business entity, location, transport assets and suppliers. These identifiers allow others in the product supply chain to connect transport activities and events accurately to create supply chain visibility.

These identifiers are incorporated into the Master Data a company uses on a regular basis in transacting with Consignors, Consignees and its own suppliers (fuel, vehicles, mechanics, etc).

Tasks related to traceability

- Creation of unique identifiers for the business, location, transport assets and suppliers
- Creating unique and accurate Master Data relating to regular Consignor identity and location and/or 3PL provider (warehousing)
- Providing unique entity identification and accurate Master data relating to regular Consignee company (the business receiving the product).

Key participants

- Company manager
- Unique identifier issuer GS1 Australia
- Suppliers
- Regular Consignors
- Regular Consignees.

Organic produce requirements for transport operators

The National Standard for Organic and Bio-dynamic Produce covers the transport requirements for certified organic produce and is mandatory for export produce. Section 2 of the Standard covers transport, storage, preparation and packaging of certified organic produce.

The key principle is that organic products are handled in a manner that prevents contamination or substitution with substances or products not compatible with the Standard.

For the transport operator, the certified organic status of the produce is vital information, allowing the operator to apply the Standard to these products and activities, while maintaining traceability of the product in their custody.

As few transport companies directly certify to the National Standard, it is essential for certified organic produce Consignors to provide their Transport Operators with specific requirements for their consignments.

Transport labels placed on the pallet, bin or tub, should identify that the freight is Certified Organic produce, so that it can be easily separated from non-certified product in transit and at transport depots.

Exporters of organic produce will require verification from the Transport Operator that the certified organic produce has been transported in compliance with the National Standard. The Transport Operator will be required to provide records of the operations related to the transport activity, such as cleaning of the transport container, how the certified organic produce is separated from non-certified produce in transit.

This is typically in the form of a Transport Declaration signed by the transport manager and driver. In the case of bulk carrying, a transport declaration shall accompany all consignments and wherever feasible shall include all other measures such as labelling, signage and supply of certificate, to ensure the authenticity and control of the certified product is maintained.[2]

A Transaction Certificate is also issued by the authorised Organic Certifying Body to enable carriage of goods for export. It records the Transport Company and consignment details in a similar manner to a Consignment Note or Waybill for air and sea mode.

Tasks related to traceability

- Identification of Certified Organic produce in transport operations
- Separation of certified product, packaged or in bulk, from non-organic certified product
- Pest control measures – transport containers will include physical barriers or treatments
- Proof that no prohibited substances for post-harvest/quarantine were used
- Access for inspection by organic certifying bodies authorised by the Department of Agriculture, Water and the Environment
- Record-keeping to demonstrate the National Standard has been implemented.

For international shipments

- Completion of a signed Transport Declaration
- Completion of a Transaction Certificate by the Consignor stamped by the authorised Organic Certifying Body.

See Export module for additional shipping documentation requirements (dependent on product and market destination).

Key participants

- Exporter of organic produce
- Authorised organic certifying body
- Transport operator/carrier – surface, air, sea
- Department of Agriculture, Water and the Environment.

[2] ACO Labelling and Style Guide 2018.

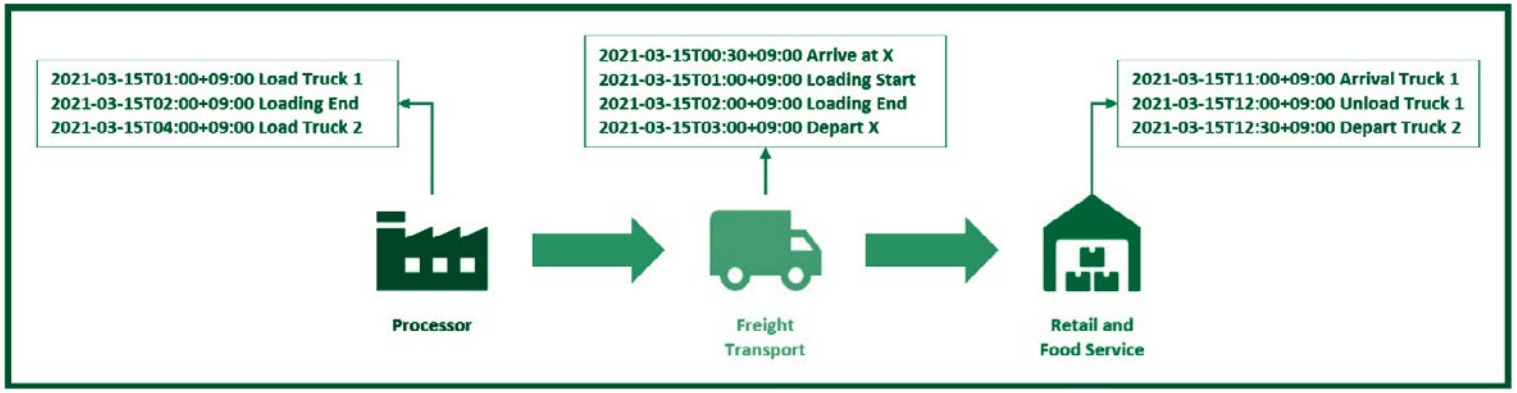
Transport bookings

Transport bookings are initiated by the grower/producer or wholesaler/packer or exporter of organic produce. In terms of freight transport, this business is named the Consignor of Freight. Occasionally, a retailer may be both the Consignor and Consignee, organising or owning their own fleet to relocate product. A Consignee is the party receiving the product via freight transport.

Most freight transport companies have a website booking system and consignment tracking portal. If the transport booking is a regular occurrence, the Consignor business will create an account with one or more transport companies, depending on the nature of the transport task and the characteristics of the product. Transport companies may be specialised in a geography, the speed of delivery required, dimensions or weight of the freight, the need to manage the cold chain, transport a specific product such as bulk product or grain.

Tasks related to traceability

- Consignor provides correct information to the transport company on the consignment size, weight, quantity, content and specific requirements, to ensure equipment is matched to the task and certified organic status is notified
- Booking confirmation from the transport company, used as a tracking reference
- Creation of a Consignment Note containing detailed instructions, contract terms and conditions of transport



- Preparation of a Delivery Order for the Consignee which travels with the freight
- Application of a Transport Label to the logistics units (tub, tray, bin, carton, pallet, drum, Intermediate Bulk Container (IBC)
- The Consignor will notify the Consignee of the pending shipment using an Advance Shipping Notice.

Key participants

- The supplier of the food product or 3PL as Consignor of the freight
- The transport company/Logistics Service Provider (LSP) receiving and confirming the transport booking
- The customer as Consignee of the freight providing accurate Master Data for the transport booking.

Pick Up

Based on a transport booking confirmation and Delivery Order being issued by the Consignor, the transport company will arrive to pick up the freight at the scheduled time. Some larger Consignors have "gate in" records and may record the vehicle registration on arrival.

Tasks related to traceability

- Vehicle arrives (Gate In)
- Signed Consignment Note provided to the driver
- Vendor Declarations (CVD) signed and handed to the driver
- Weight Declaration checked to ensure Mass limits are not exceeded e.g. COR Container Weight Declaration, grain harvest management scheme) from weighbridge
- Scan or record product unit label (items, cartons, pallets etc) to verify loaded product, including date and time
- Transport leaves (Gate Out).

Key participants

- Consignor
- Transport Company
- Logistics Service Provider
- Driver.

In transit

The ability to track goods in transit is important to the Consignor and Consignee so both can track the transit time and efficiently plan for the inbound receival of the product.

Transport companies can track the vehicle in transit, providing location data on the shipment to the Consignor by associating the vehicle location with the transport booking number.

An alternative means to transmit location and product monitoring data is via on-board devices placed with the shipment that can transmit data in transit. Telemetry, or remote sensing data, is transmitted via telecommunication networks and enables monitoring of on-board systems and locations e.g. telemetry transmissions.

These technologies enable tracking of the vehicle mass, distance and location and monitoring of the condition of the freight in terms of temperature, vibration, in real or near-time, depending on the quality of the telecommunications network.

Many smaller volume Consignors/shippers use an application programming interface (API) supplied by their Logistics Service Provider or Freight Transport company, which enables data related to the shipment to automatically integrate with enterprise systems, providing in-transit visibility of the shipment for nominated supply chain parties.

Transport status messages relate to delays, disruptions, incidents and events taking place in the transit of the product, enabling the Consignor and Consignee to take responsive actions.

For some transport tasks, depot stopovers or staging of transport can mean a change of equipment, and transfer of load units e.g. pallets or cartons from one vehicle to another. Some transport depots offering "milk run" style pickups from small less-than-truckload (LTL) shippers such as small producers and the transport depot will provide short term storage prior to assembling a full truckload for a longer transit to market.

Tasks related to traceability

- Location of product in transit e.g. transport company customer portal or push message
- Notification of delays or disruptions or estimated time of arrival
- Short term storage at transport depot e.g. LTL shipments.

Key participants

- Transport company
- Driver
- Consignor
- Consignee.

Cross-docking

Cross docking involves the transfer of load units from one vehicle to another. Typically this may be product from linehaul interstate transits that are transferred to smaller vehicle for urban or regional delivery. These load units carrying the product are otherwise undisturbed i.e. they remain intact. The Wholesale and Distribution Module covers cross-docking operations where products are combined or broken down for reconfiguration and further transport. The distinguishing factor is that the stock is not put away in storage but transferred from an inbound to an outbound dock, thus the term 'cross-docking'.

Tasks related to traceability

- Scan of the off-loaded unit transport labels to transport company system and supplier enterprise system
- Scan of re-loaded transport labels
- Truck registration recorded with transport labels loaded on trailer
- Entry and exit time and date stamp recorded for inbound and outbound vehicles by truck registration number
- Driver ID recorded for inbound and outbound vehicles.

Key participants

Transport company - depot manager, load planner, driver

[3] Creative Safety Supply
www.creativesafetysupply.com

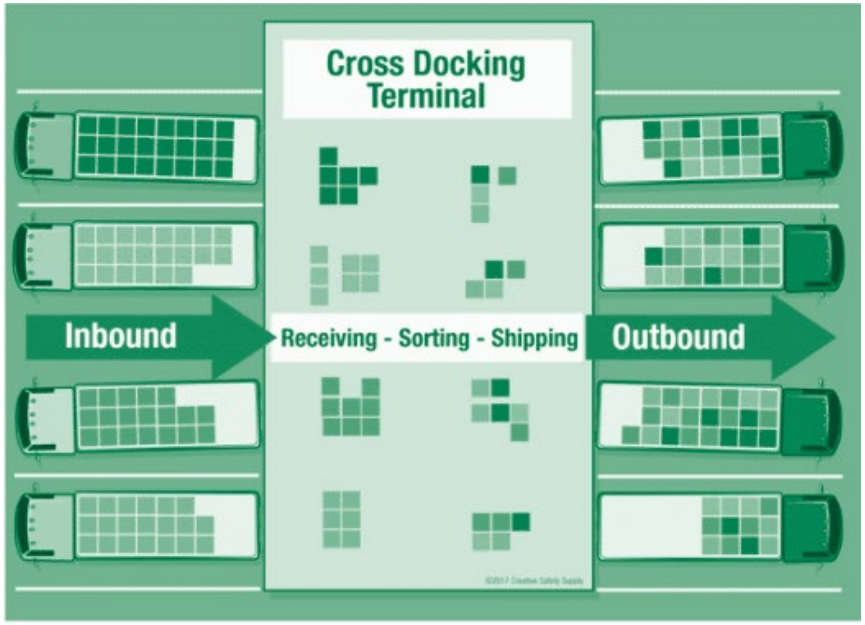


Figure 2: Cross docking of freight
Source: Creative Safety Supply 2017[3]

Delivery

The processes related to delivery of food products are initiated by the Transport Company booking an appointment to deliver the goods with the Consignee. This is essential in the case of large retailer distribution centres where product from multiple suppliers is received and large volumes of goods are dispatched daily. Booking and adhering to delivery windows is a key process for transport companies.

Gate arrival is a means to record a specific vehicle registration and the turnaround time for the vehicle on site. The vehicle will be directed to a dock or to a marshalling area to await entry to a loading dock, where receival activities take place. At the receival dock, retailer staff will scan the transport labels and reconcile the consignment against the Delivery Order and *Advance Shipping Notice*. Any damaged goods will be set aside, and any missing cartons or pallets will be recorded. Depending on the arrangement with the transport company, these goods may be returned to the supplier via the same truck.

In relation to food deliveries, specific recommendations from FSANZ relate to inspection of the packaging for leakage, damage or pest infestation, correct temperature at arrival and that the use-by date is not expired. Often retailers will reject the consignment if sufficient shelf life is unable to be achieved, resulting in lost value.

Once inspection is completed, a Proof of Delivery or Commodity Vendor Declaration is signed by the receival staff and the vehicle exits the site, with Gate Out recorded by a gatehouse or security system. The transport company will then submit an invoice to the Consignor.

Tasks related to traceability

- Record vehicle arrival
  - Gate in date and time stamp
  - Vehicle registration number
  - Driver ID and site induction status.
- Inspect delivered goods by inbound receival staff
- Scan into Consignee system by printing and attaching barcodes or scanning labels
- Proof of Delivery signed by Consignee representative
- Consignor notified of goods arrival and any missing or rejected stock
- Transport vehicle exits delivery site.

Key participants

- Transport company
- Logistics Service Provider
- Driver
- Consignor
  Consignee receivals staff

Returns and salvage

Suppliers and their *3PL warehouses* or LSP may require the transport company to return freight/stock that has been rejected at the consignee receival. Rejection of part or all of a consignment at delivery can have a significant impact on transport scheduling. The transport company may also be tasked with collection of salvage stock, which may have been accepted at receival but unable to be sold or has been removed from the retailer shelves or production plant due to expiry or damage.

Traceability of returns and salvage is usually based on the policies and standard operating procedures agreed between suppliers and customers. Suppliers need to develop and adhere to procedures for recording damaged cartons/packs and product returns for disposal. Traceability audits will highlight the need for returns to be recorded.

Scenarios in relation to transport of the returns may be:

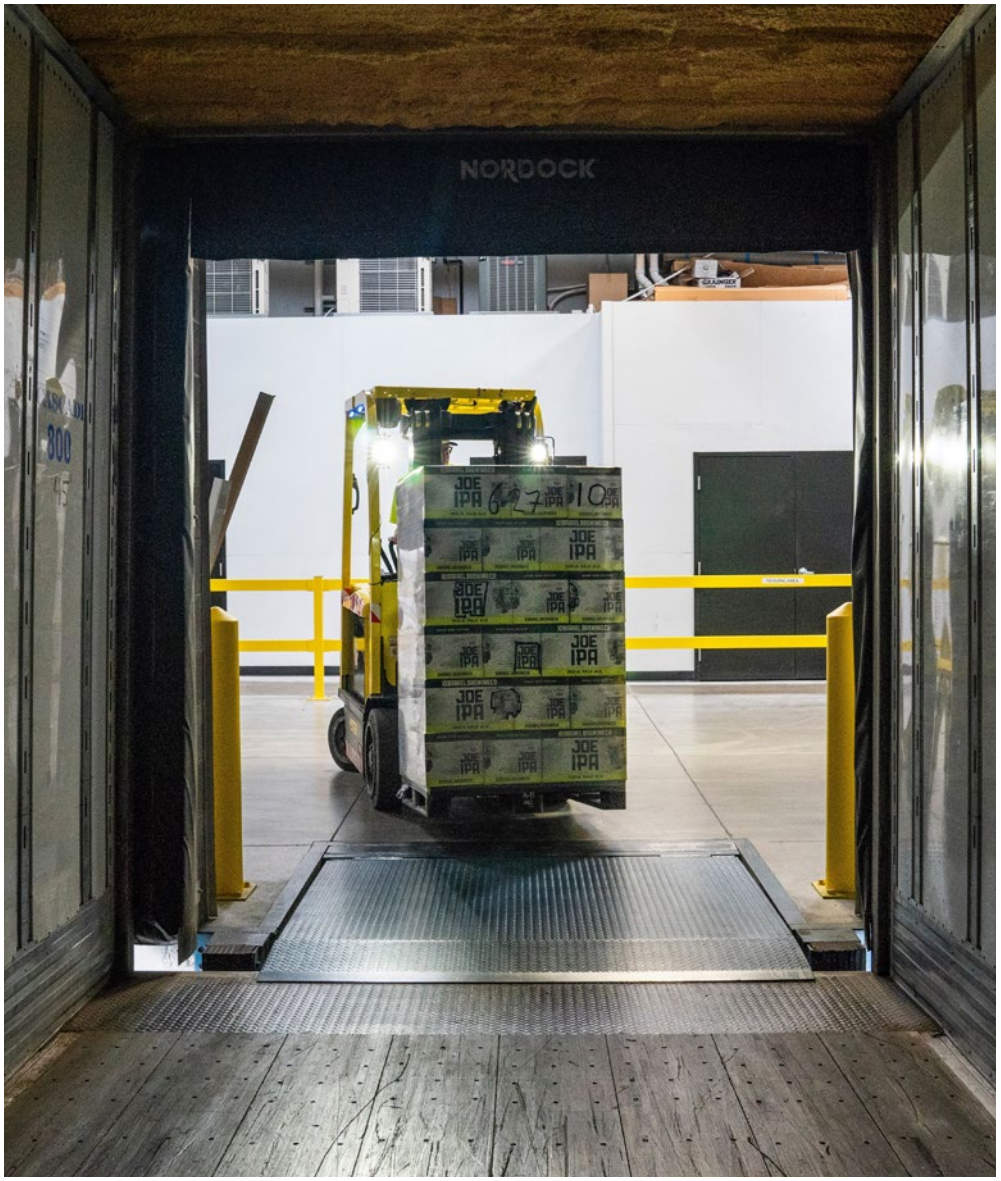
- The truckload is rejected prior to unloading; the driver must return the consignment to the Consignor; the product is not scanned or unloaded
- Part of the consignment is rejected at receival; the consignee will scan the cartons or pallets and notify the consignor; the transport company returns the rejected units on the same vehicle
- The consignment is received, scanned and unloaded; rejected units are notified to the Consignor and returned via a different vehicle.

Tasks related to traceability

- The Consignee (receiver) notifies the Consignor (supplier) of missing and damaged stock units that have been rejected, or that the entire truckload has been rejected
- The Consignor instructs the transport company to return or dispose of stock units
- The returned stock is scanned at unloading
- The disposition of returned stock is decided and recorded on the Consignor system
- The transport company issues an invoice recording disposal or return of stock units.

Key participants

- Transport company
- Logistics Service Provider
- Driver
- Consignor (supplier of product or their 3PL/LSP)
- Consignee receivals staff.



Transport asset/load unit traceability

Load units are transport assets or equipment used to contain or unitise freight. They increase the efficiency of logistics by enabling transport equipment such as forklifts to carry and stack multiple cartons or individual items for storage or distribution.

Common load units are pallets, bins, tubs, bags, bulk liquid tanks, dry bulk containers, shipping containers, trays. They do not include packaging.

Traceability of load units can improve utilisation and avert high costs associated with loss of equipment and detention charges.

It is likely that the rollout of 5G telecommunications networks will see a proliferation of sensor equipment integrated into load units to support traceability of product and associated transport equipment, helping to track and manage these assets.

Tasks related to traceability

- Assign a unique identifier to the transport asset
- For pooled assets such as pallets, ensure *pallet transfer authority* is signed at consignee receival
- Scan load unit barcodes/identifiers on inbound and outbound loading or apply IoT devices using active RFID or Bluetooth for pallet tracking (particularly useful in closed loop supply chains).

Key participants

- Transport company
- Load unit leasing company
- Receival at consignee
- Consignor or 3PL supplier.

Intermodal and multimodal freight transport

Intermodal freight terminals are the points within supply chains where load units are transferred between different modes of transport: rail, road, sea and air. Intermodal terminals play a key role in permitting the most appropriate mode of transport to be used for different elements of the transport task, combining the flexibility of road operations with the linehaul efficiency of rail transport and the ability of sea transport to extend the transport chain beyond the geographical limits of the Australian mainland. The participants in the intermodal supply chain include rail transport providers, road transport providers, terminal operators both import/export and domestic, freight forwarders and shipping/air lines.[4]

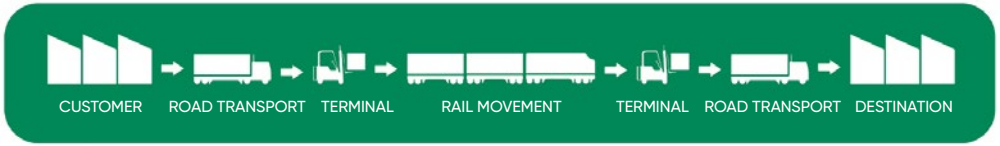
If a transport task is undertaken using multiple modes but without opening the container then it is called **intermodal**. The freight remains under the control of one LSP who arranges different modes under one main contract with the Consignor/supplier of product. If the container is opened and the goods transferred to another transport mode, it is termed **multimodal** freight. It may be arranged through coordination of multiple transport contracts by the Consignor.

Australian businesses use different transport modes to move food products, including rail (rail shuttle, inter-capital, port rail); coastal shipping; domestic and international airfreight (dedicated freight, charter and passenger underbelly services). A combination of modes of transport is effective in managing long distance transits e.g. Perth-Sydney, or for freight accumulated in production zones and destined for export ports. Coastal shipping is effective for heavy or bulk food products that are less time-sensitive or regularly replenish food manufacturing e.g. malt, oil or grains. Airfreight is an effective solution for high value, time-sensitive products.

Within an intermodal hub distribution centre, pallets may be unloaded and goods re-configured for a specific destination or to optimise space on specialised transport equipment.

Traceability of the product is usually based on the container or pallet identification however use of multiple modes may require tracking at a load unit level if the product is reconfigured for different transport modes.

The four most critical data points for a tracking system to report are accurate, to-the-minute GPS-based location status, whether the container is loaded or empty, whether the door is open or closed, and for some products, the ability to send an alert if temperature and humidity fall outside of normal ranges.



Tasks related to traceability

- Location of the container or load unit in transit
- Arrival and departure of road freight vehicles at intermodal hubs
- Cross-docking between modes
- Load unit reconfiguration e.g. re-palletisation – re-labelling pallets and load units.

Key participants

- Transport company/companies (road, rail, shipping, airline)
- Consignor
- LSP/3PL supplier
- Intermodal terminal operator (rail, air, sea)
- Port manager
- Domestic freight forwarder.

[4] QTLC www.qtlc.com.au/freight-sectors/intermodal/

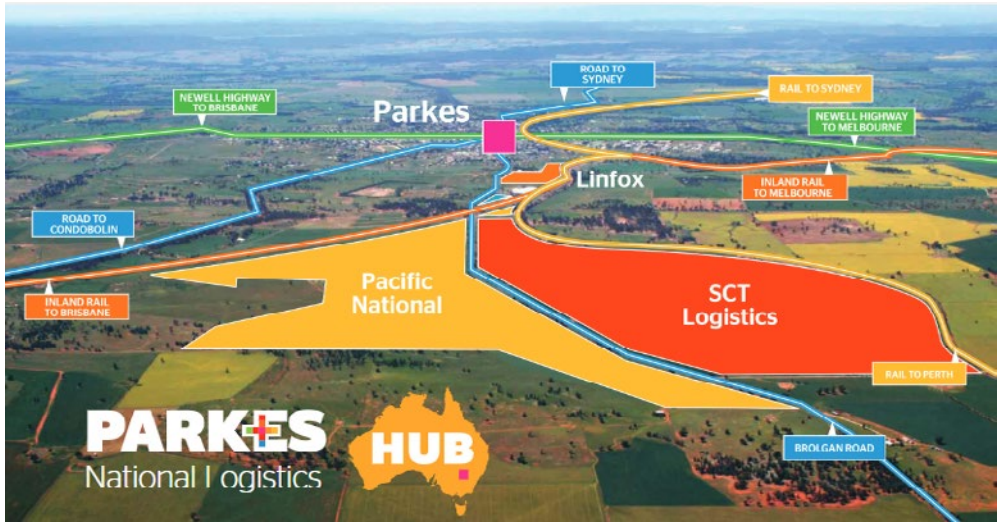


Figure 6: Example of intermodal hub
Source: Prospectus Parkes National Logistics Hub

Coastal Shipping variations

Coastal shipping requires some different procedures and documentation to surface transport. Coastal shipping consignments can be co-mingled with international cargoes as the product is transferred to/from road or rail transport via seaport terminals.

Tasks related to traceability

- Consignor prepares Bill of lading required by shipping line
- Shipping line prepares manifest for loading
- Shipping line issues Ship arrival notice sent to LSP nominee
- Discharge of load unit from vessel to CTO
- *Cargo Availability* Notice sent by CTO to LSP, Consignee
- Transport company books access to collect from CTO
- Transport company uses Delivery Order to verify access to cargo
- Transport company picks up load unit/ container and exits port gate
- Transport company delivers to Consignee
- POD signed by Consignee.

Key participants

- Consignor
- Shipping line
- Cargo Terminal Operator
- Transport company
- Consignee
- Freight Forwarder
- Logistics Service Provider.

Critical Tracking Events

Critical Tracking Events (CTEs) are events that occur to the product (the traceable object) during its lifecycle and associates the identity, movement and transformation of the food product with locations and participants.

The **critical tracking events (CTEs) f**or each of the identified freight transport activities are summarised as follows

On-farm activity	CTE code	Critical Tracking Events (CTEs)
Establish identities and locations	**FTO CTE1A**	• Consignor and 3PL identity and location • Consignee identity and location
Transport Company licences, permits and registrations	**FTO CTE1B**	• Transport Company licences and registrations e.g. Food Transport Business Licence is required to carry eggs, dairy, meat, plant products, seafood • Shipping lines must have a Coastal Trading Licence • Transport access permits, as required • Mass Management schemes registration • Vehicle registrations (including trailer/wagon ID) • Driver Identification and evidence of site inductions/security card • Safe Food Accreditation.
Transport operations for certified organic produce	**FTO CTE2**	• Identification of Certified Organic produce in transport operations • Separation of certified product, packaged or in bulk, from non-organic certified product • Access for inspection by organic certifying bodies authorised by the Department of Agriculture, Water and the Environment • Record-keeping to demonstrate the National Standard has been implemented. **For international shipments** • Completion of a signed Transport Declaration • Completion of a Transaction Certificate by the Consignor stamped by the authorised Certifying Body
Booking and preparing for transport • Transport Booking Confirmation from the transport company, used as a tracking reference • Consignor/shipper prepares Consignment *Note/ eNVD/CVD/Waybill*	**FTO CTE3**	**Booking and preparing for transport** • Receive Transport Booking Number (shipment tracking reference) • Prepare Consignment Note/CVD

On-farm activity	CTE code	Critical Tracking Events (CTEs)
• Preparation of a *Delivery Order* for the Consignee which travels with the freight		• Prepare Delivery Order
• Affix a *Transport Label* to the product carton and pallet		• Affix Transport Labels
• Notify the consignee of the pending shipment using an *Advance Shipping Notice.*		• Send Advance Shipping Notice to the Consignee.
Pick up	**FTO CTE4**	• Gate arrival of transport
Vehicle arrives (Gate In timestamp recorded)		• Vehicle registration recorded • Driver ID and induction/security access card validated
• Signed Consignment Note provided to the driver		• Consignment Note signed (online or handed to driver)
• Vendor Declarations CVD signed and handed to the driver		• Vendor Declarations entered on system or hard copy signed by Consignor
• COR compliance check re load restraint, mass management, driver fatigue (Consignor risk)		• COR compliance checks completed and entered in consignor system.
• Scan load unit label (items, cartons, pallets etc) to verify loaded product, including date and time		• Scan and load product
Truck Departs	**FTO CTE5**	• Transport leaves consignor site and Gate Out data recorded
In Transit Monitoring and updates	**FTO CTE6**	• GPS tracking coordinates recorded
• Location of product in transit e.g. transport company customer portal or push message		
• Notification of delays or disruptions or estimated time of arrival		• Transport status message issued
Cross-docking	**FTO CTE7A**	
FCL/FTL cross-docking		• Scan the container/load unit number before unloading
• Scan load unit into depot Transport Management System as received. A Dock allocation will be issued for container/load unit		
• A Load Planner will allocate each load unit to the vehicle, wagon, and vessel slot.		
• The load unit ID is re-scanned at loading.	**FTO CTE7B**	• Re-scan the container/load unit number at re-loading to vehicle, rail wagon, vessel
• All load units are reconciled to vehicles prior to transit.		
LCL/LTL cross-docking	**FTO CTE8A**	
• Scan of the off-loaded load unit transport labels to transport company system		• Load unit is scanned at re-loading and reconciled to vehicle/wagon/vessel
• Allocation of load units to Bays		
• Load units may be reconfigured with product from multiple inbound loads for one destination or to make up a full container load		
• Load units are re-labelled with new transport labels	**FTO CTE8B**	• Load unit scanned prior to unloading
• Units are re-loaded and transport labels scanned with new container/skid/wagon number/truck registration assignment	**FTO CTE8C**	• New transport label affixed and allocated to container/wagon ID and scanned at re-loading
• Gate In and Gate Out process recorded	**FTO CTE9**	• Date and Time stamp records entry and exit of vehicles and drivers
Delivery	**FTO CTE10**	
• Gate in process at Consignee premises		• Gate in process completed – Load units received recorded in WMS/ERP system – Proof of Delivery completed – Goods received notified to supplier ERP.
• Goods scanned into Consignee system		• Gate out process completed
• Consignor notified of goods arrival and any missing or rejected stock		• Transport vehicle exits delivery site
• Transport vehicle exits delivery site		
Returns and salvage	**FTO CTE11**	
• The consignor instructs the transport company to return or dispose of stock units		• Consignor instructs transport company to return/dispose of rejected stock
• The returned stock is scanned at unloading		• Returned load
Transport Asset/Load unit traceability	**FTO CTE12A**	
• Assign an identity to each transport asset		• Create Load Unit • Apply scannable unique ID
• For pooled assets such as pallets, ensure pallet transfer authority is signed at consignee receival		• Pallet transfer authority signed by Consignee or Consignor

On-farm activity	CTE code	Critical Tracking Events (CTEs)
• Scan load unit barcodes on inbound and outbound loading or apply IoT devices using active RFID or Bluetooth for load unit tracking (particularly useful in closed loop supply chains)	FTO CTE12B	• Scan load units prior to unloading and when re-loading on transport vehicles
Intermodal and multimodal	FTO CTE13	
• Location of the container or load unit in transit		• GPS tracking coordinates
• Arrival and departure of road freight vehicles at intermodal hubs	FTO CTE14	• Gate In and Gate Out records
• Recording load units allocated to each rail wagon/container on consist/vessel via new transport labels	FTO CTE15	• Transport company ID • Rail wagon ID • SSCC of transport label
Coastal shipping	FTO CTE16A	
• Consignor prepares Bill of lading required by shipping line		• Bill of Lading received by Shipping Line
• Shipping line prepares manifest for loading		• Ship Arrival Notice
• Shipping line issues Ship arrival notice sent to LSP nominee		
• Discharge of load unit from vessel to CTO		• Cargo Availability Notice
• Cargo Availability Notice sent by CTO to LSP, consignee		
• Transport company books access to collect from CTO		
• Transport company uses Delivery Order to verify access to cargo		
• Transport company picks up load unit/container and exits port gate	FTO CTE16B	• Delivery Order
Delivery		
• Transport company delivers to consignee	FTO CTE17	• Proof of Delivery POD signed by Consignee
• POD signed by consignee		

Key data elements

Key Data Elements (KDE) ensure that captured and recorded data can be interpreted and used as relevant and required by all supply chain partners. Key Data Elements define Who, What, When, Where and Why for each Critical Tracking Event.

Event Code	CTE	Key data Inputs and Outputs	
FTO CTE1A	**Establish identities and locations for consignor and consignee**	**Global Location Number**	
		GLN Creation	
		Who	Logistics Service Provider ID - GLN Transport Company ID – GLN Issuing Agency
		What	Freight location
		When	Date/Time of GLN Issuance
		Where	Issuing Agency
		Why	Request for GLNs
FTO CTE1B	**Transport Company licences, permits and registrations**	**Food Transport Business Licence and food safety program**	
		Transport operators carrying food consignments need to apply for a licence from the state food authority. All vehicles used to transport prescribed products and field harvest vehicles need to be listed. The state food authority will also undertake a food safety audit and require a food safety program is in place. Annual audits are required. Plant biosecurity certificates may be required from the Consignor for interstate transportation.	
		Food Transport Licence	
		Who	Logistics Service Provider ID - GLN Transport Company ID – GLN Issuing Agency
		What	Organisation
		When	Date/Time of Licence issuance
		Where	Issuing agency
		Why	Request for Food Transport Licence
		Information to be shared to a traceability platform	
		• Global Location Number (GLN) • Export registered establishment number • Food Transport Business Licence Number	

Event Code	CTE	Key data Inputs and Outputs
FTO CTE2	**Transport operations for certified organic produce** Identification of Certified Organic produce in transport operations	• Transport label – "Certified Organic" • Consignor notifies "Certified Organic" product
	Separation of certified product, packaged or in bulk, from non-organic certified product	• Transport Declaration description of how product separated
	Record-keeping to demonstrate the National Standard has been implemented.	• Record inspections by authorised organic Certification Body • Record compliance with National Standard.
	For international shipments Completion of a signed Transport Declaration Completion of a Transaction Certificate by the Consignor stamped by the authorised Certifying Body	Signed Transport Declaration • Consignor business name • Consignor Organic Certified number • Pick up location • CVD number • Vehicle inspection and cleaning completed • Transport Operator trading name and logo • Date loaded • Transport Organic Certified number • Vehicle registration • State of registration • Vehicle description • Produce segregation methods • Consignment details • Manager signature and date • Driver signature and date. **Information to be shared to a traceability platform:** • Certified Organic status of Consignor • Transport Declaration number

Event Code	CTE	Key data Inputs and Outputs
	Booking and Preparation for Transport Receive Transport Booking number	• Transport Booking reference number (used for consignor tracking of shipment • Consignor name and address • Consignee name and address • Description of goods • Quantity, weight, dimensions of product • Declaration by consignor • Signed by transport company/LSP. On company letterhead
FTO CTE3	**Prepare Consignment Note/CVD/ Delivery Order**	• "Ship to" identity and location • Mode of transport • Special needs for the shipment – Certified Organic, temperature • When to release the shipment • Shipment has been paid for. **Information shared to a traceability platform** • Delivery Order number.
	Affix Transport Labels	Labels on load units – • Company name of consignor • Address • Product description • Count • Content • Batch/Lot number • Use by date • Net weight • Serialised Shipping Container Code (SSCC).
	Send Advance Shipping Notice	**ASN contains data sourced from the Purchase Order and Packing List –** • Consignor/supplier identity description • Contact person at supplier • Shipment date and time • Transport company identification and booking reference number • Special handling instructions • Item level list including item description, quantity and purchase order number • Number and type of units e.g. cartons • Packing List Reference number • "Ship to" consignee identity and location • Gross weight of shipment (including packaging).
	Gate arrival	• Vehicle registration number • Driver identification • Driver site induction/access card valid • Time and date stamp.

Event Code	CTE	Key data Inputs and Outputs
		Key Data Element examples/guidance
		Arrival
		Who Consignee ID - GLN Logistics Service Provider ID - GLN Transport Company ID - GLN Driver ID - GSRN
		What Vehicle ID - GIAI
		When Date/Time of vehicle arrival
		Where Arrival Gate Location ID - GLN
		Why Pick Up Links: Gate Arrival record
		Information to be shared to a traceability platform • Date and time stamp of pick up • ASN Number • Consignment Note Number
FTO CTE4	**Pickup** Consignment Note signed	• Consignor name and address • Consignee name and address • Description of goods • Quantity, weight, dimensions of product • Declaration by consignor • Signed by transport company/LSP • Consignment Note Number.
	Declarations entered on relevant platforms or hard copy signed by Consignor	Commodity Vendor Declaration - • Variety • Chemical treatment • Residue status • Genetic modification status.
	Chain of Responsibility (COR) checks completed	www.nhvr.gov.au coradviser.com.au • Mass • Dimension • Load restraint.
	Scan and load product	• SSCC of load units (scanned at loading

Event Code	CTE	Key data Inputs and Outputs
FTO CTE5	Transport leaves and Gate Out process completed	**Key Data Element examples/guidance**
		Departure
		Who Logistics Service Provider ID - GLN Transport Company ID - GLN Driver ID - GSRN
		What Consignment ID - SSCC Vehicle ID - GIAI
		When Date/Time of Departure
		Where Gate Out Location ID - GLN
		Why Transport Vehicle Departure Links: Gate out record
		Information to be shared to a traceability platform • COR compliance check completed • Vehicle registration • Gate out date and time • CVD number as required • ICA certification number as required • SSCC of transport assets loaded (scan of transport labels)
FTO CTE6	**In transit tracking** GPS vehicle/ container tracking Transport Status messages	• Date and time • Location coordinates • Estimated and actual time of departure • Estimated and actual time of arrival • Location and route ID • Time of loading and unloading • Vehicle and trailer/wagon/vessel type and capacity • Transport asset ID e.g. pallet/container/skel • Reason for delay Key Data Element examples/guidance.
		In Transit GPS Tracking/Transport status
		Who Transport Company ID - GLN Driver ID - GSRN
		What Consignment ID - SSCC Vehicle ID - GIAI
		When Date/Time of GPS transmission
		Where Location and route ID - GLN
		Why In Transit GPS tracking, Transport status Links: GSP Tracking data, Transport Status Message

Event Code	CTE	Key data Inputs and Outputs
		Information to be shared to a traceability platform • GPS coordinates at regular timestamped intervals • Actual departure and arrival time • Reason for delay and actions that may impact traceability (consider decoupling equipment; transfer to another vehicle etc)
FTO CTE7A	**Cross docking** **FCL/FTL cross-docking** Scan load unit/ container before unloading	• Company name of consignor • Address • Product description • Count • Content • Batch/Lot number • Use by date • Net weight • Serialised Shipping Container Code (SSCC). **Key Data Element examples/guidance** **Unloading** **Who** Logistics Service Provider ID - GLN; Transport Company ID - GLN; Driver ID - GSRN **What** Consignment ID - SSCC; Vehicle ID - GIAI **When** Date/Time of Unloading **Where** Warehouse Location ID - GLN **Why** Unloading; Links: Unloading record **Information to be shared to a traceability platform** • SSCC unloaded from vehicle (scanned at unloading)
FTO CTE7B	**FCL/FTL cross-docking** Re-scan load unit/container at loading	• Company name of consignor • Address • Product description • Count • Content • Batch/Lot number • Use by date • Net weight • Serialised Shipping Container Code (SSCC). **Key Data Element examples/guidance** **Loading** **Who** Logistics Service Provider ID - GLN; Transport Company ID - GLN; Driver ID - GSRN **What** Consignment ID - SSCC; Vehicle ID - GIAI **When** Date/Time of Loading **Where** Warehouse Location ID - GLN **Why** Loading; Links: Load/Vehicle Reconciliation; Loaded units record **Information to be shared to a traceability platform** • SSCC of re-loaded freight • Vehicle registration associated with re-loaded SSCC
FTO CTE8A	**LCL/LTL cross-docking** Load unit is scanned at re-loading and reconciled to vehicle/wagon/ vessel	• The load unit ID is re-scanned at loading. • All load units are reconciled to vehicles prior to transit. **Key Data Element examples/guidance** **Loading** **Who** Logistics Service Provider ID - GLN; Transport Company ID - GLN; Driver ID - GSRN **What** Consignment ID - SSCC; Vehicle ID - GIAI **When** Date/Time of Loading **Where** Warehouse Location ID - GLN **Why** Loading Links: Loaded units record
FTO CTE8B	Load unit/ container scanned prior to unloading	• Company name of consignor • Address • Product description • Count • Content • Batch/Lot number • Use by date • Net weight • Serialised Shipping Container Code (SSCC). **Key Data Element examples/guidance** **Unloading** **Who** Logistics Service Provider ID - GLN; Transport Company ID - GLN; Driver ID - GSRN

Event Code	CTE	Key data Inputs and Outputs	
		What	Consignment ID - SSCC Vehicle ID - GIAI
		When	Date/Time of Unloading
		Where	Warehouse Location ID - GLN
		Why	Unloading Links: Unloaded units record
		Information to be shared to a traceability platform	
		• SSCC unloaded	
FT CTE8C	New transport label affixed, allocated to wagon/vehicle/ vessel and re-scanned	New transport label • Company name of consignor • Address • Product description • Count • Content • Batch/Lot number • Use by date • Net weight • Serialised Shipping Container Code (SSCC).	
		Key Data Element examples/guidance	
		Transport Label Allocation	
		Who	Logistics Service Provider ID - GLN Transport Company ID - GLN Consignor ID - GLN
		What	Consignment ID - SSCC Vessel ID - GIAI
		When	Date/Time of Departure
		Where	Location ID - GLN
		Why	Transport Label Allocation Links: Transport Label Allocation record
		Information to be shared to a traceability platform	
		• SSCC associated with new transport label	
FT CTE9	**Gate Out process recorded**	• Date and time stamp • Vehicle registration • Driver ID.	
		Key Data Element examples/guidance	
		Gate Out	
		Who	Logistics Service Provider ID - GLN Transport Company ID - GLN Driver ID - GSRN
		What	Consignment ID - SSCC Vehicle ID - GIAI
		When	Date/Time of Departure
		Where	Gate In/Gate Out Location ID - GLN
		Why	Arrival/Departure Links: Gate-in/Gate Out records
		Information to be shared to a traceability platform	
		• Gate out date and timestamp	
FTO CTE10	**Delivery** Gate in process Load units scanned and recorded in WMS/ERP system	• Vehicle registration • Driver ID • Driver site induction/access card number • Date and time • Transport label from load unit scan	
	Proof of Delivery completed	• Date delivered • Job number (transport company) • Invoice number (credit) • Freight paid by • Collected from location • Delivered to location • Number of load units or items • Contact name and number of Consignor • Terms & Conditions acceptance • Signature of Consignee	
	Goods received notified to supplier ERP	Usually EDI message listing • All or a portion was received • Discrepancy between content received and purchase order • Damaged items • Missing stock items	
	Gate out process completed	• Date and time stamp • Vehicle registration	
		Key Data Element examples/guidance	
		Loading	
		Who	Consignee ID – GLN Logistics Service Provider ID - GLN
		What	Consignment ID - SSCC
		When	Date/Time of EDI message issued

Event Code	CTE	Key data Inputs and Outputs	
		Where	Destination Location ID - GLN
		Why	Goods received Links: Goods received record
FT CTE11	**Returns and salvage** Consignor instructs transport company to return/dispose of rejected stock Returned load units scanned at unloading	• Transport label scan at loading • Transport label scan at un-loading	
		Key Data Element examples/guidance	
		Unloading	
		Who	Logistics Service Provider ID - GLN Driver ID - GSRN
		What	consignment ID - SSCC Vehicle ID - GIAI
		When	Date/Time of Return unloading
		Where	Destination Location ID - GLN
		Why	Return Links: Unloading record
		Information to be shared to a traceability platform	
		• SSCC of returned or disposed goods	
FT CTE12A	**Transport asset/load unit traceability** Apply scannable unique ID	Create load unit • SSCC number	
	Pallet transfer authority signed by consignee or consignor	Aggregating load units - Pooled pallet movement docket • Consignor ID • Consignee ID • Delivery date/ transfer of equipment date • Receival authorisation • Equipment ID • Number of pallets • Type of pallets • Driver signature • Customer signature	
		Key Data Element examples/guidance	
		Create Load Unit	
		Who	Consignor ID – GLN Logistics Service Provider - GLN Driver ID - GSRN
		What	Consignment ID - SSCC Vehicle ID - GIAI
		When	Date/Time of Returns loading
		Where	Consignor Location ID - GLN
		Why	Create Load Unit Links: Consignment Record
		Information to be shared to a traceability platform	
		• SSCC of pallets	
FT CTE12B	**Scan load units prior to unloading and when re-loading on transport vehicles**	Scan pallet SSCC at loading and unloading	
		Key Data Element examples/guidance	
		Unloading and Loading	
		Who	Transport Company ID - GLN Driver ID - GSRN
		What	Consignment ID - SSCC Vehicle ID - GIAI
		When	Date/Time of Unloading/Loading
		Where	Unloading/Loading Location ID - GLN
		Why	Unloading/Loading Links: Unloading/Loading records
FT CTE13	**Intermodal and multimodal transport** GPS tracking	• GPS coordinates longitude and latitude • Time and time zone	
		Key Data Element examples/guidance	
		GPS Tracking	
		Who	Transport Company ID - GLN Driver ID - GSRN
		What	Consignment ID - SSCC Vehicle ID - GIAI
		When	Date/Time of GPS transmission
		Where	Location and route ID - GLN
		Why	In Transit GPS tracking Links: GPS Tracking data
		Information to be shared to a traceability platform	
		• SSCC of returned or disposed goods	

Event Code	CTE	Key data Inputs and Outputs
FTO CTE14	**Gate In and Gate Out record**	• Entry and exit gate arrival/departure date and time • Vehicle registration number • Driver ID • Driver site induction • Security card number verification (ASIC/MSIC)
FT CTE15	**Transport company** Loading bay, transport vehicle, wagon allocation	• Recording load units allocated to each rail wagon/container on consist/vessel via new transport labels – new transport label scanned

Key Data Element examples/guidance

Arrival / Departure	
Who	Logistics Service Provider ID - GLN Transport Company ID - GLN Driver ID - GSRN
What	Consignment ID - SSCC Vehicle ID - GIAI
When	Date/Time of Arrival / Departure
Where	Gate in/Gate Out Location ID - GLN
Why	Arrival / Departure Links: Gate In and Gate Out record

Key Data Element examples/guidance

Loading	
Who	Logistics Service Provider ID - GLN Transport Company ID - GLN Driver ID - GSRN
What	Consignment ID - SSCC Container ID - GSIN Vehicle ID - GIAI
When	Date/Time of Loading
Where	Location and route ID - GLN
Why	Loading records

Event Code	CTE	Key data Inputs and Outputs
		Information to be shared to a traceability platform • GPS tracking data • Gate In and Gate Out date and time • SSCC associated with new transport label and vehicle
FT CTE16A	**Coastal shipping** Planning Bill of Lading signed by shipping line	• Cargo description • Consignor ID • Vessel the cargo is being transported on • Shipping line • Bill of Lading number • Freight forwarder • Consignee • Notify party (usually the freight forwarder of LSP
	Ship Arrival Notice	Message to nominated parties of – • Shipment reference number • Container number • Vessel name • Shipping line number • Estimated time of arrival
	Cargo Availability Notice	Message to nominated parties (consignee, transport company, LSP) Advice on Bill of Lading/Notice that freight is paid and container is released ready for collection
FT CTE16B	**Loaded truck/ train exits port**	Gate out record • Vehicle registration • Date and time • Container number

Key Data Element examples/guidance

Transport Departure	
Who	Port ID - GLN Driver ID - GSRN
What	Container ID - GSIN Vehicle ID - GIAI
When	Date/Time of Departure
Where	Port Location ID - GLN

Event Code	CTE	Key data Inputs and Outputs	
		Why	Transport Departure Links: Transport Status message Gate Out record
FT CTE17	**Delivery** POD signed by Consignee	• Date delivered • Job number (transport company) • Invoice number (credit) • Freight paid by • Collected from location • Delivered to location • Number of load units or items • Contact name and number of Consignor • Terms & Conditions acceptance • Signature of Consignee	

Key Data Element examples/guidance

Delivery	
Who	Consignee ID - GLN Receivals Staff ID - GSRN Driver ID - GSRN
What	Consignment ID – SSCC Number of load units or items
When	Date/Time POD signed
Where	Destination Location ID - GLN

Application of GS1 global data standards

Adoption of *global data standards* enables data sharing between businesses through using common formats. These formats allow a business to identify participants, locations, products, processes and events in the supply chain.

Data standards that apply to key data elements and shared information are identified in this section.

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Location	Food Processor, Dispatch Dock, Transport Company, Logistics Services Provider, Drop point, Storage	Global Location Number (GLN)	N13	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	Use-by Date, Date of transport booking, Date of pickup, Date of dispatch Date of goods delivery Date of goods receipt	Year -Month-Date	YYMMDD	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD
Product Identifiers	Outputs such as finished goods, packaged or processed goods	Global Trade Item Number (GTIN)	N14	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Traceability Attributes	Batch, Serial Number, Production Date.		AN20	Traceability Attributes, such as Batch or Lot Number, Serial Number, Production Date etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	Crate or Box of finished Goods, Pallet of Finished Goods.	Serial Shipping Container Code (SSCC)	N18	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Weights & Measures	Variable count of items. Count of items on a logistics unit. Total weight of pallet in NET Kilos. Total Length of goods delivered in Metres. Total volume of goods delivered in Cubic Metres.	Must be accompanied with a GTIN	Varying	Variable measure trade items use GS1 Application Identifier data fields that contains the quantity or dimension of a variable measure trade item. It also denotes the unit of measure. These element strings are used to complete the identification of a variable measure trade item. They contain information such as the weight, size, volume, or dimension of a variable measure trade item.
Assets	Returnable assets like IBC, crate, pallet Individual assets like transport vehicle, trailer, vessel, transport equipment etc	Global Returnable Asset Identifier (GRAI) Global Individual Asset Identifier (GIAI)	N13	Can be identified as an asset type only or an optional serial number can be added to distinguish individual assets. www.gs1au.org
Document dentifiers	Food transport Business licence, Vendor declarations, transport messages	Global Document Type Identifier (GDTI)		Can be encoded in a barcode or printed directly on the document. Companies can use the GDTI as a method of identification and registration of documents and related events. www.gs1.org
Service provide rand recipient relationships	Driver ID, Consignee receivals staff	Global Service Relationship Number (GSRN)		Service providers and service clients can be individuals or businesses. The GSRN can identify either a recipient or a provider of the organisation's services, and often both roles need to be captured or recorded simultaneously. www.gs1.org

Useful links

Transport and handling of certified organic produce

www.awe.gov.au see Section 2
www.awe.gov.au
www.awe.gov.au

Food Transport business establishment, licensing and registrations

www.service.nsw.gov.au
ablis.business.gov.au
www.primesafe.vic.gov.au
www.safefood.qld.gov.au

Vehicle and driver licensing and regulation

National Heavy Vehicle Regulator
www.nhvr.gov.au
info.australia.gov.au

Chain of Responsibility

www.nhvr.gov.au

Transport asset/load unit traceability
austlogistics.com.au

Plant and animal biosecurity certification for interstate transport
www.interstatequarantine.org.au

List of Abbreviations

3PL - Third Party Logistics

CVD - Commodity Vendor Declaration

LTL - Less than full truckload

IBC - Intermediate Bulk Container

LCL - Less than full container load

FSANZ - Food Standards Australia New Zealand

FCL - Full Container Load

FTL - Full Truck Load

Glossary

Advance Shipping Notice

An advance ship notice or advance **shipping** notice **(ASN)** is a notification of pending deliveries, similar to a packing list. It is usually sent in an electronic format and is a common EDI document.

ASIC/MSIC

An Aviation Security Identification Card (ASIC) and Maritime Security Identification Card (MSIC) is required for drivers entering air and sea ports in Australia.[6]

Bill of Lading (BOL)

The Bill of Lading is used for international shipments and for coastal shipping processes. The BOL contains all the pertinent details required to ship the product and then invoice the transaction correctly once the transaction is completed.

It acknowledges the receipt of cargo, provides evidence of contract of carriage and documents title of the goods.

Cargo Availability Notice

Once a Bill of Lading is marked as all freight paid and cleared with Customs, a notice may be sent to the consignee and their transport company that the cargo is now available for collection from the port of discharge.

Chain of Responsibility (COR)

The aim of COR is to make sure everyone in the supply chain shares responsibility for ensuring breaches of the Heavy Vehicle National Law do not occur. Under COR laws if you are named as a party in the chain of responsibility and you exercise (or have the capability of exercising) control or influence over any transport task, you have a responsibility to ensure the Heavy Vehicle National Law is complied with.

The law recognises that multiple parties may be responsible for offences committed by the drivers and operators of heavy vehicles. A person may be a party in the supply chain in more than one way. For example they may have duties as the employer, the operator and the consigner of goods.

Legal liability applies to all parties for their actions or inactions. The parties in the Chain of Responsibility for a heavy vehicle are:

- an employer of a driver
- a prime contractor for the driver – if the vehicle's driver is self-employed
- an operator of the vehicle
- a scheduler for the vehicle
- a loading manager for any goods in the vehicle
- a loader and/or unloader of a vehicle
- a consignor of any goods for transport by the vehicle
- a consignee of any goods in the vehicle
- a loader and/or unloader of any goods in the vehicle.[7]

Consignor

The owner of the goods being contracted to be shipped/transported. The agent for the consignor may be their 3PL operator but the party known as the consignor is the owner of the product. The consignor is responsible for the goods in transit until the nominated consignee signs for receipt of the goods.

Consignee

The consignee is the recipient of the goods being shipped. A consignee is a customer or client. Although products may be transported to a warehouse operated separately from the listed consignee, legally the responsible ultimate owner of the product is the consignee.

Consignment Note

The consignment note is a key document used in transporting freight within domestic supply and in the landside logistics of import and export.

The goods are deemed to be "on consignment" until they reach the consignee.

The document is prepared by the consignor and countersigned by the transport carrier as a proof of receipt of the consignment for delivery at the destination.

Container Weight Declaration (CWD)

A CWD is a written declaration of the weight of a container and its contents. It may be either in hard copy or electronic form, or a placard attached to the freight container. It may consist of one or more documents in different formats – for example, documents may be in the form of a sheet of paper, an email, on an electronic device, or in otherwise electronic form – but in any case, it must be able to be produced in its entirety, to an authorised officer, upon request.

Although there is no specific form for a CWD, it must include the following information:

- weight of the container including its contents
- container number and other details necessary to identify the container
- name and residential address or business name and address in Australia of the responsible entity for the freight container
- date of declaration.

Delivery Order

A document from the Consignor of the freight which orders the release of the cargo to another party. This permits the delivery direct to a warehouse or depot, as organised with the Consignee. This enables the Consignor to order pick up of product from a 3PL warehouse in order to deliver to the party named in the Delivery Order.

FSANZ

Food Standards Australia New Zealand (FSANZ) is a statutory authority in the Australian Government Health portfolio. FSANZ develops food standards for Australia and New Zealand.

The Code is enforced by state and territory departments, agencies and local councils in Australia and the Australian Department of Agriculture and Water Resources for food imported into Australia.

[6] www.homeaffairs.gov.au/transport-security/Pages/identity/applying-asic-msic.aspx

[7] www.nhvr.gov.au/safety-accreditation-compliance/chain-of-responsibility/about

Load Unit

The Principle of Unit Load states that, "it is quicker and economical to move a lot of items at a time rather to move each one of them individually". In other words, this principle suggested that the larger the load handled, the lower the cost per unit handled. Packages loaded on a pallet, in a crate or any other way that enables them to be handled at one time as a unit is described as a load unit.

Load units may be pallets, tubs, barrels, shipping or intermodal containers, tanks, cages or unit load devices (airfreight).

Logistics Service Provider (LSP)

Logistics refers to the overall process of managing how resources are acquired, stored, and transported to their final destination. There are three major activities in logistics – inbound, outbound and reverse logistics. A logistics service provider is responsible for outsourced logistics activities, generally contracted to a product supplier or retail customer. The LSP provides a broader range of services as compared with freight transport.

LTL/LCL shipment and FTL/FCL shipment

LTL stands for "less-than-a truckload"; LCL stands for "less than a container full" shipment, which can require load de/consolidation to achieve cost-effective freight transport.

FTL stands for "full truckload" and FCL for "full container load".

Order Confirmation

A legally binding commitment to deliver specified good on specified terms. This enables the buyer to plan for receipt of these goods and if unconfirmed, to look to alternative suppliers.

Proof of Delivery (POD)

A commercial document used by the Consignee or their Logistics Service Provider to notify the Consignor of the receipt and acceptance of a delivery. A signed POD enables the Transport Company to raise an invoice.

Purchase Order

A commercial document issued by a buyer to a supplier. This is a legally binding offer to buy product in return for payment. The terms and conditions for delivery and payment are detailed in this document, which also details the product quantity, price, terms and conditions, product quality specifications.

Ship Arrival Notice

A notice is sent from a shipping line, freight forwarder to advise nominated parties e.g. consignee, transport company of the arrival of the vessel and container at the discharge port. This enables the consignee and their transport company to make a vehicle booking to collect the cargo when it is cleared.

Third Party Logistics (3PL)

Outsourcing of distribution, warehousing or fulfilment. In food logistics, a 3PL may operate storage for multiple food suppliers or retailers, often specialising in cold chain management, a specific product, or distribution at a national, metropolitan or regional level. 3PL warehouses may assemble products for promotions, prepare in-store product displays. Through their warehouse management system they monitor inventory and interact with customers to manage inventory, assembling orders and preparing for dispatch. A proportion of 3PL suppliers also offer distribution and delivery services.

Transaction Certificate for Certified Organic produce

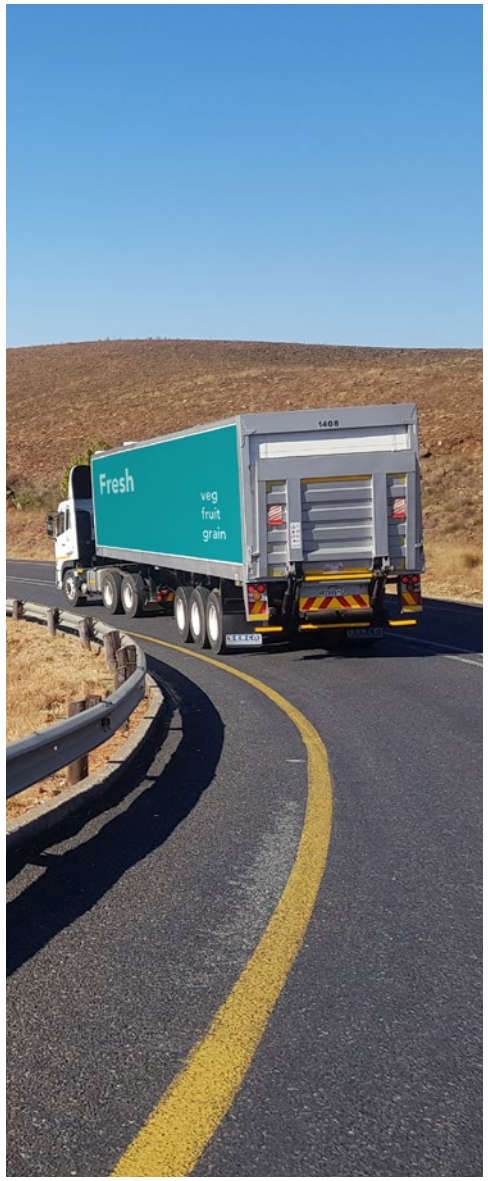
A Certificate issued by the authorised Organic Certifying Body to confirm the goods in a consignment are produced in accordance with national and international standards. These certificates are for export to countries where Australia has established equivalency in terms of requirements related to certified organics, such as US Department of Agriculture National Organic Program (NOP), Japanese Agriculture Standard (JAS). Organic produce cannot be shipped internationally without the Transaction Certificate or Organic Goods Certificate.

Transport Declaration for Certified Organic produce

The purpose of a Transport Declaration is to provide signed declaration that the requirements for Certified Organic produce transport have been adhered to and the Transport Operator has implemented those requirements for a specified consignment, in accordance with international and national standards for certified organic produce.

Vendor Declarations

Vendor declarations relate to regulatory requirements associated with biosecurity, traceability and safety. They can include Commodity Vendor Declarations for movement of fodder or grains, Container Weight Declaration for mass management.



Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Wholesale & Distribution of Organic Produce

Organic Produce Wholesale And Distribution

Food wholesalers and distributors provide producers with a channel to market through receiving product from suppliers and distributing to retail or food service.

The transactions in wholesale are between businesses (B2B) and generally don't involve direct to consumer sales. They are often in larger volume lots e.g. bulker bags, full cases suitable for caterers, restaurants, or retail re-packaging.

Typically, the wholesaler may hold a range of products in volume from growers, packers and processors, or may specialise in a particular product category such as organic produce.

Using a wholesaler or food distributor saves retailers and food service the need to interface with multiple suppliers or organise individual pick up and deliveries. The ability of the wholesale buyer to purchase in bulk can represent savings for small businesses such as restaurants and specialist retailers.

A food distributor may act as an agent for a food processor, selling the product to retailers or food service operators. Distributors may work directly between growers, processors and retailers, with wholesalers supplying retail and food service or directly servicing institutions such as hospitals or schools.

Distribution centres may be operated by a retailer or wholesaler or supplied by an outsourced third-party logistics company (3PL). Perishable produce come into warehousing for short term storage, to be grouped according to destination. Distribution centres may break down bins or pallets of the product to re-group them for a retail outlet or a specific delivery geography. They may cross-dock the freight for this purpose without breaking down the load unit, transferring a truckload of pallets to outbound vehicles for different destinations. Products from other sources can be also loaded on the same vehicle.

The workflow and tasks of a full-service distribution centre commence when goods are received from a source and end when goods are received by the customer business. Returned products may re-enter the wholesaler/ distribution centre or be directed to a specialised section/facility.

Wholesalers rely on effective warehouse management systems to keep control of inventory and distributors rely on both warehouse management and transport management systems to direct inbound and outbound products.

The traceability challenge is to maintain the identity and location of organic product as it is received, unpacked, stored, picked and packed for outbound delivery. Co-mingling of product and shrinkage due to damage or error are a risk in wholesaling and distribution activities.

Processes covered in this module include:

- Establishing identities
- Inbound product receival at wholesaler or distribution centre
- Storage of the product
- Sale of the product
- Distribution to food operators.

Establishing identities

The creation of unique identifiers for suppliers, the wholesaler and distribution centre, as well as customers will enable accurate information relating to the chain of custody of the product and enhance track and trace processes. Recording this data in the context of a sale and subsequent movement of the product, can accelerate the speed of locating product and accounting for shrinkage in this segment of the supply chain.

Identifiers may be recorded as a Property Identification Codes (if goods are supplied directly from producer); a Food Business Licence number; or a readable business name and address on the item or carton label. At a supply chain level, a Global Location Number incorporates information on the business entity and location which can be used as a unique code to locate the business geographically and as a trading entity.

Identification of products at item, lot, tray, carton level and subsequently at load unit level (e.g. pallets, crate or bin), is critical to traceability in wholesale and distribution centre operations as the product may be broken down or consolidated to any of these levels during processes such as cross-docking, put away in cool storage, picking and packing and assembling customer orders for dispatch.

Attributes can be associated with the product using these identifiers, to support inventory management (e.g. best-before, expiry date, Certified Organic, temperature) and in expediting delivery to customers (specific instructions, dock number, open hours).

Certification as an organic produce handler

Organic certification by growers ensures the application of organic standards in production of the product.

Businesses that handle this produce can certify against the *National Standard for Organic and Bio-Dynamic Produce* to ensure handling and storage practices maintain the certified status the grower has achieved.

A Certified Organic Handler is audited against the standard. Key matters to address are:

- An organic goods handling plan
- Prevention of co-mingling with non-certified produce
- Prevention of contamination during treatment of produce e.g. gassing of bananas
- Prevention of contamination by chemicals used for cleaning, pest control
- Cleaning of surfaces where certified organic produce is placed e.g. further packing
- Use of fumigants.

In relation to traceability, the organic standard requires the handler to record the organic status of produce suppliers and to ensure a traceability record system is in place for produce supplied and sold/distributed.

Tasks related to traceability

- Certification as a Certified Organic handler
- Completion of food safety regulation and licensing
- Creation of unique identities for the business and supply chain partners e.g. suppliers and customers and their locations
- Creation of unique identifiers for the products traded or handled
- Creation of unique identifiers for the load units that contain the product.

Key Participants

- Wholesaler
- Suppliers (growers, processors)
- Property identification issuing organisation
- Global Location Number issuing body
- B2B Customers
- Food Authorities – state and local government
- Organic Certifying bodies.

Inbound product receival at wholesaler or distribution centre

Most wholesalers and distribution centres receive product on a load unit such as a pallet. Each load unit is affixed with a logistics label that contains information relating to the load in both human readable form and barcoded. Each load unit is typically scanned by the Transport Company prior to unloading, capturing key traceability information (product, lot number, best before date, quantity).

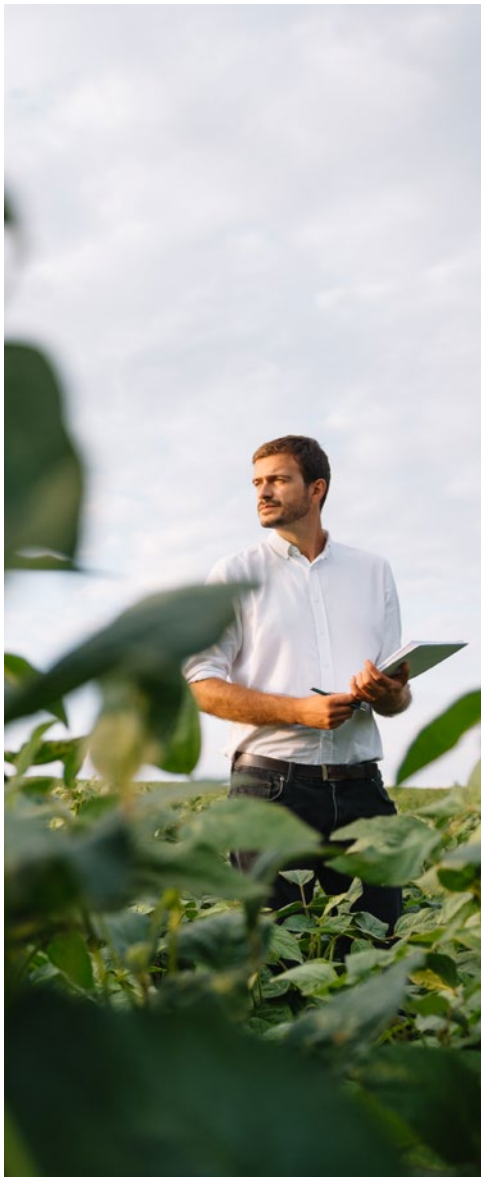
Warehouse/Distribution Centre (DC) staff need to conduct an inspection which confirm the following:

- the use-by or best before dates are consistent with shelf-life specifications
- the product is undamaged in its packaging
- spills or contamination by pests have not occurred
- the products as listed in the *Delivery Documentation tally*.

Once the inspection is complete, receival staff will unload the consignment and sign a Proof of Delivery, effectively proving the receipt of the goods.

Once unloaded, the inbound product is entered in the Inventory Management System and received product is then moved to an allocated bay for re-loading for outward dispatch (cross-docking), or put away in an allocated slot in the warehouse/DC, where the systems are updated. Some organisations may have implemented Warehouse Management Systems (WMS) to manage the movement of stock.

Fresh produce storage is generally divided into temperature levels – ambient or chilled.



Tasks related to traceability

- Inspect inbound product – reject of accept all or part of a consignment
- Sign Proof of Delivery
- Notify supplier of Purchase Order reconciliation with Supplier Invoice
- Enter goods receipt into Inventory systems. Best practice is to scan product barcode/identifier into the warehouse management system
- Record use-by/product expiry date
- Allocate to identified storage slot, bay or floor grid area
- Customer re-packs rejected stock and re-labels if new packaging is used
- Return or disposal of rejected stock.

Key Participants

- Receival staff
- Transport driver
- Warehouse operations staff
- Accounts staff.

Storage of the product

Food product *warehouse management systems* manage multiple needs, such as

- Inventory management – including First-In:First Out (FIFO) or First Expiry:First out (FEFO), rotation of product
- Visibility of stock down to bin location by lot number
- Stock counts
- Provide visibility of stock levels for customers and sales agents – often across several storage sites
- Order fulfilment
- Labelling of stock
- Shipment tracking of in-transit goods
- Returns monitoring
- Security and food safety
- Temperature, humidity requirements.

Wholesalers and Distribution Centres carry multiple stock keeping units (SKUs) and for those managing e-commerce operations, multiple item-level stock.

Different methods and technologies are used for tracking product in storage, including

- Barcode scanning of associated storage location
- Voice pick systems to manage order fulfilment
- Active RFID tags to track product movement within the storage facility
- Spreadsheets.

Quality control and inspection of stock

The quality assurance (QA) department performs periodic checks of random samples of stock to ensure their condition meets a certain required standard. Products are checked throughout the warehouse racking, goods in and returned stock phases. The inspector may also do cycle counts to identify missing stock. Quality control requirements are often associated with retailer standards or industry standards specific to the type of food being inspected e.g. organic.

Providing visibility for customers and sales agents

Availability of stock is made visible for Customers' *Order Management Systems* through integration with the Wholesaler or Distribution Centre Warehouse Management System.

Tasks related to traceability

- Location of stock by item, lot, carton and pallet
- Count of stock keeping units (SKUs)
- Visibility of stock levels to customers and suppliers
- Quality Assurance inspection
- Recording of stock shrinkage in storage
- Returns monitoring
- Food safety compliance
- Monitoring of storage conditions e.g. temperature, humidity.

Key Participants

- Warehouse operational staff
- Suppliers
- Customers
- Quality Assurance inspectors and auditors
- Food safety auditors
- Customer auditors.

Continuous data logging from calibrated sensors is the preferred approach for cold storage. In less critical, short term or smaller business operations, monitoring must be sufficiently frequent to detect trends, and in particular malfunctions, in temperature control. At a minimum, temperature readings must be at least twice daily.

Sale and dispatch of the product

Product sales for Wholesalers commence with a Customer Purchase Order, or Customer Account Orders for replenishment of stock levels at food operators. This activates the Order Acknowledgement and Order Confirmation detailing the specified goods to be delivered and terms of the sale. An Order Confirmation is dependent on the wholesaler ensuring the stock is available, highlighting the value of visibility of stock levels and locations.

The Customer Order is then initiated, and a packing (or picking) list is created to ensure the right products and quantities are picked and assembled for packing for outbound delivery. As products are picked, they are scanned according to the packing list. Some products are required to be packed into store-ready displays or require additional labelling for sales promotion. This is completed and product is re-packaged prior to palletising.

In the packing area the product is scanned as it is loaded to a transport asset load unit such as a pallet or tub. At this stage the product identification is now associated with this load unit. The pallet is shrink wrapped and a transport label affixed, which now associates each item or carton to the load unit and transport management system (vehicle registration, transport booking reference, delivery order and consignment note).

An Advance Shipping Notice is prepared for the customer and issued. This allows the customer to prepare for the inbound stock.

The product is now ready for delivery and a Delivery Order is prepared for the Transport Company, detailing the consignment instructions.

A Consignment Note is prepared to facilitate handover of the outbound shipment to the transport company.

An Invoice is then issued to the Customer requesting payment for the goods. Account credits are made for damaged, missing or returned stock. In some cases, the invoice is raised once the goods have been received by the customer and a delivery confirmation (Receipt Advice) is sent back.

Tasks related to traceability

- Receipt of Purchase Order from customer
- Product picked and packed and linked to a logistics unit
- Advance Shipping Notice issued to the customer
- Customer Invoice issued
- Transport Management System booking reference assigned.

Key Participants

- Sales representatives and agents
- Warehouse operational staff
- Wholesaler administrative staff
- Customers
- Transport suppliers.

Delivery to food operators

For wholesalers and distribution centres, the Proof of Delivery message indicates the delivery has been received by the Customer.

The Customer will communicate any under or over delivered stock, damaged or missing stock against their Purchase Order and notify the Wholesaler within a specified timeframe so the under/over stock can be included in the next order.

Arrangements for return of damaged or rejected stock are made as per sale terms and conditions. Returned stock will either be disposed of or re-enter the inventory of the wholesaler once its disposition is determined. Recording this stock and its re-entry or disposal will be required for traceability audit.

The complexity around handling returns mandates the following rules: - When customers return goods, they should seek, and be given Return Management Authorisation, which outlines what is being returned and why. - All returns must be traceable, to their order, document and invoice. - Companies must have a pre-determined returns process that delineates what is to be done with the goods once received back into the warehouse, e.g. return to stock, repair, destroy, discard, recycle, return to manufacturer, etc. - All credits must be system-recorded together with reasons why the goods are returned. - Inventory must be updated where goods are returned to stock, or held for further action.[1]

Tasks related to traceability

- Proof of Delivery received
- Reconciling Purchase Order with Invoice
- Stock returns management.

Key Participants

- Transport Company
- Customer
- Warehouse operations staff.

[1] AFGC Australian Food Cold Chain Logistics Guidelines 2017 www.afgc.org.au

Critical Tracking Events

For each of the identified wholesale and distribution activities, **critical tracking events (CTEs)** establish identity and enable traceability and compliance with traceability-related regulation are summarised as follows:

Critical Tracking Events (CTEs) are events that relate to the identity, movement or transformation of the food product.

Wholesale and distribution activity	CTE code	Critical Tracking Events (CTEs)
Certification as a Certified Organic Handler	**OWD CTE1A**	Implementation of Organic Handling Plan
Establishment of unique identifiers	**OWD CTE1B**	Creation of unique identities for the business and supply chain partners; products traded or handled
Licensing and food safety program establishment	**OWD CTE1C**	Registration of food premises and food safety plan enacted
Receival from suppliers • Sign Proof of Delivery • Notify supplier of Purchase Order reconciliation with Supplier Invoice • Scan product barcode/ identifier into warehouse management system • Record use-by/ product expiry date • Allocate to identified storage slot, bay or floor grid area.	**OWD CTE2**	Receipt of Product completed and recorded in inventory systems.
Inspection • Inspect inbound product – reject of accept all or part of consignment • Quality Assurance inspection Food safety compliance.	**OWD CTE3**	Inspection can occur at time of receipt, or once stock putaway has been completed
Storage • Product moved from receiving area to warehouse location	**OWD CTE4**	• Put away stock in warehouse storage location
Monitoring produce • Count of stock keeping units (SKUs)		
• Visibility of stock levels to customers and suppliers	**OWD CTE5A**	• Inventory reports by lot and use- by/expiry dates
• Recording of stock shrinkage in storage		
• Monitoring of storage conditions e.g. temperature, humidity, pest inspections and treatments.	**OWD CTE5B**	• Monitoring of storage conditions temperature, humidity, pest inspections and treatments
Delivery preperation		
• Customer Purchase Order or on-line order received	**OWD CTE6A**	• Receipt of Purchase Order from customer
• Order Acknowledgement sent to customer	**OWD CTE6B**	• Consignment Note/Delivery Order prepared
• Stock availability checked and Order Confirmation sent to customer confirming terms of the sale • Customer Order created and packing list prepared • Product picked from storage • Product packed for outbound transport • Transport booking made and Delivery Order and Consignment Note prepared.	**OWD CTE6C**	• Transport label scanned and transport load units recorded
Delivery to Customer		
• ASN issued to Customer	**OWD CTE7A**	Delivery of Goods to supplier. • Advance Shipping Notice received by customer
• An Invoice is sent to the Customer • Proof of Delivery received from Transport Company • Reconciling Purchase Order with Invoice and ASN to identify over/under/ missing/reject stock	**OWD CTE7B**	• Signed POD from Transport Company
Returns Management	**OWD CTE8A**	Rejected stock re-packed and re-labelled with original item or lot number recorded
	OWD CTE8B	Enter stock ID prior to disposal or donation

Key Data Elements

Event code	CTE	Key data elements
OWD CTE1A	Certification as Certified Organic Handler	• Certified Organic Handler number • Certifying Body • Expiry date
OWD CTE1B	Creation of unique identities for the business entities, locations; produce traded or handled; load units that contain the produce	• Global Location Number • PIC code (growers) • Grower Certified Organic number
OWD CTE1C	Registration of food premises and food safety plan enacted	• Food Licence number **Information to be shared to a traceability platform** • Certified Organic Handler number, certifying body and expiry date • Global Location Number • PIC code (growers) • Food Premises Licence number and expiry date.
OWD CTE2	**Product Receival** • Inbound product receipted into Wholesaler/DC Warehouse Management System • Signed Proof of Delivery • Record FI:FO for lot, bins, cartons, pallets of product • Supplier notified of missing stock; under/over stock; damaged stock and returns – PO-DO-Invoice 3-way reconciliation.	• Supplier/Vendor ID • Supplier GLN • Purchase Order Number • Logistics unit ID • Product ID • Lot, Use-By or Best-Before date • Quantity • Date due for delivery and invoice payment • Invoice number • Code for rejection – under/over; missing; damaged; QA fail.

Goods receipt	
Who	Distributor/Wholesaler Issuing Agency
What	Purchase Order, Delivery Note, Logistics/Pallet ID, Product ID, Quantity, lot, Date Information
When	Date/Time of Receipt
Where	Receipt location
Why	Receipt of product

Event code	CTE	Key data elements
OWD CTE3	**Inspection** At goods receipt and during inventory management	**Information to be shared to a traceability platform** • Certified Organic Handler number, certifying body and expiry date • Global Location Number • PIC code (growers) • Food Premises Licence number and expiry date. • Supplier ID • Purchase Order Number • Logistics/Pallet ID • Product ID • Quantity • Lot Number • Code for rejection – under/over; missing; damaged; QA fail.

Goods Inspection	
Who	Distributor/Wholesaler Issuing Agency
What	Purchase Order, Delivery Note, Logistics/Pallet ID (SSCC) Product ID, Quantity, Lot, Date Information
When	Date/Time of Inspection
Where	Inspection location
Why	Inspection

Information to be shared to a traceability platform

- Product ID of produce removed from stock
- Quantity
- Lot ID.

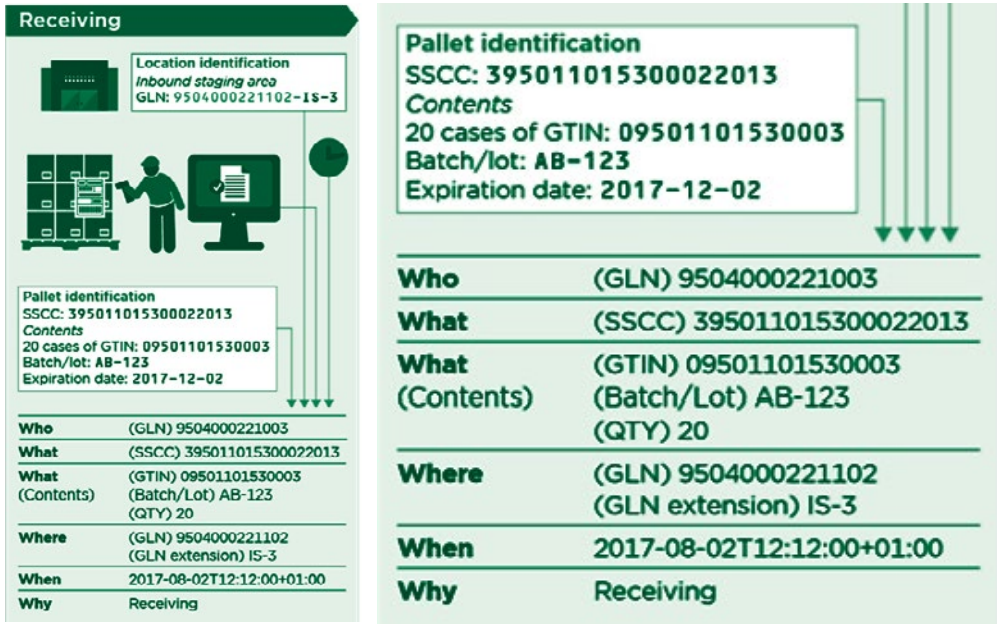
Event code	CTE	Key data elements
OWD CTE4	**Storage** Product Put away into storage location	• Use-by/expiry dates • Storage slot barcode identified on ERP/WMS system • Product barcode scan/identifier recorded at putaway **Put Away** **Who** Distributor/Wholesaler **What** Product ID, Quantity, Batch, Date Information, Logistics/Pallet ID **When** Date/Time of Put away **Where** Receipt location **Why** Stock Put away (movement) **Information to be shared to a traceability platform** • Product ID • Product quantity/SKUs in storage inventory • Product use-by; expiry dates
	Inventory Monitoring and reporting	
OWD CT5A	Inventory reports by lot and use-by dates Stock shrinkage records	Inventory level reports by • Lot/SKU number • use-by/expiry dates
OWD CT5B	Storage condition inspection	Temperature • Temperature records twice daily (°Celsius) • Corrective actions • Inspector name and signature **Pest incursion and treatment compliant to certified organic standard** • Date and time of inspection and treatment • Supplier ID of chemical/product used • Product name, batch number and expiry date • Rate of application • Pest Report document ID.

Event code	CTE	Key data elements
	Order preparation	
OWD CT6A	Receipt of Purchase Order from Customer	Inbound Purchase Order - • Customer name and location • Seller name and location • Product quantity • Product price • Terms and conditions of sale • Product quality specifications • Delivery terms and conditions • Payment terms and conditions. **Pest incursion and treatment compliant to certified organic standard** • Date and time of inspection and treatment • Supplier ID of chemical/product used • Product name, batch number and expiry date • Rate of application • Pest Report document ID.
OWD CT6B	**Consignment Note Delivery Order prepared**	Consignment note: • Consignor company name, email, address, contact, telephone • Consignor company name, email, address, contact, telephone • Deliver to company name, email, address, contact, telephone • Delivery instructions – this may include required handling of certified organic produce • Goods description – product, number of units, weight, dimensions
OWD CT6C	**Transport label scanned and transport load units recorded**	Goods dispatch - • Transport label scan (SSCC of each load unit) **Information to be shared to a traceability platform** • Purchase Order number • Product ID • Lot number/Use by/Best before dates • Quantity picked • Bin/Storage location • Date.

Event code	CTE	Key data elements
OWD CTE7	**Delivery to Customer** • Transport Management System booking • POD from Transport company • ASN received by Customer • Invoice issued to Customer • Reconciliation of PO: Invoice: ASN and list variations in message to Wholesaler/DC.	• Booking Reference/Tracking number/Consignment note/Delivery Order number • POD/Receival Advice • ASN number • Supplier invoice number • Item/lot code • Quantity missing/under/over supplied or rejected. **Information to be shared to a traceability platform** • Purchase or Customer Order Number • ASN number • Consignment note number.
OWD CTE8A	**Returns management** Rejected stock re-packed and re-labelled with original item or lot number recorded	• Original lot code recorded • New lot code recorded • Quantity • Load unit SSCC • Shipment number • New Consignment Note issued.
OWD CTE8B	Enter stock ID in Inventory system/ WMS prior to disposal	• Item and Lot ID, quantity of stock for disposal, waste (potential reuse/composting) • Stock disposal recorded in WMS **Information to be shared on Traceability platform** • Return Identification • Product ID, Lot and quantity returned • Returned Date • Reason for return • Logistics unit identifier.

Application of GS1 global data standards

Adoption of global data standards enables data sharing between businesses through using common formats. These formats allow a business to identify participants, locations, products, processes and events in the supply chain.



Source: GS1 Global Fruit and Vegetable Traceability 2021

The following data standards have been defined and included to support the list of CTEs and KDEs listed in this module.

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Location	Distributor Receiving Dock	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	Date of stock receipt, date of despatch	Year-Month-Date	**YYMMDD**	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD.
Product Identifiers	Packaged Product	Global Trace Item Number (GTIN)	**N14**	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org
Traceability Attributes	Batch, Serial Number, Production Date	AI (10) = Batch	**AN20**	Traceability Attributes, such as Batch or Lot Number or Serial Number etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	Pallet of packaged product	SSCC	**N18**	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Returnable Asset	Chep Pallet	AI (8003)	**N29**	The Returnable Asset Identifier is especially suitable for the management of reusable transport items, transport equipment, and tools. It can identify these returnable assets by type and if needed also individually for tracking and sorting purposes www.gs1.org
Consignment	Grouping of logistics units assigned by the transport company	GINC	**N30**	The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together. www.gs1.org
Shipment	Grouping of logistics units	GSIN	**N17**	The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together. www.gs1.org

Useful links

Certified Organic Handler
ACOStandards
www.agriculture.gov.au

Food Safety in transport and distribution
www.foodsafety.com.au
www.foodstandards.gov.au
www.freshcare.com.au
ablis.business.gov.au
www.afgc.org.au
afccc.org.au

GS1 Global Fruit and Vegetable Traceability
gs1go2.azureedge.net

Glossary

Advance Shipping Notice (ASN)

An advance ship notice or advance **shipping** notice **(ASN)** is a notification of pending deliveries, similar to a packing list. It is usually sent in an electronic format and is a common EDI document.

B2B/E2E

Business -to-Business and Exchange-to-Exchange describes the IT system and business transactions between trading partners in a supply chain. In E2E transactions of data it is presumed these are automated processes.

Certified Organic

A certified organic product has been produced, handled and sold in accordance with the Australian Certified Organic Standard 2021 (domestic) or the National Standard for Organic and Biodynamic Produce 2016 (export).

Consignment Note

The consignment note is a key document used in transporting freight within domestic supply and in the landside logistics of import and export.

The goods are deemed to be "on consignment" until they reach the consignee.

The document is prepared by the consignor and countersigned by the transport carrier as a proof of receipt of the consignment for delivery at the destination.

Cross dock

An area within a warehouse or distribution centre where inbound goods are sorted and re-loaded on transport without storage. Bays in a cross-dock are temporary holding locations for goods prior to re-loading.

Delivery Order (DO)

A document from the Consignor of the freight which orders the release of the cargo to another party. This permits the delivery direct to a warehouse or depot, as organised with the Consignee. This enables the Consignor to order pick up of product from a 3PL warehouse in order to deliver to the party named in the Delivery Order.

First in: First out (FI-FO)

FO-FO is a stock rotation mechanism based on recording the best-before/use-by/expiry date of food product received into a warehouse management system, to ensure food product is not overlooked and wasted due to expiry of these dates.

Inventory Management

Inventory is goods in raw form, bulk or packaged ready for sale. Management of inventory in the wholesale and distribution phase involves tracking and controlling this stock, generally in its finished product condition, ready for sale and delivery to food business operators.

Load Unit

The Principle of Unit Load states that, "it is quicker and economical to move a lot of items at a time rather to move each one of them individually". In other words this principle suggested that, the larger the load handled, the lower the cost per unit handled. Packages loaded on a pallet, in a crate or any other way that enables them to be handled at one time as a unit is described as a load unit.

Load units may be pallets, tubs, barrels, shipping or intermodal containers, tanks, cages or unit load devices (airfreight).

Order Acknowledgment

An Order Acknowledgment is a commercial document/electronic message issued by the Wholesaler or Distribution Centre acknowledging receipt of the Purchase Order.

Order Confirmation

A legally binding commitment to deliver specified good on specified terms. This enables the buyer to plan for receipt of these goods and if unconfirmed, to look to alternative suppliers.

Order Management System

An order management system (OMS) is a tool that records all the sales and purchase order details of a business on a single platform.

Proof of Delivery (POD)

A commercial document used by the Consignee or their Logistics Service Provider to notify the Consignor of the receipt and acceptance of a delivery. A signed POD enables the Transport Company to raise an invoice.

Purchase Order (PO)

A commercial document issued by a buyer to a supplier. This is a legally binding offer to buy product in return for payment. The terms and conditions for delivery and payment are detailed in this document, which also details the product quantity, price, terms and conditions, product quality specifications.

Quality Assurance (QA)

In the context of food distribution and storage, QA involves compliance with regulatory requirements (based on Food Safety standards) and the specifications of industry and customer standards. Some QA standards and certification programs are

Freshcare

Freshcare is an industry owned, not-for-profit on-farm assurance program, established and maintained to service the Australian fresh produce industry. Freshcare is currently the largest Australian on–farm assurance program for fresh produce; proudly providing on-farm food safety & quality and environmental certification services to over 5000 members nationally.

Global G.A.P

Global G.A.P is a not-for-profit organisation with a crucial objective: safe, sustainable agricultural production worldwide. We set voluntary standards for the certification of agricultural products around the globe — and more and more producers, suppliers and buyers are harmonising their certification standards to match.

GFSI

The Global Food Safety Initiative (GFSI) is a business-driven initiative for the continuous improvement of food safety management systems to ensure confidence in the delivery of safe food to consumers worldwide. GFSI provides a platform for collaboration between some of the world's leading food safety experts from retailer, manufacturer and food service companies, service providers associated with the food supply chain, international organisations, academia and government.

HARPS

The Harmonised Australian Retailer Produce Scheme (HARPS) is a retailer-led scheme designed to assist with compliance to food safety, legal and trade legislation for suppliers to the major grocery retailers in Australia, by harmonising certification requirements for the major retailers in Australia.

SQF

SQF is recognised by retailers and food-service providers around the world who require a rigorous, credible food safety management system. The SQF Program is recognised by the Global Food Safety Initiative (GFSI) and links primary production certification to food manufacturing, distribution and agent/broker management certification.

Return Merchandise Authorisation (RMA) or Returns Authorisation Notice (RAN)

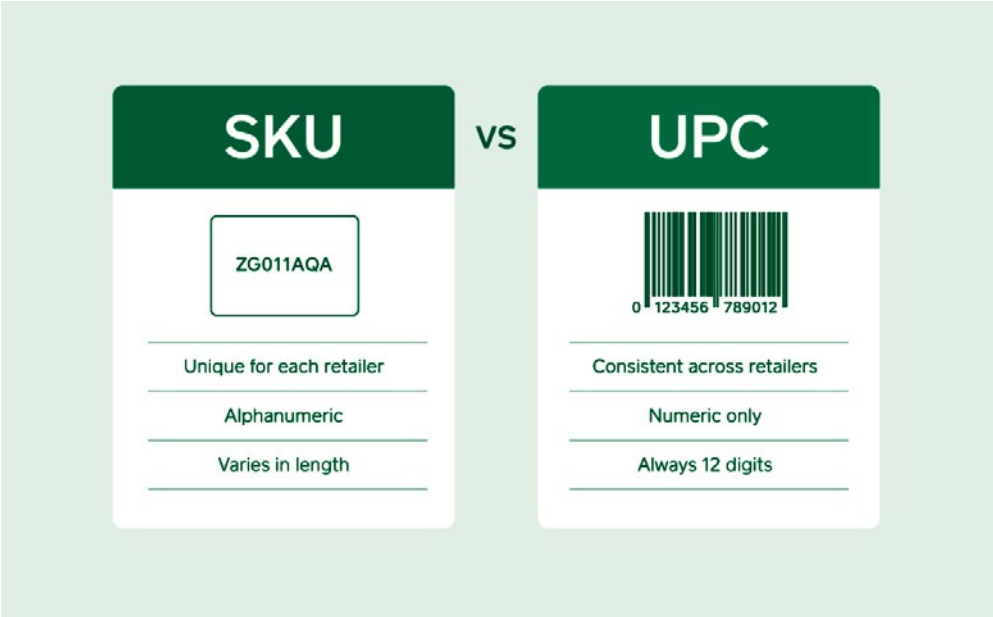
A form used commonly in e-commerce to facilitate the return of product. The RMA details the reason for return of the product and enables execution of the agreed returns policy between the wholesaler and food business operator.

Shrinkage

Shrinkage of product in wholesale and distribution refers to the loss of stock and its value due to administrative errors, product deterioration and damage (e.g. packaging, contamination), theft or fraud.

Stock Keeping Unit (SKU)

Retailers use SKUs to identify products placed on sale to consumers. They are distinct to each retailer and designed for internal purposes. In connected Point of Sale and Inventory Management Systems, retailers may choose to track product based on their SKUs. Use of SKU number in traceability is limited at a supply chain level in comparison to a Universal Product Code (UPC) barcode symbol.



Transport Management System (TMS)

A TMS enables a wholesaler or distributor to coordinate movement of product from one location to another, including procurement of transport services, planning of inbound and outbound delivery route, transport mode and timelines, product tracking in transport processes and transport invoice control.

Warehouse Management System (WMS)

A warehouse management system is a software solution to manage and optimise inventory and supply chain operations in a distribution centre. Typical functions of a WMS include

- Receiving products
- Tracking stock
- Efficient storage
- Picking and packing product for delivery
- Dispatch of goods
- Returns management
- Messaging between suppliers and customers.

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Retail

Organic Fresh Produce Retail

This module covers key activities that generally take place along a retail business supply chain where organic fresh produce is sold to customers and usually to be consumed elsewhere. Retail businesses may include supermarkets, green grocers, convenience stores, or market stalls.

The National Standard for Organic and Bio-Dynamic Produce outlines the following principles for wholesalers and retailers in relation to organic products:

- Wholesalers and retailers should source Australian certified organic or bio-dynamic produce to ensure a consumer has confidence that the purchased product complies with this nationally recognised Standard
- To maintain consumer confidence, Australian retailers and wholesalers should be certified in accordance with this Standard
- Wholesalers, retailers, and exporters of certified products ensure the ongoing integrity of products through segregation, protection from contamination, truth in labelling, and documentation.

Section 7 of this National Standard states:

"The operator will ensure that all in-conversion, organic and/or bio-dynamic produce is: clearly labelled in accordance with the requirements of this Standard; and sourced and transported in such a manner so as to maintain the in-conversion, or organic, or bio-dynamic integrity."

"An operator who re-packs and/or labels in-conversion, organic or bio-dynamic produce must be certified in accordance with this Standard."

"Where conventional and in-conversion, organic or bio-dynamic produce is contained or displayed within the same area/building, products must be separately stored or displayed and clearly labelled."

"An operator will not display any advertising material or products that are misleading or confusing to consumers."

"For the cleaning and sanitising of equipment and areas used within the retail, wholesale or export operation, the operator will only use those inputs listed in the Appendix E of the Standard."

"Only products produced in accordance with this Standard are eligible for an Organic Goods (export) Certificate, which can be issued by an approved certifying organisation or competent authority.

As an example of how this Standard is applied, according to the Australian Certified Organic Standard 2021 "a clearly traceable audit trail shall be maintained by the Retailer for all certified products handled and traded, to be made available to the certifying body at any time on request. Where non-certified products are also traded, the audit trail shall clearly enable tracing of both organic and non-certified traded products. Onus is on the Retailer to ensure all traded produce is sourced from currently certified producers. This shall include maintenance of updated certificates or similar documentation that outlines producer certification number, certification status and expiry date."

In this module, processes/activities associated with Retail operators include:

- Establishing Master Data
- Sourcing of product suppliers
- Auditing suppliers for traceability and food safety
- Inventory management in 3rd Party Logistics warehousing and Retail Distribution Centres
- Receipt of food product
- Storage of inbound product
- Ensuring food integrity, quality and safety
- Point of Sale data capture
- Product returns and store salvage.

Establishing Master Data

Regulatory agencies may mandate establishment activities for food retail businesses. This can be required for local, state or national government responsibilities, such as ensuring the entity can be located in the circumstance of a food safety or health risk-related disease outbreak or food recall.

Councils classify every food premises within their municipal districts. Classification is determined by the food safety risk of the premises. The registering Council will determine the classification of the premises. All food retail businesses need to apply for a licence and registration with their local Council. This licence is annual.

In addition to having a food business licence number, creating a unique identification and location reference for the retail business will enable food logistics and traceability of inbound shipments to be undertaken efficiently. This is effective for food retailers with multiple outlets, enabling each to have a unique identifier for use in distribution.

Organic Certification of Retailers

Retailers selling organic fresh produce may become certified to maintain certified organic status of supplied product in handling and trading the product. They may also seek to create a retailer brand for the product, while maintaining the certified organic status gained by the grower.

Organic certification as a retailer requires an annual audit conducted by one of Australia's organic certification bodies against the *National Standard for Organic and Biodynamic Produce* (2016). Importantly, a certified organic retailer can use the certified organic bud logo indicating to the consumer that the product is certified organic. This is a distinct value representing assurance for the consumer that the produce is genuinely produced according to certified organic production systems, given the term "organic" may be used on labelling in Australia for products without organic certification.

Traceability can be created through establishing the identity of items supplied, suppliers and businesses handling inbound product. Assets used to store and move product can also be identified and correlated with the product and locations.

Key tasks related to traceability

- Certify as a trader/handler of organic produce
- Allocate a Global Location Number (GLN) (entity and location) to each retailer distribution centre, warehouse and retail outlet
- Ensure Logistics Service Providers such as 3PL (third party logistics) storage are identified
- Request GLN of suppliers
- Create identification of own transport assets such as store-ready pallets, trays, bins or tubs
- Ensure unique identification of each item or lot sold.

Key participants

- Retailer
- Logistics service provider/3PL
- Suppliers to retail
- Organic certifying body
- GS1 supplier of unique supply chain identifiers.

Sourcing of organic produce

Identifying, contracting and managing product suppliers is a major activity for food retail businesses. Sourcing involves –

- Establishing the requirements for products
- Defining the sourcing strategy to follow
- Sourcing potential suppliers from local and overseas markets
- Identifying certified organic suppliers based on requirements
- Evaluating possible suppliers
- Negotiating contract specifications
- Reviewing contracts to ensure compliance with standards and policies
- Signing the contract based on supplier/vendor agreements
- Managing the supplier.

Sourcing from organic suppliers

For food retail businesses, traceability should extend to being able to identify the source of all fresh produce and other inputs such as packaging materials.

Food retail businesses may source the same variety of a product from many producers or locations. For example, a food retail business may select an intermediary such as a wholesaler to supply product from several farms of origin. Once the product is collected from different farms, verifying the origin of the product supplied becomes increasingly challenging. Without a traceability system in place from the original source of the farm produce, claims related to provenance are difficult to authenticate and substantiate.

Product suppliers should be able to provide verification of provenance of supplied raw produce (including packaging material) consistent with certified organic standards. This may take place as part of the due diligence process in sourcing and procurement practices. Product suppliers with traceability systems will be able to provide data that can be automatically shared in a permissioned supply chain network.

Auditing suppliers for traceability and food safety

A traceability system should be audited at a minimum frequency of 12 monthly across the groups of products handled. Where multiple product groups exist, the traceability audit may cover one group annually on a rolling basis.

Once a traceability exercise is completed, records of the audit showing all steps should be maintained and corrective actions applied as required.

The key requirement in a traceability audit is for the supplier and retailer to be able to track a product forward and trace the product backward (minimum one up, one down). In many audit standards, the supplier will perform a traceability exercise. This generally places the burden of demonstrating an established traceability system on the supplier.

In an onsite traceability exercise, the auditor will select a product, and the retailer and suppliers will need to produce records of the source of the product and packaging used for the product and complete the exercise within a specified time.

Typically, two years minimum retention is required by auditors and for the purpose of being able to rely on a due diligence defence with food safety regulators domestically (and internationally in case of exports). For organic produce, a five-year record retention is required.

The documentation for a traceability test should include the following:

- Product lot identification including quantities
- Packaging used and unique identifier
- Location and quantities of product within the food retailer's control and quantities sold/shipped to individual consumers including on-line consumers.

Tasks related to traceability

- Create establishment master data for the organic fresh produce supplier
- Create unique identifiers for product suppliers
- Verifying the grower's organic status and certification
- Conduct process mapping of the product flow from point of origin to consumer
- Undertake regular supplier audit.

Key participants

- Producer/grower
- Supplier (wholesaler, packaging company)
- Retailer.

Inventory management in 3PL warehousing and Retail Distribution Centres

Retailers are increasingly outsourcing the management of their inventory to integrated logistics suppliers offering *3rd Party Logistics* (3PL) warehouse and distribution solutions.

3PL warehouses and distribution centres receive, store and distribute goods from suppliers. They de/consolidate loads of product into consignments for the retailer. Sometimes, storage is not involved at all and goods are moved on immediately (cross-docked). At other times, the 3PL may assemble retail displays or prepare sales campaign products.

Best practice inventory management enables total stock visibility and precise ordering. It reduces wastage, out-of-stock situations and delivers cost savings and improved food safety.

3PL and Distribution Centres rely on a suite of IT systems such as Warehouse Management System, Inventory Management System, Transport Management System, to trace products as they are received, stored, value-added and dispatched to retail businesses.

Scanning the barcode as inventory is received, moved from the back room to the shelf, and eventually sold, enables key data to be captured electronically and exchanged without manual intervention into retail store administration and purchase order processing systems. In many instances this data is an input to the Computer Assisted Ordering (CAO) systems in place in many retailers, which automatically optimise inventory and replenishment processes. The key benefits include reduced inventory held, reduced out-of-stocks, less product waste due to obsolescence, better recall efficiency and effectiveness, improved demand forecasting, and fewer staff required for managing inventory.

All finished product available in the warehouse/DC inventory is able to be made visible to the retailer ordering stock.

Tasks related to traceability

- Stock receival
- Inventory management
- Retailer Purchase Order processing
- Picking and packing of stock
- Notifying the Retailer of impending shipment
- Booking Transport
- Loading outbound stock.

Key participants

- Supplier
- 3PL warehouse of distribution centre operator
- Transport company
- Retailer.

Receipt of food products

Buying product for retail is initiated by the retailer submitting a *Purchase Order*. The Purchase Order becomes a fundamental traceability tool alongside the *Customer Invoice* for retailers and their suppliers to reconcile what products were received. *Order Acknowledgement and Order Confirmation* by the supplier then allows the retailer to plan for receival of stock. An *Advance Shipping Notice* or *Delivery Order* or *Transfer* document (if stock is from the retailers' own storage) provide the retailer with details of the goods, delivery date and the number of load units being shipped. This enables loading dock/receival staff to prepare for the goods and temperature-controlled space to be available for the inbound fresh produce.

The suppliers of fresh produce to major supermarkets will need to meet mandatory packaging and barcoding requirements defined in supplier guides. Failure to do so can cause major handling issues, processing and delivery delays and may result in orders being rejected. There can be significant variation in requirements from retailer to retailer. As an example, some retailers require a very high percentage of product received to be in Shelf Ready Packaging as it reduces store labour requirements as well as reducing corrugated cardboard waste.

The fresh food supplier will create a *Customer Order* once product, quantity, variety, delivery terms and price have been agreed with the retailer. Often the supplier will have a term contract to supply, or the fresh product has been grown to order.

The chain of custody passes to the food retail business on receipt of the product or in the case of backhaul /customer pick up at the time the truck is finished loading at the supplier's distribution facility.

Store receipt can be line by line (carton by carton) or 'Receipt In Full'. Upon receipt, the store system receives against the purchase order (PO) or Transfer for the articles and quantities and this is then recorded in the Store inventory.

FSANZ (see FSANZ Chapter 3, Food Standards Code) provides the following advice in relation to receival of food –

"If an enforcement officer asks you to do so, you must be able to provide the officer with information on the suppliers of any food on your premises and what that food is. You need this information in case food on your premises is found to be unsafe or contaminated in some way and has to be returned to the supplier or destroyed.

Although most, if not all of the food you buy will be labelled with the name of the product and the name and address of the manufacturer, importer or packager of the food, you may also have unpackaged or unlabelled food on your premises and will need other ways of proving what this food is and where it came from. You might do so using your supplier invoices, or you might keep some other record of your suppliers and what you buy from them and the food you have on your premises.

You must not accept food unless you can identify it and trace it back to its supplier."

This requires that the Supplier maintains a system of traceability with the ability to trace fresh food products, including packaging material.

Inventory records for vehicles that transport products enable those products to be tracked from loading to delivery and include tracking the movement of trailers/vehicles. A *Returns Policy* and *Procedures* agreed between the Retailer, Supplier, 3PL, Distribution Centre and Transport Company will outline all procedures to ensure traceability of damaged packs and of any products returned to stock or for disposal.

Handling of certified organic produce

Australian Certified Organic Standards require the following:

- Documentation of organic status of products handled
- Prevention of co-mingling with non-certified organic product
- Storage arrangements to prevent mixing
- Avoidance of contamination with prohibited treatments e.g. gassing of bananas
- Use of barriers in transport and storage
- For bulk product – avoiding contact with contaminated surfaces and clean down prior to use - practice and recording
- Monitoring potential contamination
- If last resort treatment is required, as approved by the organic certifying body, and with residue monitoring.

Certified organic fresh produce growers may sell via community markets. For market stalls to comply with the Australian Organic Standard, the following will be required:

- Organic certification by the stallholder (handler)
- "Certified Organic" number on display by stallholder
- Market operator to check the certified status of the stallholder
- If selling processed produce, the processor's organic certificate number and status
- Capable of responding to regular and random audits.

Tasks related to traceability

- Advance Shipping Notice received by food retailer
- Product is delivered with Delivery Order correlated to the ASN (advanced shipping notice)
- Product is unloaded from transport at receival dock
- Product is inspected (contamination; identification; temperature) and accepted/rejected/returned to suppliers with reason recorded
- Inbound product is matched to purchase order and over/under/missing stock notified to supplier
- Proof of Delivery signed
- Received product is scanned/entered into the retailer *Enterprise Resource Planning* (ERP) or inventory system
- Supplier Invoice is reconciled with Purchase Order/ASN/and transport documentation, such as Delivery Order and Proof of Delivery.
- Organic status of retailer or market stallholder achieved through certification and displayed at the retail outlet/stall.

Key participants

- Supplier of product
- Food retailer – goods receival staff and accounts
- Market operator
- Market stallholder (handler)
- Transport company and driver
- Food safety inspector
- Retailer Quality Assurance inspector
- Organic certifying body.

Storage of inbound product

Fresh food product may be transferred to the food retailer's own pallets or bins for storage. The product, which may be in bulk bags, loose in tubs or crates or enclosed in cartons, is associated with a storage location/ temperature-controlled storage area in the inbound storage area.

Some retailers have their own stock identifiers such as *Stock Keeping Units* (SKUs) to identify product and associate it with their internal record keeping, order management system and stock location in store. They may use a SKU reference to order product from their regular suppliers. Use of a SKU as a single identifier is problematic in supply chain level traceability, as partners along the supply chain may not have access to internal product codes.

Retailers may also "portion pack" foods bought on a wholesale basis or in larger lots or in cases where the smaller stores require less than one case quantities of generally slower moving inventory. For traceability, retailers rely on labelling each pack with information linking the sold product to supplied product information, including product identity, supplier identity, lot code, date received and consumer information such as use-by date, storage conditions, allergens etc.

Tasks related to traceability

- Position in storage identified and allocated
- Product transferred to internal storage asset e.g. pallet, bin, tub, tray
- Product put away ready to be called forward to retail sales floor
- Product best before, expiry dates recorded e.g. Julian date.

Key participants

- Supplier of product
- Food retailer – goods receival staff and accounts
- Transport company and driver
- Food safety inspector
- Retailer Quality Assurance Inspector.

[1] A Julian Date is a traceability date that appears on a food product as a 4-digit code, in the absence of Best Before or Use By information. The first number indicates the year and the remaining numbers indicate the day in the calendar, e.g. a Julian Date of 6273 assigns 6 for year 2016 and 273 for 30 September.

Ensuring food integrity, quality and safety

Ensuring food safety is a key obligation of all food businesses including retailers. This ensures that the food is safe and suitable to consume. Food safety standards also contain health and hygiene obligations for food handlers, aimed at lowering the incidence of food-borne illness.

Traceability is a key means to manage the integrity of food product stored on-site and on floor display, by understanding the status of the product in the in-store inventory system, through the following:

- Recording inspections of storage conditions, particularly ambient temperature and light levels and effectiveness of refrigeration equipment
- Recording batch and lot number and expiry date at receival and adding this to the retail inventory management system for each SKU/GTIN/lot or batch
- Using colour markers on items to indicate expiry time/date of products at item or lot.
- Implementing a First-In – First Out (FIFO) stock movement plan/system. This may be as basic as a whiteboard recording batches and their use-by/expiry dates
- Undertaking regular stock counts to identify older stock.

Retailers may use a range of display and service formats including temperature-controlled display cabinets, shelves of finished goods at ambient temperature, or displays of unpackaged items such as fresh produce in store-ready pallets, bins or racks.

For organic produce, this needs to be displayed separate from non-organic produce. "Certified produce shall be sold in block sections, and/or shall not be mixed in with conventional or uncertified products where cross-contamination risks may be posed. There shall be barriers or other physical means of separation of uncertified and certified products, with designated areas for storage for organic products."

"Where non-certified products are also traded in the fresh produce section(s), signage shall be such as to clearly demarcate such produce from certified produce. This may include such produce being labelled as "Conventional" and/or clear signage demarcating certified organic foods only from all other areas."

Products marketed as organic shall refer only to certified products. **Products not traceable and verifiable as certified shall not be labelled as such instore.**

Product may have an identifier affixed as a barcoded label or sticker or it may have arrived in a break bulk format without item level identification. Ensuring all product has labelling, display and consumer-available information regarding use-before and expiry dates for the item/lot can be critical to the speed and accuracy of product recall. This enables a lot number or use-by date to guide removal of product, rather than an entire display being removed.

Tasks related to traceability

- Record Quality Assurance inspections of storage conditions and stock in inventory system
- Record Lot/Batch and expiry date at receival
- Undertake regular stock counts
- Separate certified organic produce that is traceable from uncertified produce on retail display.

Key participants

- Food retailer
- QA and food safety inspectors
- QA Auditors
- State level food retail regulators and health authorities
- Organic certifying body.

Point of Sale data capture

Point of Sale (POS) is generally defined as a location where a product can be purchased by a consumer. This can be referred to as a retail checkout where barcode symbols are normally scanned via a POS scanning device.

A key ingredient for food traceability is relevant data associated with a physical product. That is one that is uniquely identified and can be linked to supporting business process. In this context the Global Trade Item Number (GTIN) is the most commonly implemented GS1 Standard. It is encoded in the universal product code (UPC) barcode for point-of-sale scanning and checkout systems. Point of sale is a dynamic environment in which a product may be withdrawn from the inventory system or reduced for sale. Active barcodes can adapt quickly to these variations to align with POS variations.

In the case of most modern retailers, it is the aggregation of inventory that is sold at retail at all stores (through POS capture) that triggers automatic replenishment from supplier to the retailer's warehouse. Recording GTINs at point of sale and linking the sale with the customer loyalty card enables tailored offers to be made, as well as providing evidence of the product in a food safety recall.

In the case of a biosecurity or health and safety breach detected at a retail business, records and other documentary evidence relied upon at the point of sale to establish a product's country of origin is also key evidence for regulators and health authorities. This will help regulators and health authorities to rapidly and accurately trace a food product or ingredient through the supply chain to the originating source, as well as trace from the source forward.

Clause 11 of Standard 3.2.2 – Food Safety Practices and General Requirements specifies:

A food business must ensure that food for disposal is held and kept separate until it is:

a) *Destroyed or otherwise used or disposed of so that it cannot be used for human consumption*

b) *Returned to its supplier*

c) *Further processed in a way that ensures its safety and suitability or*

d) *Ascertained to be safe and suitable.*

A food business must clearly identify any food that is held and kept separate as returned food, recalled food, or food that is or may not be safe or suitable, as the case may be.

This means that recalled food must be held, separated and identified from other food until it is either destroyed, used for purposes other than human consumption (e.g. animal feed), returned to its supplier, or further processed or otherwise determined to be safe and suitable.

Key tasks related to traceability

- Recording the product identity via the POS system capable of amending inventory levels automatically
- Notifying nominated supply chain partners of product sale status.

Key participants

- Food retail outlet e.g. store staff, stallholders
- Food safety regulators
- End consumers.

Product returns and store salvage

Product returns result from overstock product supplied, damaged stock unloaded at the receival dock or stock that does not have the required shelf life prior to expiry as specified by the retailer (although in each case the approval for returns in predicated by previously negotiated agreements between suppliers and retailer). Product returns are a subset of a broader discipline within supply chains termed "reverse" logistics.

Traceability of this rejected stock can be achieved through a Returns Policy with suppliers and a Standard Operating Procedure (SOP) which staff can enact. Some retailers have Returns Centres or a 3PL dedicated to managing returns. On-line retailing can present a challenge as it entails high rates of returned items.

Store salvage is the merchandise that retailers are unable to sell in their own stores. For example, many fresh produce lines are removed from shelves if they are approaching their expiration dates or because they are no longer at their peak quality, and hence stores consider them unfit for sale.

In order to dispose of these items, retailers are likely to take several steps:

- Sell a pallet, bin or truckload for only a small portion of the actual cost. If something is salvage, it is sold as-is.
- Depending on the condition of the product, the retailer may return the product to the supplier or DC
- Also, depending on the quality of the product, retailers may participate in food donation programs, organic composting and recycling initiatives
- Simply dispose of the product through processes agreed to between the supplier and retailer in a manner that meets the guidelines of regulatory bodies.

Tasks related to traceability

- Identification of products returned to the retailer by consumers
- Identification of products returned by the retailer to supplier or DC/Returns Centre.

Key participants

- Retailer
- Consumer
- Product supplier
- Distribution Centre (DC), Returns Centre, 3PL Returns warehouse.

Critical Tracking Events

For each of the identified organic retail activities, **critical tracking events (CTEs)** which establish identity and enable traceability and compliance with traceability-related regulation are summarised in the following table. It should be noted that while regulators often identify standard CTEs, in many cases, supply chain actors may choose to track additional events occurring within their supply chain to create a more robust picture of their supply chain.

Critical Tracking Events (CTEs) are events that relate to the identity, movement and transformation of the food product.

Organic Retail activity	CTE code	Critical Tracking Events (CTEs)
Organic certification	**OR CTE1A**	Certify as a "Certified Organic" trader or handler as an individual retailer or retailer chain
Establish master data identification of food retailer	**OR CTE1B**	Apply for Global Location Number Food retailer licence issued
Establish master data for suppliers	**OR CTE1C**	Creating establishment master data for the organic producer/supplier
Auditing suppliers for traceability	**OR CTE2**	Verifying the origin and integrity and ability to track product for certified organic produce supplier
Inventory management in 3PL warehousing and Retail Distribution Centres		
Stock receival	**OR CTE3A**	Stock inspection – record rejected stock
	OR CTE3B	Sign Proof of Delivery
	OR CTE3C	Provide Inventory Reports to Retailer/visibility of organic stock in storage
Stock Putaway/Inventory Management	**OR CTE4A**	Enter SSCC scan/record into inventory (WMS)
	OR CTE4B	Implement measures to prevent co-mingling and contamination
	OR CTE4C	Record use-by/expiry date for FI-FO management
Picking stock for dispatch	**OR CTE5**	Customer order picked for dispatch to Store, packed and transport label applied
Dispatch product to Store	**OR CTE6**	Product leaves Warehouse and is dispatched to Store
Receipt of food products at retail outlet		
Record/scan stock into receival area	**OR CTE7A**	Stock delivered to Store
Record use-by/expiry date **Reconcile against Purchase** **Order/Delivery Order/Supplier Invoice**	**OR CTE7B**	Proof of Delivery signed Record and notify variations to supplier
Enter received stock into store inventory system	**OR CTE7C**	Received product is scanned/entered into the retailer *Enterprise Resource Planning (ERP)* or inventory system

Organic Retail activity	CTE code	Critical Tracking Events (CTEs)
Storage of inbound product **Position in storage identified and allocated** **Product transferred to internal storage asset e.g. pallet or bin** **Product put away ready to be called forward to retail sales floor**	**OR CTE8**	Location and storage asset ID for inbound product recorded
Ensuring food integrity, quality and safety **QA inspection**	**OR CTE9**	Record Quality Assurance (QA) and certified organic system inspections of storage conditions and stock in inventory system
Monitor stock in store **Record lot/item GTIN and expiry date at receival** **Undertake regular stock counts**	**OR CTE10**	Display organic produce in designated location
Point of sale (POS) data capture	**OR CTE11**	Record the product identity via the POS system capable of amending inventory levels automatically
Product returns and store salvage	**OR CTE12A**	Identification of products returned to the retailer by consumers
	OR CTE12B	Identification of products returned by the retailer to supplier or DC

Key data elements

Key Data Elements (KDE) ensure that captured and recorded data can be interpreted and used as relevant and required by all supply chain partners. Key Data Elements define Who, What, When, Where and Why for each Critical Tracking Event identified above.

Event Code	CTE	Key data elements
OR CTE1A	**Certified Organic Trader**	• Certified Organic Trader/Handler number • Certifying body • Date of expiry of certification (currency)
OR CTE1B	**Establish master data identification of food retailer**	**Global Location Number (GLN) of retailer** **Request for GLN** **Who** Retailer, Issuing Agency **What** Retailer, location, business entity **When** Date/Time of Issuance **Where** Issuing Agency **Why** Requirement for Global location numbers, establishment
OR CTE1C	**Establish master data of suppliers**	**Food Licence Number** This licence number is issued by local government **Information to be shared to a traceability platform** • Certified Organic Trader number, certifying body and expiry date • Global Location Number (GLN) • Food business registration number
OR CTE2	**Verifying the product origin and integrity and ability to track product**	**Supplier Traceability Audit** • Trial traceability exercise result • Date of audit • Auditor ID • Organic Certification number, certifying body and expiry • Country of origin (international supplier) • Relevant test certificates **Information to be shared to a traceability platform** • Test Certificate number and date • Traceability audit date • Traceability audit result – document code
	Inventory management in 3PL warehousing and Retail Distribution Centres	
OR CTE3A	**Stock receival –**	• Unique identifier on product and container scanned/recorded into receival system
	Stock inspection, record rejected and accepted stock	• Under/over, damaged, missing, expiring stock recorded against Delivery Order and original retailer Purchase Order (EDI message)
OR CTE3B	**Sign POD**	• Proof of Delivery number
	Inventory management - enter/scan product into Inventory/ Warehouse Management System	• Pallet/bin/container SSCC • Carton ID if load unit unpacked • Item level Lot or Batch number • GTIN/SKU number • Date received • Storage slot location (if using a fixed location system) • Product ID • Product supplier name • Lot/batch number • Use by/Expiry date.

Event Code	CTE	Key data elements
OR CTE3C	**Provide inventory reports to Retailer/ visibility of stock in storage**	• Date of report • Stock reference (SKU, GTIN) • Description • Location • Quantity • Reorder level • Value • Daily stock in/stock out count.

Goods Receipt	
Who	Distributor/Wholesaler Issuing Agency
What	Purchase Order, Delivery Note, Logistics/Pallet ID, Product ID, Quantity, Batch, Date Information
When	Date/Time of Receipt
Where	Receipt location
Why	Receipt of product

Information to be shared to a traceability platform

- Supplier ID
- POD number
- Lot/batch number and expiry date
- Returned stock reconciliation report message
- Inventory report (dated).

	Put away	
OR CTE4A	**Scan and record in inventory**	• Pallet/bin/container SSCC • Quantity • Carton ID if load unit unpacked • Item level Lot or Batch number • GTIN • SKU number • Date and time of put away • Storage slot location (if using a fixed location system).

Put Away	
Who	Retail Distribution
What	Product ID, Quantity, Batch, Date Information, Logistics/Pallet ID, Location (Bin)
When	Date/Time of put away
Where	Warehouse bin location
Why	Stock Put away (movement)

Event Code	CTE	Key data elements
OR CTE4B	**Implement measures to prevent co-mingling and contamination**	• Organic management plan and records
OR CTE4C	**Record product use-by/expiry dates**	• Lot number/GTIN/SKU • Use-by date **Information to be shared to a traceability platform** • Logistics Pallet ID (SSCC) • Warehouse Bin Location • Product ID • Lot number • Quantity • Date of put away • POD number reference.
OR CTE5	**Picking stock for Store dispatch**	• Store Order Number/Purchase order number • Product ID • Quantity • Store Location • Delivery date

Picking	
Who	Retail Distribution
What	Store Order, Picking list number, Product ID, Quantity, Batch, Date Information, Logistics Unit number (SSCC)
When	Date/Time of pick
Where	Pick location
Why	Picking stock

Information to be shared to a traceability platform

- Logistics Pallet ID
- Warehouse Bin Location
- Product ID
- Quantity Picked
- Batch number
- Date of Pick

Event Code	CTE	Key data elements
OR CTE6	**Dispatch to Store**	• Logistics Pallet ID scanned and loaded to vehicle • Product ID • Quantity • Lot number • Store ID • Transport company name • Delivery Note (shipment number) • ASN and purchase order number

Dispatch to store	
Who	Retail Distribution
What	Store Order, Delivery Note, ASN number, Logistics/Pallet ID (SSCC) Product ID, Quantity, lot number, Date, Shipment number
When	Date/Time of Dispatch
Where	Dispatch location
Why	Dispatch of product

Information to be shared to a traceability platform

- Store ID
- Store Order/Purchase Order Number/ASN number
- Logistics/Pallet ID
- Product ID
- Lot number
- Quantity
- Date of Dispatch
- Shipment Number (from ASN or Delivery Order).

	Receipt of food products at retail outlet	
OR CTE7A	**Record/scan barcodes on stock at receival area, recording Lot use-by dates**	• Product ID (SKU + GTIN) • Lot number • Use-by/expiry date for each lot
OR CTE7B	**Sign POD**	• Signed POD number for delivery
	Reconcile against Purchase Order/Delivery Order/Supplier Invoice	**Rejected/missing stock identified and recorded** • Supplier ID • Lot/batch numbers • Reason for rejection • Record variations x SKU/GTIN, lot number and supplier ID.
OR CTE7C	**Received product entered into store inventory system**	

Receipt at Store	
Who	Transport Provider Store ID
What	Store Order, Delivery Note, ASN number, Logistics/Pallet ID (SSCC) Product ID, Quantity, Batch, Date Information, Shipment number
When	Date/Time of Dispatch
Where	Dispatch location
Why	Dispatch of product

Information to be shared to a traceability platform

- Delivery Note number
- Store Order number
- Logistics/Pallet ID
- Product ID
- Lot number
- Quantity
- Date of receipt.

	Storage of inbound product	
OR CTE8	**Location of inbound product in storage area**	• Storage asset ID (SSCC) • Location in in-store storage area specifically for organics
	QA Inspection	

Event Code	CTE	Key data elements
OR CTE9	**Quality Assurance (QA) and food safety inspection (FSI) inspection and audit**	• Product ID • Lot number • Location (organic produce) • Quantity • Date of inspection (quality/organic) • Discarded produce lot number. **Information to be shared to a traceability platform** • Product ID • Lot number • Store ID • Quantity • Date of inspection • Discarded stock ID (pallet, tub, crate, carton numbers); lot number; product ID).
OR CTE10	**Monitor stock on display in store** **Point of sale (POS) data capture**	• Organic produce in designated location in-store
OR CTE11	**Record the product identity via the POS system** **Notify nominated supply chain partners of product sale status**	**Unique identifier indicating lot affixed with compliant product information** • Name of the food • Use by date • Product lot identification • Description of the product • Description of allergens • Instructions for storage and preparation • Country of origin information • Warning and advisory statements • Relevant nutritional information • Information about weights and measures (volume and quantity) • Certified Organic grower/supplier number, name and address of the supplier • Organic Certifying Body. **Information to be shared to a traceability platform** • Product ID • Quantity Sold • Lot number (if captured at POS) • Use by/best before (if captured at POS) • Store ID • Supplier name and number.

Event Code	CTE	Key data elements
	Product returns and store salvage	
OR CTE12A	**Identification of products returned to the retailer by consumers**	• Product unique identifier (GTIN, SKU code, item or article number) • Sales Receipt number • Disposition – return to supplier, destruction, salvage • Tracking of returns?
OR CTE12B	**Identification of products returned by the retailer to supplier or DC**	• Record/scan of product prior to loading on pallet/tub for return to DC or direct to supplier • Delivery Order number. **Product Returns** **Who**: Retail store **What**: Product ID, Lot, Date Information, Logistics unit/pallet ID, Quantity **When**: Date/Time of Return **Where**: Store Location **Why**: Product return/reason for return **Information to be shared to a traceability platform** • Product ID • Quantity Returned • Lot number • Store ID • Reason for return.

Application of GS1 Data Standards

Adoption of global data standards enables data sharing between businesses through using common formats. These formats allow a business to identify participants, locations, products, processes and events in the supply chain.

Data standards that apply to key data elements and shared information are identified in this section.

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Location	**Manufacturing wPlant, Finished Goods Location, Dispatch Dock**	Global Location Number (GLN)	N13	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	**Production Date and/or time, Use By date, Best Before Date, Pack Date**	Year -Month-Date	YYMMDD	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD.
Product Identifiers	**Input materials such as raw ingredients and packaging, Outputs such as finished goods, packaged or processed goods**	Global Trade Item Number (GTIN)	N14	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org Information on how to allocate a GTIN to a variable weight or variable measure trade item www.gs1.org
Traceability Attributes	**Batch/Lot code, Serial Number**		AN20	Traceability Attributes, such as Batch or Lot Number or Serial Number etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	**Pallet of Finished Goods, Crate or Box of finished Goods**	Serial Shipping Container Code (SSCC)	N18	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Assets	**Returnable assets Ie: IBC or individual assets Ie: A crate**		N13	Can be identified as an asset type only or an optional serial number can be added to distinguish individual assets. www.gs1au.org
Shipment	**Grouping of logistics units**	GSIN	N17	The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together. www.gs1.org

Useful links

Food Safety

FSANZ
www.foodstandards.gov.au

Australian Institute of Food Safety
www.foodsafety.com.au

Food business licensing
ww.foodstandards.gov.au

Food business classifications

Each state and territory in Australia have different classifications for food businesses. The classification of a food business relates to the licenses required. To determine the classification of a food business, see the following links

NSW – www.foodauthority.nsw.gov.au
ACT – www.health.act.gov.au
VIC – www.health.vic.gov.au
QLD – www.health.qld.gov.au
SA – www.health.sa.gov.au
WA – www.public.health.wa.gov.au
NT – www.health.nt.gov.au
TAS – www.dhhs.tas.gov.au

Certified Organic Trader

Approved Certifying Bodies (export) and recognition of international certifying bodies
www.agriculture.gov.au

Australian Certified Organic standards
www.austorganic.com

Retailer Supplier Standards

www.supplierportal.coles.com.au
www.metconnect.metcash.com
www.corporate.aldi.com.au

Glossary

ASN	An **advance ship notice** or **advance shipping notice (ASN)** is a notification of pending deliveries, similar to a packing list. It is usually sent in an electronic format and is a common EDI document.
Certified Organic Trader	A trader of certified organic goods, a certified organic trader or handler maintains the integrity of the goods to the certified organic standard in Australia.
CAO	**Computer-Assisted Ordering** is a tool combining retail sales data and forecast demand, in order to automate retail replenishment.
DC	A **Distribution Centre (DC)** is a short term storage site to assemble products for retail outlet orders.
DO	**Delivery Order.** A document from the Consignor of the freight which orders the release of the cargo to another party. This permits the delivery direct to a warehouse or depot, as organised with the Consignee. This enables the Consignor to order pick up of product from a 3PL warehouse in order to deliver to the party named in the Delivery Order.
ERP	**Enterprise Resource Planning** systems integrate the main business functions of a company, including accounts, supply chain, manufacturing, human resources, operations and reporting.
FI-FO	**First-in: First out** inventory management costs inventory on the basis of the length of time the stock has been on hand.
Lot	A lot is an amount of a food that the manufacturer or producer identifies as having been prepared, or from which foods have been packaged or otherwise separated for sale, under essentially the same conditions, for example: **a.** from a particular preparation or packing unit; and **b.** during a particular time ordinarily not exceeding 24 hours. The lot identification (which could be a number or other information) is used to track a product in the event of a recall and needs to be able to identify where the food was packed or prepared.
Organic standards	The National Standard for Organic and Biodynamic Produce Edition 3.7 2016 is the standard for certification of export goods required by the Department of Agriculture, Water and the Environment. It provides assurance to importing countries that certified organic goods are genuine. The national standard has equivalence to certified organic status in key trading markets. The Australian Certified Organic Standard 2021 (AS6000:2015) is the voluntary domestic standard for certified organic goods. Certification is a key assurance for consumers that the goods are genuine organic products.
PO	**Purchase Order.** A commercial document issued by a buyer to a supplier. This is a legally binding offer to buy product in return for payment. The terms and conditions for delivery and payment are detailed in this document, which also details the product quantity, price, terms and conditions, product quality specifications.
POS	**Point of Sale.**
Shelf-ready packaging	The Australian Food and Grocery Council has guidelines for shelf-ready packaging. www.afgc.org.au
SKU	**Stock Keeping Unit.**
UPC	**Universal Product Code.**

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Foodservice

Organic Produce in Foodservice

Demand for organic produce in retail and foodservice has grown strongly in the past five years and is predicted to rise by around eight percent per annum to 2026.[1] Interest by Australian consumers in the health attributes of organic foods, as well as concerns for ethical and sustainable food production, are driving demand.

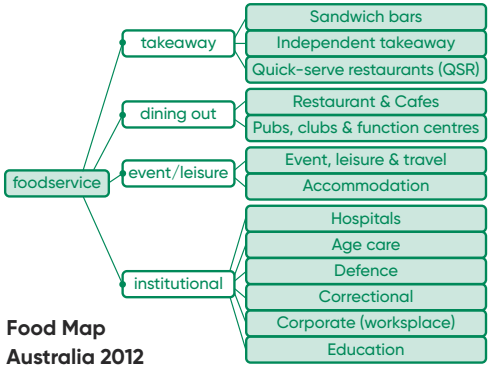
Organic produce attracts a premium of 1.5 to 2 times that of conventional produce, with organic fruit, vegetables and herbs making up 45% of the Australian organics market.

The foodservice industry encompasses activities, services, and business functions involved in preparing and serving food to people eating away from home. This includes all types of restaurants from fine dining to fast food. It also includes institutional food operations at locations such as schools and hospitals, as well as other specialty vendors such as food truck operators and catering businesses.

This module covers key activities that generally take place along in a foodservice supply chain. From a foodservice perspective, traceability means the ability of foodservice partners to quickly verify the history, location, and usage of organic produce, resulting from coordinated efforts of trading partners to collect and maintain product information that supports visibility of the product's movement through this distribution channel.

In this module, processes/activities are associated with foodservice operations and traceability of sourced organic produce are:

- Establishment
- Ordering food supplies
- Receival of product
- On-site storage
- Maintaining traceability once bulk packs are opened
- Ensuring food integrity, quality and safety.



Food Map Australia 2012

Establishment

Certified Organic Restaurants and Prepared Food Suppliers

A restaurant or foodservice operator may wish to distinguish the business in the market through certifying as an outlet for organic meals.

For certified organic operators, the following standards apply.

- **8.3.1** Allowance for licensing of food outlets for the purpose of use of the logo and claims as to certified organic foodstuffs enabling marketing (including labels and signboards) by a certified operation shall be given where the following are adhered to.
- **8.3.2** Claims as to "Organic" shall be made only in instances of verified use of ingredients or products fully in conformance with this Standard and able to be traced via effective documents and records.
- **8.3.3** The Bud logo may be used on the menu.
- **8.3.4** Certified organic meals may be specified as such on the menu.
- **8.3.5** Use of "In Conversion to Organic" products or ingredients shall be labelled as such.
- **8.3.6** Preparation of ingredients and all ingredients used in meals claiming organic status shall conform to the principles outlined in section 6 on preparation and other relevant sections of this Standard.
- **8.3.7** At a minimum the operator shall ensure that at any one time:
- **8.3.8** Three or more dishes, with one full course meal (where applicable – this may be entrée + main, or main + dessert depending on menu offering) from the entire menu, arise from certified organic sources and/or ingredients. A minimum of 95% of agricultural ingredients of such meals shall come from certified organic sources.
- **8.3.9** Beverages shall incorporate certified organic ingredients or shall be certified organic where available in commercial quantities.
- **8.3.10** Certified organic ingredients shall be sourced in preference to non-certified ingredients wherever available in commercial quantities.
- **8.3.11** Management control shall be maintained, including effective staff knowledge of certification systems, organic production principles and handling of certified products.
- **8.3.12** Segregation and prevention of contamination of certified products shall be maintained at all times.

[1] IBISWorld Organic Farming Australia Industry Report, November 2020

- **8.3.13** An auditable traceback of all ingredients used in meals and beverages shall be made possible via the use of documents and recording systems. Purchased produce shall be accompanied by relevant labelling and documentation noting certification status, certification number and name of certification organisation. Documents required for audit by the certifying body shall include all non-certified ingredients used within the operation.
- **8.3.14** Best Management Practice in environmental management shall be maintained in the use of energy, cleaning agents, and wastage as well as workplace health and safety.[2]

Licensing as a food outlet

Local councils and state authorities administering food safety regulations are involved in licensing food premises and allocating a current licence number to each foodservice business.

In addition to obtaining this registration and licence, creating a unique identification and location reference for the foodservice business will enable food logistics and traceability of inbound and outbound shipments to be undertaken efficiently. This is effective for foodservices with multiple outlets, enabling each to have a unique identifier for use in distribution.

Traceability can be created through establishing the identity of items supplied, as well as suppliers and businesses handling inbound product. Assets used to store and move product can also be identified and correlated with the product and locations.

Key tasks related to traceability

- Certification as a Certified Organic foodservice operation
- Allocate a Global Location Number (GLN) (entity and location) to each warehouse and foodservice outlet
- Ensure Logistics Service Providers such as 3PL (third party logistics) storage are identified
- Request GLN or Property Identification Code (PIC) of suppliers
- Create identification of own transport assets such as pallets, trays, tubs.

Key participants

- Certified Organic certifying body
- Foodservice operator
- Logistics service provider/3PL
- Suppliers to foodservice
- Local and state food safety authorities.

Sourcing of organic produce

Identifying, contracting and managing product suppliers is a major activity for food operators. Sourcing involves:

- Establishing the requirements for products
- Defining the sourcing strategy to follow
- Sourcing potential suppliers from local and overseas markets
- Identifying desired suppliers based on requirements
- Evaluating possible suppliers
- Negotiating contract specifications
- Reviewing contracts to ensure compliance with standards and policies
- Conduct appropriate Know Your Customer (KYC) validations and checks such as Politically Exposed Persons (PEP); Sanctions Screening; Tax ID; International Bank Account Number (IBAN) Verification [3]
- Develop and agree to appropriate service agreements and performance metrics
- Signing the contract
- Managing the supplier.

In sourcing agricultural produce into Foodservice businesses, identification and verification of supplier entities and the origin of the produce in terms of grow locations may be mandated by the supplier contract. This also supports the Foodservice Operator to tell the story of the product to consumers and in product recall.

For Foodservice Operators, traceability should extend to being able to identify the source of all food products including fresh produce, processed food products and other inputs such as packaging material.

Foodservice businesses may source the same category of product from multiple producers or locations. For example, a Foodservice Operator may select an intermediary such as a wholesaler to supply product from several farms of origin. Once the product is collected from different farms, verifying the origin of the product supplied becomes increasingly challenging. Without a traceability system in place from the original source of the farm produce, claims related to provenance are difficult to authenticate and substantiate.

Produce suppliers, who may be growers or food processors, should be able to provide verification of provenance of supplied raw produce and the components of the processed farm produce (including packaging material). This may take place as part of the due diligence process in sourcing and procurement practices. Product suppliers with traceability systems will be able to provide data that can be automatically shared and can be established during this process.

[2] ACO Australian Certified Organic Standard 2021

[3] www.austrac.gov.au / www.iban.com.au

Sourcing organic produce

Purchasing "Certified Organic" produce is a key method to assure the produce has been grown using organic production methods. The certified organic grower is audited annually against the National Standard for Organic and Biodynamic Produce or the Australian Certified Organic Standard 2021 (AS6000:2015). Under these standards, the grower will provide certificate number, the name of the certifying body and the expiry date for annual audit. A foodservice operator can check that the grower is certified organic and the certification is current.

Produce substitution along supply chains is a concern for foodservice operators, where genuine organic produce may be substituted with non-organic produce. Processors and wholesalers undergoing regular audit as "Certified Organic Handlers" have systems in place to prevent comingling with non-organic produce.

Analytical testing of organic can verify the levels of synthetic pesticides, herbicides, hormones and antibiotics, however testing can be prohibitive in terms of time and cost for a perishable product.

Foodservice operators may circumvent intermediaries and source direct from certified organic growers.

Auditing suppliers for traceability and food safety

The key requirement in a traceability audit is for the Foodservice Operator to be able to link the unique identifiers of the food products to the origin/provenance of the product.

Relevant record keeping is an essential part of the mandatory food safety plan requirements for food businesses throughout Australia. Failure to keep proper records to demonstrate adherence to a food safety plan can be a criminal offence. Typically, two years minimum retention is required by auditors and for the purpose of being able to rely on a due diligence defence with food safety regulators.

For certified organic produce, traceability is an essential requirement. Records are required to be retained for five years by growers and handlers.

The documentation for a traceability test (and food safety) should include the following:

- Product lot identification including quantities
- Packaging used, supplier details, receival and usage records
- Quantities of waste products created and disposal records
- Location and quantities of product within the Foodservice Operator's control, and those sold/shipped to individual consumers (including on-line consumers).
- Proper records and logs with the times and temperatures to which goods have been subjected to make appropriate decisions regarding food safety.

Key tasks related to traceability

- Create master data for suppliers – food, cleaning products, packaging
- Verify the product origin and integrity
- Complete supplier audit.

Key participants

- Producer/grower
- Supplier (processor, wholesaler, packaging company)
- Traceability Auditor
- Food authorities
- Foodservice Operator
- Organic certifying bodies (international and Australian).

Inventory management in foodservice 3PL warehouses and distribution centres

Caterers and restaurant chains may operate their own distribution operations. Increasingly, larger scale operators are outsourcing the management of their inventory to integrated logistics suppliers offering 3rd Party Logistics (3PL) warehouse and distribution solutions.

3PL warehouses and distribution centres receive, store and distribute goods from suppliers. They de-consolidate loads of product into consignments for the foodservice operator, delivering in regular consignments as required.

A key aspect of these processes is inventory management. Best practice inventory management enables total stock visibility and precise ordering. It reduces wastage, out-of-stock situations and delivers cost savings and improved food safety.

3PL and Distribution Centres rely on a suite of IT systems such as Warehouse Management System, Inventory Management System, Transport Management System, to trace products as they are received, stored, value-added and dispatched to foodservice businesses. Organic produce available in the warehouse/DC inventory is able to be made visible to the foodservice operator ordering stock.

Key tasks related to traceability

- Inventory management
- Purchase Oder processing
- Dispatch
- Delivery.

Key Participants

- Supplier
- 3PL warehouse of distribution centre operator
- Transport company
- Foodservice Operator.

Receipt of food products from supplier/3PL warehouse

Receiving produce for foodservice is initiated by the Foodservice Operator submitting a Purchase Order. The Purchase Order becomes a fundamental traceability tool alongside the Customer Invoice for Foodservice Operators and their suppliers to reconcile what products were received. Order Acknowledgement and Order Confirmation by the supplier then allows the Foodservice Operator to plan for receival of stock. An Advance Shipping Notice and Delivery Order provides the Foodservice Operator with details of the goods, delivery date and the number of load units being shipped. This enables loading dock/receival staff to prepare for the goods, and storage space to be arranged.

The supplier will create a Customer Order once product, quantity, variety, delivery terms and price have been agreed with the Foodservice Operator.

FSANZ (see FSANZ Chapter 3, Food Standards Code) provides the following advice in relation to receival of food:

"If an enforcement officer asks you to do so, you must be able to provide the officer with information on the suppliers of any food on your premises and what that food is. You need this information in case food on your premises is found to be unsafe or contaminated in some way and has to be returned to the supplier or destroyed."

Although most, if not all, of the food you buy will be labelled with the name of the product and the name and address of the manufacturer, importer or packager of the food, you may also have unpackaged or unlabelled food on your premises and will need other ways of proving what this food is and where it came from. You might do so using your supplier invoices, or you might keep some other record of your suppliers and what you buy from them and the food you have on your premises.

You must not accept food unless you can identify it and trace it back to its supplier.

This requires that the Supplier maintains a system of traceability with the ability to trace products.

The transport company making food deliveries will record the transport booking reference and the Consignment Note related to the delivery and attach the Delivery Order for the Foodservice Operator receiving the goods.

A Returns Policy and Procedures agreed between the Foodservice Operator and Suppliers outlines all procedures for returned stock to enable traceability of damaged packs and of any products for disposal.

In order to retain the integrity of certified organic produce, it is important to maintain segregation from non-organic produce received.

Key tasks related to traceability

- Advance Shipping Notice received by foodservice operator
- Product is delivered with Delivery Order correlated to the ASN (advance shipping notice).
- Product is unloaded from transport at receival dock
- Product is inspected (contamination; identification; temperature) and accepted/rejected/returned to suppliers with reason recorded (as per returns policy and procedures)
- Inbound product is matched to purchase/customer order and over/under/missing stock notified to supplier
- Proof of Delivery signed
- Received product is scanned/recorded in the Foodservice Operator *Enterprise Resource Planning (ERP)* or inventory system
- Supplier Invoice is reconciled with Purchase/Customer Order/ASN/and transport documentation, such as Delivery Order and Proof of Delivery.

Key participants

- Supplier of product
- Foodservice Operator – receival staff and Accounts
- Transport company and driver
- Food safety inspector.

On-site storage of inbound product

Organic fresh food produce may be transferred to the Foodservice Operator's own storage pallets/tubs/containers. The product, which may be in bulk bags, loose in tubs or crates or enclosed in cartons is recorded with a storage location.

Key tasks related to traceability

- Position in storage identified and allocated
- Product transferred to internal storage asset e.g. pallet, bin, tub
- Product put away ready to be called forward to food preparation area
- Product identifiers, supplier and best before, expiry dates recorded.

Key Participants

- Foodservice Operator – goods receival staff and accounts
- Food safety/QA Inspector.

Maintaining traceability once bulk packs are opened

Tracking by lot or item is the most effective means to undertake a recall in food preparation. This means being able to record the lot number of the organic fresh produce supplied and in turn of foods prepared. Records of the supplier, the lot number and the use-by date related to the fresh produce and on portions used for food preparation, allows recall to be limited to that specific lot prepared within a fixed timespan. An enterprise system enabled to scan this data allows association of the food served with the fresh produce ingredients supplied. Scanning/ recording the lot number and ID of the certified organic supplier on portions before placing in cool rooms and refrigerators can link food served with the produce as supplied.

As a recipe is being prepared, record the ingredient batch/lot number, the name of the ingredient, the brand name, the date received, and the quantity used in the recipe. Once the production of the recipe is completed, create and record batch codes for end consumer reference. This batch code and a use-by date becomes a reference for consumers of catering at an event or restaurant diners. If more than one lot is used in a foodservice production, both lot numbers need to be recorded.

Key tasks related to traceability

- Record lot/batch number and use-by date from supplier on portions before food preparation
- Record ingredient batch/lot number, the name of the ingredient, the brand name, the date received, and the quantity used in the recipe
- Place batch number and use-by date on each serve for end-consumer reference
- Record which location/event/outlet the batch is delivered to (own transport or see Freight Transport module).

Key Participants

- Foodservice Operator food preparation and production staff.

Ensuring food integrity, quality and safety

Ensuring food safety is a key obligation of all food businesses. This ensures that the food is safe and suitable to consume. Food safety standards also contain health and hygiene obligations for food handlers, aimed at lowering the incidence of food-borne illness.

Traceability is a key means to manage the integrity of food product stored on-site, by understanding the status of the product, through :

- Recording inspections of storage conditions, particularly ambient temperature and light levels and effectiveness of refrigeration equipment
- Recording lot number and use-by date at receival and adding this to the inventory management system for each lot of organic fresh produce
- Using colour markers or labels on items to indicate use-by date of products at item/ lot/batch level
- Implementing a First-In-First Out (FIFO) stock movement plan/system. This may be as basic as a whiteboard recording lots and their use-by/expiry dates
- Undertaking regular stock counts to identify produce approaching use-by date.

Key tasks related to traceability

- Record inspections of storage conditions and stock in inventory system
- Record Supplier, Lot/Batch and use-by/ expiry date at receival
- Implement a FIFO stock movement system
- Undertake regular stock counts .

Key Participants

- Foodservice Operator
- Appointed food safety inspector
- State level regulators.

Critical Tracking Events

For each of the identified foodservice activities, **critical tracking events (CTEs)** which establish identity and enable traceability and compliance with traceability-related regulation are summarised in the following table.

Organic Foodservice (OFS) activity	CTE code	Critical Tracking Events (CTEs)
Establishment		
Certified Organic operator	**OFS CTE1A**	• Receive Certified Organic status under the Australian or National Organic Standards
Establish master data for the foodservice business, including assets and packed food portions	**OFS CTE1B**	• Apply for Global Location Number • Food operator licence issued • Create unique ID for assets e.g. tubs, vehicles • Create unique ID for outbound packed food portions.
Establish master data for suppliers	**OFS CTE1C**	Create master data for suppliers of food, cleaning products, packaging
Auditing suppliers for traceability and provenance		
	OFS CTE3A	• Verify the grower certified organic status
	OFS CTE3B	• Audit the supplier's ability to track product from origin.
Inventory management	**OFS CTE4A**	Inventory Reports to Foodservice Operator for produce in 3PL storage
Order Receipt and Picking Customer Order processing • Order received • Stock availability confirmed • Packing list prepared • Order picked and packed • Advance Shipping Notice sent to Foodservice Operator.	**OFS CTE4B**	Foodservice Operator lodges order
Order Dispatch • Delivery Order prepared • Transport booked • Stock relocated to outbound area and loaded onto load unit • Consignment Note prepared • Product loaded.	**OFS CTE5**	Order dispatched from supplier or storage
Receipt of food products at Foodservice Operator • Record/scan stock into receival area • Record use-by/expiry date • Reconcile against Purchase Order/Delivery Order/ Supplier Invoice • Enter received stock into inventory system recording supplier, lot number and use-by date.	**OFS CTE6**	Product received and receipted into inventory management systems.
On-site storage of inbound product Position in storage identified and allocated Product transferred to internal storage asset e.g. pallet or bin	**OFS CTE7**	Product put away ready to be called forward to recipe preparation.
Maintaining traceability once bulk packs are opened		
Record lot/batch number and use-by date from supplier on portions before food preparation	**OFS CTE8**	• Record supplier, lot and use-by date on portions from bulk packs
Record quantity used	**OFS CTE9**	• Record lot details, use-by and quantity used in recipe
Delivery to end consumer	**OFS CTE10A**	• Place batch number and use-by date on each serve for end-consumer reference
	OFS CTE10B	• Record which location/event/outlet the batch is delivered to (own transport or see Freight Transport module).

Key data elements

Key Data Elements (KDE) ensure that captured and recorded data can be interpreted and used as relevant and required by all supply chain partners. Key Data Elements define Who, What, When, Where and Why for each Critical Tracking Event.

Event Code	CTE	Key data elements
	Establishment	
OFS CTE1A	Receive certified organic status under the Australian or National Organic Standards	• Certified Organic Operator number • Certifying Body • Expiry
OFS CTE1B	Unique identification of business and assets	• Global Location Number • Food operator licence number • Tubs, crates, vehicles unique identifiers
OFS CTE1C	Create master data for suppliers of organic produce, inputs e.g. cleaning products and packaging	• GLN numbers for suppliers • PIC number for growers • Certified Organic status of grower/supplier • Certifying Body • Expiry date. **Information to be shared to a traceability platform** • Foodservice Certified Organic status • Certifying Body • Expiry date • Global Location Number (foodservice operator) • Global Location Number (suppliers) • Serialised shipping container code number of foodservice tubs, crates, vehicles, pallets.
OFS CTE2A	Verify the produce origin and organic status	• GLN of grower • Certified organic number, certifying body name and expiry date • Organic Production Plan containing test results
OFS CTE2B	Audit the supplier's ability to track organic produce from origin	• Organic Supplier Traceability Audit results • Date of audit • Auditor ID. **Information to be shared to a traceability platform** • Grower PIC • Grower certified organic status • Grower certifying body • Certification expiry date • Date of organic supplier traceability audit • Auditor ID • Audit result document code.
	Warehousing and storage	
OFS CTE3A	Inventory reports to Foodservice Operator for visibility of inventory in storage	• Current stock on hand by GTIN, SKU, SSCC • Stock shrinkage • Date • Stock reference (SKU, GTIN) • Description • Location • Quantity • Reorder level.
OFS CTE3B	Foodservice Operator lodges order	Customer Order • Date • Foodservice Operator ID and location (GLN) • Product GTIN/SKU/SSCC identifier • Quantity and unit (carton, drum etc) • Date required • Delivery instructions e.g. opening hours, dock location). **Information to be shared to a traceability platform** • Inventory report (dated) • Customer order number • Lot number • Use By/Best Before dates • Logistics unit number (SSCC).

Event Code	CTE	Key data elements
	Order Dispatch	
OFS CTE4	Order dispatched from grower or supplier storage	• Customer Order Number/Purchase Order Number • Product • Quantity • Lot • Use By/Best Before dates • Date of dispatch **Information to be shared to a traceability platform** • Customer order number/purchase order number • Advance Shipping Notice number • Logistics Unit numbers (SSCC).
	Receipt of food products at Foodservice Operator	
OFS CTE5	Inspect produce and sign Proof of Delivery	Proof of Delivery • Delivery date • Number of units – pallets, cartons, drums • Delivery Note number • Name and signature of receiver
	Record and notify variations to warehouse/DC or supplier	• SKU/GTIN, lot number and supplier ID of rejected/missing stock.
	Received product entered in foodservice outlet inventory system	• Product ID (SKU + GTIN) • Lot/batch number • Use-by/expiry date for each lot. **Information to be shared to a traceability platform** • POD number (includes time and date) • Delivery Note number/Receipt ID • Product ID • Quantity/weight • Lot number • Use by/Best before date.

Event Code	CTE	Key data elements
	Storage of inbound product	
OFS CTE6	Product internal storage unit ID and located recorded	• Storage unit ID • Location in storage.
	Maintaining traceability once bulk packs are opened	
OFS CTE7A	Record supplier, lot and use-by on portions of product from bulk packs	• Supplier ID • Lot number • Use-by date.
OFS CTE7B	Record lot details and quantity used in recipe/production	• Product ID (brand and supplier) • Lot number • Quantity used • Date. **Information to be shared to a traceability platform** • Supplier of lot • Lot numbers used in food preparation • New batch code allocated to re-packed items • Use-by date for each lot and batch.
	Delivery to end consumer	
OFS CTE8A	Label serves of newly produced meal portions for end consumer reference	• Product ID (including proportion of organic ingredients) • Batch code • Use-by date
OFS CTE8B	**Record delivery location for each batch number**	• Delivery location ID • Batch number • Quantity delivered • Delivery date **Information to be shared to a traceability platform** • Ingredients (including proportion of organic ingredients) • Quantity produced (portions) • Batch number and date of production run • Best Before/Use-by dates • Delivery location and date.

Application of GS1 Data Standards

Adoption of *global data standards* enables data sharing between businesses through using common formats. These formats allow a business to identify participants, locations, products, processes and events in the supply chain.

The following data standards have been defined and included to support the list of CTEs and KDEs listed in this module.

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Location	Distributor Receiving Dock	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	Date of stock receipt, date of despatch	Year -Month-Date	**YYMMDD**	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD.
Product Identifiers	Packaged Product	Global Trace Item Number (GTIN)	**N14**	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org
Traceability Attributes	Batch, Serial Number, Production Date, Best Before, Use by	AI (10) = Batch	**AN20**	Traceability Attributes, such as Batch or Lot Number, Serial Number, Production Date etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	Pallet of packaged product	SSCC	**N18**	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Returnable Asset	Chep Pallet	AI (8003)	**N29**	The Returnable Asset Identifier is especially suitable for the management of reusable transport items, transport equipment, and tools. It can identify these returnable assets by type and if needed also individually for tracking and sorting purposes. www.gs1.org

Useful links

Certified Organic Operator
www.austorganic.com
www.aco.net.au

Food Safety
FSANZ www.foodstandards.gov.au

Australian Institute of Food Safety
www.foodsafety.com.au

Food business licensing
www.foodstandards.gov.au
www.health.vic.gov.au 404 ERROR

Food business classifications

- **NSW** www.foodauthority.nsw.gov.au
- **ACT** www.health.act.gov.au
- **VIC** www.health.vic.gov.au
- **QLD** www.health.qld.gov.au
- **SA** www.health.sa.gov.au
- **WA** ww2.health.wa.gov.au
- **NT** www.health.nt.gov.au
- **TAS** www.dhhs.tas.gov.au

Glossary

Certified Organic

In Australia there are two organic certifications. Australian Organic owns and maintains the Australian Certified Organic Standard (ACOS) 2021.

In addition to the Australian standard, which is voluntary for domestic production and distribution of certified organic produce, the National Standard for Organic and Biodynamic Produce 2016, is a mandatory standard used to align Australian organic products with international organic standards. An organic product is deemed as a "prescribed" food export and must be certified under this national standard.

Lot

A lot is an amount of a food that the manufacturer or producer identifies as having been prepared, or from which foods have been packaged or otherwise separated for sale, under essentially the same conditions, for example:

a. from a particular preparation or packing unit

b. during a particular time ordinarily not exceeding 24 hours.

The lot identification (which could be a number or other information) is used to track a product in the event of a recall and needs to be able to identify where the food was packed or prepared.

Property Identification Code (PIC)

PIC is an identifier for growers, developed for traceability by state government agricultural biosecurity agencies. At this point the PIC is not mandated for horticultural production in all states.

www.agriculture.gov.au

Reforms to PIC are likely to extend to Food businesses (excluding hospitality businesses).

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Import

Organic Imports

According to the World Bank, as of 2019, 7.3% of food consumed in Australia is imported. Australia is a net food importer in six categories: seafood, processed fruit and vegetables, soft drink, cordials and syrup, confectionary, bakery products, and oils and fats.

Food importation in Australia is dominated by small and medium-sized enterprises (SMEs), most being food wholesalers (47%), food manufacturers (16%) and food retailers (14%). [1]

Processes covered in this module include:

1. Establishment data for Australian food importer and overseas suppliers
2. Mandated food safety traceability requirements for Importers
3. Tracing product origin and composition through offshore suppliers
4. Arrival and clearance at final discharge port
5. Re/labelling of imported food products to meet Australian standards.

It is important to note that once an imported food product has received border clearance, all domestic food regulations apply. If the imported food is for retail sale, the Importer is required to register as a food business.

Establishment data

Organic certification of Importer/Wholesaler

Businesses that import certified organic products in bulk or retail shipments undergo organic certification. This enables the importing wholesaler to have in place an Organic Management Plan covering pest control practices, product handling, storage and sale, staff education and labelling, segregation of product to avoid comingling with non-organic products, identification of the status of bulk product coming in, up to date and recognised organic certification of incoming products, trace documents to verify source and organic certification of suppliers, non-certified treatment documentation relating to Australian Biosecurity requirements and in-source country treatments prior to export, and correct labelling of organic products for distribution in Australia.

Creation of master data for trading partners and locations

Sourcing of product for import usually requires the creation of master data for grower, manufacturer and exporter in the country of origin of the product as well as for the Australian importer and key nodes in the supply chain. This will enable unique identification of the entities and locations engaged in the product's journey, including packing houses, distribution centres or warehouses the product moves through. For many jurisdictions, registration of the food grower, manufacturer and exporterare required by responsible authorities.

Importer/Wholesalers of Organic Certified product need to establish an Approved Supplier list in order to verify the organic status of exporting growers and suppliers.

Creation of master data for the Food Importer

Master data relates to unique identifiers for the business entity and business location. The creation of unique identifiers enables the business and trading partners to have consistency and interoperability between systems.

"Master data is the consistent and uniform set of identifiers and extended attributes that describes the core entities of the enterprise including customers, prospects, citizens, suppliers, sites, hierarchies and chart of accounts." [2]

Business licences and notifications

If a food Importer sells product for retail, the business must register with the local Council. If the Importer sells wholesale products, they must notify the state food authority. For some products, a licence will be required.

Tasks related to traceability

- Create master data for Importer and key supply chain partner entities and locations
- Registration/notification of Food Business

Key Participants

- Producer/grower, wholesaler or manufacturer directly exporting
- Export company supplier (non-producer/manufacturer)
- Importer
- State and local authorities managing food safety and business registrations
- Issuing body for Global Location Numbers.

[1] Commonwealth of Australia, 2016, Imported Food Reforms Decision Regulation Impact Statement Department of Agriculture, Water & Environment

[2] Gartner www.gartner.com

Mandated Food Safety and Traceability requirements for importers

Organic produce imports

For imported organic products, a Transaction Certificate (a document for the sale and movement of certified products), issued or endorsed by a competent authority or government approved certification organisation, shall be available. This shall include clear statements regarding the certification status/ level and certification number of the product/s, linking them to an identifiable batch or related code number. This shall also include the date of transaction and buyer and seller details. [3]

Food receipt

In relation to food receipt, a food importer or wholesaler must be able to provide information about what food it has on the premises and where it came from.

A food business must provide, to the reasonable satisfaction of an authorised officer upon request, the following information relating to food on the food premises:

1. The name and business address in Australia of the vendor, manufacturer or packer or, in the case of food imported into Australia, the name and business address in Australia of the importer and
2. The prescribed name or, if there is no prescribed name, an appropriate designation of the food.

This means that a food business must not receive a food unless it is able to identify the name of the food and the name of the supplier.

A

food business engaged in the wholesale supply, manufacture or importation of food must have a system, set out in a written document, to ensure it can recall unsafe food. The system should include records covering:

- Production records
- What products are manufactured or supplied
- Volume or quantity of products manufactured or supplied
- Batch or lot identification (or other markings)
- Where products are distributed
- Any other relevant production records.

This information should be readily accessible to know what, how much and from where product needs to be recalled.

[3] Australian Organic Ltd, Australian Certified Organic Standard 2021, Section 3.4.5

Source: AWE www.agriculture.gov.au

Tasks related to traceability

- Record the identity of the food or ingredient and the identity of the supplier
- Document a Recall System for the business which compiles the identity and location of customers and the identity, date, volume, batch or lot of product sold.

Key Participants

- Importer
- Distribution agent
- Customer (purchase orders and sales receipts)
- Food safety inspector
- Food safety auditor.

Tracing product origin and composition through offshore suppliers

Depending on the capacity of the grower of source ingredients, a minimum of lot number identification of the product from the farm can be traced. [4] The lot number and Sales Receipt issued from the Processor or Wholesaler to the Grower can then be identified as the product becomes an input to processing or manufacturing.

See *On-Farm Production* and *Processing and Manufacturing Modules* for Critical Tracking Events and Key Data Elements for growers, pack houses and processing/ manufacturing traceability.

Methods to establish and verify product origin and authenticity relate to analytical sampling, test certificates and auditing of the grower or supplier.

Organic certification in countryof origin

Evidence of organic certification of produce in the country of origin is required for importers and wholesalers of fruit, vegetables, and herbs. Without certification, organic claims and labelling of the product for distribution in Australia cannot be claimed as "certified organic".

Tasks related to traceability

- Request proof of origin/provenance documentation from the supplier
- Undertake a traceability audit of suppliers to identify product origin and inputs to product manufacturing
- Document the Supplier policies and SOPs for traceability, recall and sourcing
- Record lot/batch numbers of incoming product.

Key Participants

- Grower
- Wholesaler/Agent
- Supplier
- Importer

Arrival and clearance at Australian discharge port

A series of documents are required to enable the physical movement of the product from the vessel or aircraft on arrival in Australia.

These include:

- Bill of Lading/Air Waybill
- Commercial invoice
- Packing list
- Packing Declaration (packing materials)
- Certificate of Origin
- Fumigation Certificate
- Import Delivery Order.

These documents record dates, times, authorisation signatures associated with the event-based movement of the product and support traceability through the import process. The Air Waybill and Bill of Lading contain detailed descriptions of the product, including supplier lot and batch numbers on each carton.

The *Air Waybill* and *Ocean Bill of Lading* are critical documents that detail the shipment. Until the airline or shipping line authorises these documents to be handed over to the party nominated by the shipper (Exporter or their Freight Forwarder/Importer or their Freight Forwarder) the cargo remains in the custody of the carrier.

For ocean shipping, generally 24 hours' notice is required from the ship's Master that the vessel is arriving in port in order to prepare for biosecurity inspection. On arrival at the port of discharge/ destination, the nominated party on the Bill of Lading (Customs Broker, Importer) is notified of the discharge of the container and once clearance is completed, the availability of the container for collection. Biosecurity inspection may be required. This may be undertaken at the port of discharge, or once the container is transported to a facility that is licensed for inspection.

The *Incoterms* (international rules for the interpretation of trade terms) of the transaction between Exporter and Importer determine the responsibility for port clearance and subsequent delivery to the Importer. Arrangements will be made via the Exporter (often via an International Freight Forwarder and their international partnering Customs Broker) to hire a Transport Company to collect the container from the terminal and deliver at the instruction of the Importer to a nominated warehouse/ DC. Shipping lines may arrange the transport delivery (carrier haulage) or the Exporter or Importer may take this responsibility (merchant haulage).

An electronic *Import Delivery Order* which the Airline/Shipping Line issues as per the Bill of Lading/Airway Bill enables the container to be loaded on the transport and leave the terminal. "Gate Out" date and time stamp at the port terminal are recorded.

On leaving the port, tracking of the transfer to the Importer premises or Distribution Centre is typically undertaken using a Transport Booking reference issued by the Transport Company, or via GPS tracking. In Australia, staging of containers is common, with the container being held at a transport depot overnight before being delivered to the Importer.

On arrival at the delivery destination, a *Proof of Delivery* by the Transport Company is signed by the Importer. The Importer will then check and remove the container seal (with IFIS inspector present as required), examine the goods as listed on the Bill of Lading/Airway Bill, packing list and commercial invoice and advise the Exporter of any variances.

[4] FAO Traceability Guide www.fao.org

Tasks related to traceability

- As per Bill of Lading, Shipping Line/Exporter/Importer or Forwarder will book transport to collect the container from the port terminal
- An Import Delivery Order will enable the transport (road or rail) to clear the terminal
- The Cargo Terminal Operator (CTO) records "gate out" details
- Proof of Delivery is signed by the Importer/DC
- Goods delivered are inspected and scanned/recorded in Importer goods receival system/Warehouse Management System.

Key Participants

- Airline/shipping line
- Transport Company
- International Freight Forwarder and Customs Broker
- CTO
- Australian Border Force/Customs
- Department of Agriculture, Water, Environment, Imported Food Inspection Scvheme (IFIS).

Border Clearance regulation

Regulation at Australian borders relates to –

- Biosecurity control preventing the introduction and/or spread of harmful organisms to animals and plants in order to minimize the risk of transmission of infectious disease.
- Food Safety control and inspection to ensure imported food complies with Australian food safety standards
- Food Import Declaration to ensure the goods are not prohibited for importation and the correct taxes and duties are paid.

Biosecurity and Food Safety

As with domestic food distribution, all importers are required to provide documents on request, demonstrating the traceability of imported food, one step forward and one step backward along the food supply chain.

The Australian Department of Agriculture, Water and the Environment (DAWE) is responsible for biosecurity risk and food safety of imported foods. It will confirm whether the product to be imported is able to be brought into Australia and under what conditions. The *Biosecurity Import Conditions System* (BICON) on-line site identifies whether the product is permitted, is subject to conditions, requires supporting documents or needs an Import Permit.

Food is classified by Food Safety Australia New Zealand (FSANZ) as being a *Risk Food* with a medium to high risk or microbial or chemical hazard; a *Surveillance Food* with a low risk; or a *Compliance Agreement Food* for regular importers who have qualified for this scheme.

Depending on the classification of the food to be imported, an Import Permit may be required. Addition documentation that may be required includes –

- Health Certificate
- Phytosanitary certificate
- Manufacturers Declarations
- Import Declaration
- Lot code listings with best-before dates.

Inspections of food take place at the premises of the Importer or a warehouse area that has an arranged agreement with DAWE. [5]

Record keeping requirements for food Importers relating to traceability of imported foods are as follows –

- Food importers, or the owner of the food at the time of importation, must keep the following information in relation to the food being imported:
- A name or description of the food sufficient to indicate its true nature
- Batch or lot identification for the food
- Name of the person, business name, street address and telephone number or email address of the producer of the food
- Name of the person, business name, street address and telephone number or email address of customers that have received the food
- The date the food was received and the date when it was dispatched to customers
- The volume or quantity of the food involved in each transaction.

Records may be kept in a manual or electronic system but must be kept for five years. [6]

Border clearance

All food importers are required to complete a *Full Import Declaration* (FID) on the Australian Border Force (Customs) *Integrated Cargo System* site. This declaration relates to the value of the cargo, to ensure all taxes and duties are paid.

Tasks related to traceability

- Maintain information to comply with the traceability requirements of state and Commonwealth legislation

Key Participants

- Importer
- Distributor
- State food safety authorities
- DAWE Imported Food Inspection Service (IFIS) inspector

[5] www.agriculture.gov.au
[6] DAWE Imported Food Notice INF18-19

Re/labelling of imported food products to meet Australian standards

Importers should contact all suppliers, or put systems in place, to ensure that the labelling on their food products comply with the Code prior to importing food products or ensure that labelling is compliant prior to inspection. The Imported Food Control Act 1992 provides for the labelling of food products to be amended after importation and before inspection by the department. [7]

If the imported product does not comply with Australian food labelling standards, the Importer may need to re-label the product. Key information required on the label relates to:

- Best-before/use-by dates – the product may have an expiry or BBE date which is not compliant
- Country of Origin
- Nutritional information
- Ingredients.

For product requiring re-labelling prior to IFIS inspection, there is an opportunity to ensure the items are allocated a unique identifier on the label, to establish traceability in distribution within Australia.

Labelling of certified organic products

There is no requirement for labelling of organic product in Australia. Claims of organic production, proportions of organically produced content etc, are currently covered in the voluntary Australian Organic Standard (AS 6000: 2015).

However, those wishing to use the Certified Organic symbol must certify the product with an authorised certifying body and follow the required labelling as to organic status – for example, see section 3.5 Australian Certified Organic Standard 2021.

Tasks related to traceability

- Include unique identifier on re-labelled products prior to distribution
- Comply with traceability requirements of Certified Organic Standard.

Key Participants

- Importer
- Labelling supplier
- Authorised Organic Certifying body.

7 www.agriculture.gov.au

Critical Tracking Events

For each of the identified Import activities, **critical tracking events (CTEs)** establish identity and enable traceability and compliance with traceability-related regulation are summarised as follows:

Critical Tracking Events (CTEs) relate to the identity, movement and transformation of the food product.

Import activity	CTE code	Critical Tracking Events (CTEs)
Establishment data		
Organic Certification of Importer/ Wholesaler	OIM CTE1A	Organic Certification and recognition by Authorised Certification bodies
Creation of Master data for Supplier and Wholesaler, Grower Creation of Importer master data	OIM CTE1B	Create master data for key supply chain partner identities and locations
Registration and Notification of Food Business and Premises	OIM CTE1C	Obtain import permit as required Food premises licence/notification
Mandated Food Safety Traceability requirements for importers		
Record the identity of the food or ingredient and the identity of the supplier	OIM CTE2	Create Traceability Record system for food imports
Document a Recall System for the business which compiles the identity and location of customers and the identity, date, volume, batch or lot of product sold.	OIM CTE3	Create a Product Recall system
Tracing product origin and composition through offshore suppliers		
Request proof of origin/ provenance documentation from the supplier Undertake a traceability audit of suppliers to identify product origin and inputs to product manufacturing Document Supplier policies and SOPs for traceability, recall and sourcing	OIM CTE4A	Proof of Origin/provenance documentation of sourced product
Maintain records of Certified Organic Suppliers	OIM CTE4B	Certification Status of international suppliers recorded in Approved Supplier List
Vessel Arrives at Port	OIM CTE 5	Vessel arrives at Australian discharge port
Clearance of container As per Bill of Lading, Shipping Line/ Exporter/Importer or Forwarder will book transport to collect the container from the port terminal An Import Delivery Order will enable the transport (road or rail) to clear the terminal	OIM CTE 6	Product transferred from Vessel to Importer Transport
Product departs Port The CTO records "gate out" details	OIM CTE8	Gate Out from port notified to Importer
Product arrives at Importer Warehouse Proof of Delivery is signed by the Importer/DC	OIM CTE9	Proof of Delivery signed by Importer
Goods delivered are treated with approved treatments and kept in controlled atmosphere required. Goods inspected Goods scanned/recorded in Importer goods receival system/ Warehouse Management System Goods receival completed	OIM CTE10	Documentation to verify goods have not been irradiated or fumigated with non-approved fumigant for organic produce.
Re/labelling of imported food products to meet Australian standards Include unique identifier on re-labelled products prior to distribution	OIM CTE11A	Apply unique identifier on re-labelled product prior to domestic distribution
Label compliant with Certified Organic status	OIM CTE11B	Use of Certified Organic labelling compliant with Australian Standard for Organic and Biodynamic Produce 2021

Key Data Elements

Event Code	CTE	Key data elements
OIM CTE1A	**Obtain Certified Organic status**	• Certified Organic number • Audit date • Authorised Certifying Body name
OIM CTE1B	**Create master data for key supply cfhain partner identities and locations**	• Global Location Number
OIM CTE1C	**Obtain import licence for premises/ establishment/s**	• Import Licence number • Food Premises Licence/Notification certificate number **Information to be shared to a traceability platform** **Request for GLN** **Who**: Importer, Issuing Agency **What**: Importer, location, business entity **When**: Date/Time of Issuance **Where**: Issuing Agency **Why**: Requirement for Global location numbers, establishment **Request for Food Licence Number** **Who**: Importer, Issuing Agency **What**: Importer business entity **When**: Date/Time of Issuance **Where**: Issuing Agency **Why**: Food Licence **Information to be shared to a traceability platform** • Certified Organic Number • Authorised Organic Certifying body name • Audit date • Global Location Number • Food Import Licence number • Food Premises Licence/Notification certificate number
OIM CTE2	**Create Traceability Record system as part of Organic Management Plan for food imports**	**Traceability system data fields** • Approved Supplier List with current Organic Certification Numbers and currency of international suppliers • a name or description of the food sufficient to indicate its true nature • batch or lot identification for the food • name of the person, business name, street address and telephone number or email address of the producer of the food • name of the person, business name, street address and telephone number or email address of customers that have received the food • the date the food was received and the date when it was dispatched to customers • the volume or quantity of the food involved in each transaction. **Traceability System set-up** **Who**: Importer **What**: Traceability system **When**: Date/Time of creation **Where**: Importer **Why**: Traceability system and compliance requirements
OIM CTE3	**Create a Product Recall system**	**Food Recall Plan and procedures:** • internal procedures and staff responsibilities for conducting a recall • contact details and procedures for notification (e.g. FSANZ and home state, distributors, wholesalers, retailers and consumers) • distribution and other records that will help identify and retrieve the recalled food • procedures for food retrieval and assessing any returned product. **Recall System set-up** **Who**: Importer **What**: Recall system and processes **When**: Date/Time of creation **Where**: Importer **Why**: recall and compliance requirements **Information to be shared to a traceability platform** • Certified Organic number • Authorised Organic Certifying body • Audit date • Product Recall procedures • Traceability records on request

Event Code	CTE	Key data elements
OIM CTE4A	**Proof of Origin/ provenance documentation**	• GLN of grower and international exporter • Sales receipt recording sale to Wholesaler • Provenance/Analytical Verification Certificate
OIM CTE4B	**Certified Organic status of sourced product**	• Certified Organic number of supplier, certifying body and audit date **Proof of Origin/Provenance** **Who**: Importer; Supplier **What**: Product ID, Provenance, proof of origin, organic certification status **When**: Date/Time of issuance **Where**: Importer **Why**: Proof of Origin, Provenance, Organic claim **Information to be shared to a traceability platform** • Grower GLN • Code of analytic testing document • Certified Organic no. of grower; certifying body; audit date • Grower sales receipt to international wholesaler
OIM CTE5	**Vessel Arrives at Port**	• Vessel ID • Bill of Lading • Port Location • Shipment ID • Date of Arrival • Container ID • Customer Order Number. **Vessel Arrives** **Who**: Vessel ID; Issuing Agency **What**: Vessel ID, Bill of Lading, Shipment ID **When**: Date/Time of Receipt **Where**: Receipt location **Why**: Receipt of product **Information to be shared to a traceability platform** • Vessel ID • Bill of Lading • Product ID • Batch • Quantity • Container ID.

Event Code	CTE	Key data elements
OIM CTE6	**Goods transferred from Vessel to Importer Transport**	• Container ID • Shipment number • Product ID • Border Clearance status • Batch • Quantity • Transport ID. **Goods Transfer** **Who**: Vessel ID; Transport ID; Port ID **What**: Vessel ID, Bill of Lading, Shipment ID **When**: Date/Time of Transfer **Where**: Port **Why**: Transfer from Vessel **Information to be shared to a traceability platform** • Transport ID • Shipment number • Product ID • Batch • Quantity • Container ID • Border Clearance Documentation • Date.

Event Code	CTE	Key data elements
	Border Clearance	
OIM CTE7	Maintain records for mandated traceability	• Vessel ID • Bill of Lading • Port Location • Shipment ID • Date of Arrival • Container ID • Customer Order Number.

Border Clearance	
Who	Importer Customs Agency
What	Vessel ID, Bill of Lading, Shipment ID
When	Date/Time of Clearance
Where	Product location at time of Clearance
Why	Border Clearance

Information to be shared to a traceability platform

- Vessel ID
- Bill of Lading
- Product ID
- Batch
- Quantity
- Container ID
- Border Clearance Documentation
- Date of Border clearance.

Event Code	CTE	Key data elements
	Goods depart Port	
OIM CTE8	Gate Out from port notified to Importer	• Transport ID • Shipment number • Product ID • Batch • Quantity • Container ID • Border Clearance Documentation • Import delivery number • Date and Time.

Product departs Port	
Who	Transporter ID Port
What	Vessel ID, Bill of Lading, Shipment ID
When	Date/Time of Departure from Port
Where	Port Location
Why	Departure from Port

Information to be shared to a traceability platform

- Transport ID
- Shipment number
- Product ID
- Batch.

Event Code	CTE	Key data elements
	Product arrives at Importer	• Date and time • Job number • Freight paid by
OIM CTE9A	Proof of Delivery signed by Importer	• Collected from • Delivered to • ECN (or if de-consolidated) number of pallets or cartons • Contact • Phone • Acceptance of terms and conditions • Signature • Receival data and time • Supplier ID and location • Lot/Batch number and use-by date • Item description • Quantity • Units • Load unit SSCC • Product requirements (temperature, humidity) • Proof of Delivery

Receipt at Importer DC	
Who	Transporter ID Importer ID
What	Container ID, Bill of Lading, Shipment ID, Logistics units, Product ID, Quantity, Batch
When	Date/Time of Receipt
Where	Receipt location
Why	Receipt of product/container

Event Code	CTE	Key data elements
OIM CTE9B	**Inspection and treatment** Documentation to verify goods have not been irradiated or fumigated with non-compliant fumigant for organic produce	• Treatment record (irradiation or fumigation) to maintain organic status. **Information to be shared to a traceability platform** • Proof of Delivery number • Shipment ID • Container ID • Product ID • Quantity received • Batch • Date of Receipt • Import Delivery Order/Air Waybill/BOL/Purchase Order reconciliation • Treatment record.
OIM CTE10	**Maintain records for mandated traceability**	Maintain records for 5 years of • a name or description of the food sufficient to indicate its true nature • batch or lot identification for the food • name of the person, business name, street address and telephone number or email address of the producer of the food • name of the person, business name, street address and telephone number or email address of customers that have received the food • the date the food was received and the date when it was dispatched to customers • the volume or quantity of the food involved in each transaction. **Information to be shared to a traceability platform** • As requested.

Event Code	CTE	Key data elements
OIM CTE11A	**Apply unique identifier on re-labelled product prior to domestic distribution**	• GTIN • Batch • Quantity • Use By/Best Before date. **Product re-labelling for local marker** **Who**: Importer ID **What**: Product ID original, Product ID new, Batch, Use By/Best Before, Quantity **When**: Date/Time of re-labelling **Where**: Warehouse **Why**: Re-labelling **Information to be shared to a traceability platform** • New GTIN of product • Batch • Use by/Best Before date • Quantity • Location.
OIM CTE11B	**Labelling/ Re-labelling of Product to Australian Organic Standards**	• The name of the product or a description of the compound feeding stuff (ingredients list) • Appropriate reference to certification (e.g., Organic, Organic in conversion, etc.) • Certification Body name, certification number, and relevant Bud logo • Name and address and/or registered mark of the certified operator or owner of the product and/or label as required by law. **Information to be shared to a traceability platform** • Certified Organic certificate number • Certifying body name • Certification status.

Application of GS1 global data standards

Adoption of global data standards enables data sharing between businesses through using common formats. These formats allow a business to identify participants, locations, products, processes and events in the supply chain.

Foundational Elements

Location Identification (GLN)

The unique identification of locations is a critical component of traceability systems and is used to identify where specific transactions and events have occurred.

The Global Location Number (GLN) is the globally unique GS1 Identification Number for locations and supply chain partners. The GLN can be used to identify a functional entity (like accounts receivable or a bill back department), a physical entity (like a distributor location, shipping dock), or a legal entity (like a parent corporation or subsidiary).

The attributes defined for each GLN [e.g., name, address, location type (e.g., ship to, bill to, deliver to, etc.)] help users to assure that each GLN is specific to one unique location within the world.

Product Identification (GTIN)

The Global Trade Identification Number (GTIN) can be used to identify loose or pre-packed trade items, input materials, outputs, at any stage of the supply chain up to the end consumer.

In order to ensure traceability along the entire supply chain, the GTIN should be allocated as early as possible. The brand owner is normally responsible for the allocation of the GTIN. In case of non-branded items (which is typical, for example, in fisheries), the GTIN is assigned by the party which brings the product into the market; this can be the producer/processor or wholesaler.

When retailers, distributors, or operators ask suppliers for own-label products, they (the retailers, etc.) are the brand owner and are therefore responsible for identifying that product in the supply chain. The best practice is to identify these own-label items using the Global Trade Item Number (GTIN). In these cases, the retailers, distributors, or operators will provide the GTIN to use on the product's packaging.

If a company further processes and packages a product in the supply chain, such as the case with store-processed product, then that company becomes the manufacturer and is responsible for assigning a GTIN and traceability attributes. This may be achieved using a combination of human readable and scannable product information. This information should also be stored for future retrieval if necessary.

A separate GTIN must be assigned to every different variation of a product. size, style, grade, colour, quantity etc are all considered separate variations and thus require separate GTINs. Each level of packaging should be numbered (and barcoded) separately to all other levels.

Attributes of Trade Items

Attribute information of trade items is any data over and above the item identifier, i.e. the GTIN.

Examples of this type of information include batch numbers, production, use by and best before dates and variable measure information such as length, weight etc. Attribute information is represented by GS1 Application Identifiers (AIs) and these ensure that the attribute information can be interpreted unambiguously by trading partners throughout the entire supply chain.

In order to enable cost-effective adoption by food processes and manufacturers, it is recommended the use of attribute data to provide traceability of product from the distributor or wholesaler for export, providing visibility and faster and more efficient recalls and food safety.

Suppliers, at their discretion, can also apply to trade items, any of the AIs available to them under the GS1 specifications. When using GS1-128 barcodes export food items, it is recommended that the following information should be encoded in the barcode on every level of packaging:

1. Item Identifier [Global Trade Item Number (GTIN)]
2. Date (Production, Packaging, Expiration or Best Before)
3. Production Information (Batch/Lot Number or Serial Number).

Batch/lot and serial identification

The minimum requirements for traceability rely upon a combination of the GTIN and batch/lot number and/or serial number.

Note 1: If both the batch/lot number and serial number are present, as sometimes happens, the batch/lot number takes precedence in case of a recall.

Note 2: Regarding Trade Item Attribute information:

- Attribute information cannot stand-alone; it must always be accompanied by a GTIN
- Attribute information must be encoded in a GS1-128 barcode/ EPC enabled RFID tag / GS1 2Dimensional Symbol.
- If an AI appears on the same item more than once (e.g. if two labels are applied to the same item) the AI must be followed by the same information on each label.

For more information regarding the use of AIs, please refer to the GS1 General Specifications: www.gs1.org

Asset Identification

The GS1 System provides a method for the identification of assets. The object of asset identification is to identify a physical entity as an inventory item.

Asset Identifiers may be used for simple applications, such as the location and use of a given fixed asset (e.g. a personal computer), or for complex applications such as recording the characteristics of a returnable asset (e.g. a Intermediate Bulk Container), its movements, its life-cycle history and any relevant data for accounting purposes.

GS1 System asset identifiers can be used to identify any fixed assets of a Company. It is left to the discretion of the issuer to determine whether the Global Returnable Asset Identifier (GRAI), AI (8003), or Global Individual Asset Identifier (GIAI), AI (8004), is more suitable for the application concerned. Asset identifiers must not be used for any other purpose and must remain unique for a period well beyond the lifetime of the relevant records.

Global Returnable Asset Identifier (GRAI) – AI (8003)

A Returnable asset is a reusable package or transport equipment of a certain value, such as a beer keg, a gas cylinder, a plastic pallet, or a crate. The GS1 System identification of a returnable asset, the Global Returnable Asset Identifier (GRAI), enables tracking as well as recording of all relevant data.

A typical application using a GRAI is in tracking returnable beer kegs. The owner of the beer keg applies a barcode carrying a GRAI to the keg using a permanent marking technique.

This barcode is scanned whenever the keg is supplied full to a customer and scanned again when it is returned. This scanning operation allows the beer keg owner to automatically capture the life-cycle history of a given keg and to operate a deposit system if desired.

Global Individual Asset Identifiers (GIAI) – AI (8004)

An Individual Asset is considered a physical entity made up of any characteristics. The Global Individual Asset Identifier (GIAI) identifies a physical entity as an asset. It must not be used for other purposes and must be unique for a period well beyond the lifetime of the relevant asset records. Whether the assigned GIAI may remain with the physical item when changing hands depends on the business application. If it remains with the physical item, then it must never be re-used. This element string might, for example, be used to record the life-cycle history of a wine vat or barrel. By symbol marking the GIAI, using AI (8004), on a given vat, or barrel, wine manufacturers are able to automatically update their inventory database and track assets from acquisition until retirement.

Note: Whilst GS1 Asset Identifiers can be used to identify returnable assets such as Shipping Containers, it is recognised that globally accepted identifiers can also be used e.g. BIC code

Logistics Units (SSCC)

The Serial Shipping Container Code (SSCC) can be used by companies to identify a logistic unit, which can be any combination of trade items packaged together for storage and/ or transport purposes, for example a case, pallet or parcel.

The SSCC is a crucial key for traceability, since it uniquely identifies each distributed logistic unit and its content.

- The SSCC enables companies to track each logistic unit for efficient order and transport management.
- The SSCC can be encoded in a barcode or EPC/RFID tag, ensuring the logistic unit can be accurately and easily identified as it travels between trading partners, anywhere in the world.
- When SSCC data is shared electronically via EDI or EPCIS, this enables companies to share information about the status of logistic units in transit, and reliably link it to related transport information such as shipment details.
- The SSCC enables companies to link to additional information about the logistic unit. This information can be communicated via a Dispatch Advice or Advanced Shipping Notice (ASN) prior to the logistic unit's arrival. Upon receipt the SSCC will be scanned, providing the required information to speed up the receipt of goods as well as the subsequent invoicing process.

The SSCC is fully compatible with ISO/ IEC 15459 – Part 1: unique identifiers for transport units. This is often referred to as the ISO licence plate and is a prerequisite for tracking and tracing logistic units in many international supply chains.

Global Identification Number for Consignment (GINC)

The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together

Logistic units in a particular shipment may be associated with different GINCs during various transport stages; for example, when the shipment gets consolidated with other shipments during its journey and deconsolidated again before it reaches the consignee. The GINC allows freight forwarders and transport providers to keep track of the logistic units being transported together.

- The GINC is typically used by freight forwarders to instruct transport providers; for example, on a Master Airway Bill (MAWB) or a Master Bill of Lading (MBL)
- The GINC can be encoded in a barcode or as text on a MAWB / MBL, or in addition to the Serial Shipping Container Code (SSCC), on a logistics label
- The GINC can be electronically used in transport instruction and transport status messages between freight forwarder and transport provider.

Global Shipment Identification Number (GSIN)

The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together.

The logistic units keep the same GSIN during all transport stages, from origin to final destination. The GSIN identifies the logical grouping of one or several logistic units, each identified with a separate Serial Shipping Container Code (SSCC).

- The GSIN can be encoded by the shipper in a barcode or as text on a House Waybill, or in addition to the SSCC, on a logistics label.
- The GSIN can be electronically used by a company in transport instruction and transport status messages between freight forwarder and transport provider, and also as a reference in the Dispatch Advice.

The GSIN is fully compatible with ISO/IEC 15459 – Part 8: grouping of transport units. The GSIN also meets the requirements for a unique consignment reference (UCR) according to the World Customs Organisation.

Data standards that apply to key data elements and shared information are identified in this section.

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Location	Manufacturing Plant, Finished Goods Location, Dispatch Dock	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	Production Date and/or time, Use By date, Best Before Date, Pack Date	Year -Month-Date	**YYMMDD**	Whilst human readable date formats can vary e.g. 21 December 2020, 21 December 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD.
Product Identifiers	Input materials such as raw ingredients and packaging, Outputs such as finished goods, packaged or processed goods	Global Trace Item Number (GTIN)	**N14**	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org Information on how to allocate a GTIN to a variable weight or variable measure trade item www.gs1.org
Traceability Attributes	Batch/Lot code, Serial Number		**AN20**	Traceability Attributes, such as Batch or Lot Number or Serial Number etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers. www.gs1au.org
Logistics Units	Pallet of Finished Goods, Crate or Box of finished Goods	Serial Shipping Container Code (SSCC)	**N18**	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Assets	Returnable assets Ie: IBC or individual assets Ie: A crate		**N13**	Can be identified as an asset type only or an optional serial number can be added to distinguish individual assets. www.gs1au.org
Consignment	Grouping of logistics units assigned by the transport company	GINC	**N30**	The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together. www.gs1.org
Shipment	Grouping of logistics units	GSIN	**N17**	The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together. www.gs1.org

Useful links

Labelling of imported food

www.agriculture.gov.au

Food safety standards of imported foods

www.foodstandards.gov.au

Imported Food Inspection

www.agriculture.gov.au

Food import business

www.foodauthority.nsw.gov.au

Food Recall Plan and procedures

www.foodstandards.gov.au

Glossary

Air Waybill and Ocean Bill of Lading

The Air Waybill (AWB) is a critical air cargo document that constitutes the contract of carriage between the "shipper" and the "carrier" (airline). The Electronic Air Waybill Resolution 672 (MeA) removes the requirement for a paper AWB. There is therefore no longer a need to print, handle or archive the paper, largely simplifying the air cargo process. (IATA)

An ocean bill of lading (OBOL, BOL, BL) is a document required for the transportation of goods overseas across international waters. The contract is legal and outlines the type, quantity, and destination of goods being carried. The shipper and carrier sign the ocean bill of lading upon shipment, and the receiver signs the document upon receipt. (Investpedia).

BICON

Australian Biosecurity Import Conditions (BICON) houses the Australian Government's Biosecurity import conditions database for more than 20,000 plants, animals, minerals and biological products.

Customs Broker

The Customs Act 1901 (Customs Act) provides that only the owner of goods or a customs broker licensed by the Comptroller-General of Customs for the Department of Home Affairs (the Department) can submit an import declaration to enter goods for home consumption in connection with the importation of those goods.

Customs Brokers also check all clearance documentation to ensure it's correct and can provide advice on the best way to obtain clearance of your goods into and out of Australia. A licensed Customs broker can lodge Customs entries in all states of Australia, and can clear cargo by air, sea, and post.

Cargo Terminal Operator (CTO)

Air CTOs undertake a wide range of activities. They may be an airline in their own right or act on behalf of other airlines. CTOs are responsible for the carriage or arranging the carriage of the cargo, the discharge of cargo from the aircraft, the release of the cargo and arranging to move it according to contractual obligations and operational requirements. (ABF)

Sea port CTOs manage terminal operations and load/unload vessels, oversee short term storage of cargoes, monitor security and transport access to the terminal.

Freight Forwarder

The freight forwarder is a business specialising in international trade and transport. A Freight Forwarder manages shipping documents, freight rates, customs clearance, packing, insurance, road transport and delivery of cargo to its intended destination.

Full Import Declaration (FID)

Customs brokers and importers must complete FIDs for imported food. FIDs are lodged through the Department of Home Affairs' Integrated Cargo System (ICS). For more information www.agriculture.gov.au

Import Delivery Order/Electronic Import Delivery Order

An Import Delivery Order is provided by the Importer/Forwarder to the carrier (shipping line/airline) to release cargo to a third party (Transport Company) for delivery to the Importer. Until this is received, the cargo cannot be released to the transport to collect from the Cargo Terminal Operator. For this process to be automated for containerised cargo, see

www.1-stop.biz

Incoterms

The Incoterms® rules are the world's essential terms of trade for the sale of goods. Whether you are filing a purchase order, packaging and labelling a shipment for freight transport, or preparing a certificate of origin at a port, the Incoterms® rules are there to guide you. The Incoterms® rules provide specific guidance to individuals participating in the import and export of global trade on a daily basis.
www.dachser.at

Proof of Delivery (POD)

A commercial document used by the Consignee or their Logistics Service Provider to notify the Consignor of the receipt and acceptance of a delivery. A signed POD enables the Transport Company to raise an invoice.

Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Export

EXPORT OF ORGANIC PRODUCE

Australia is a net exporter of food, with exports accounting for around two thirds of food produced domestically. Australia has a target of $100 billion p.a. value of food exports by 2030.[1]

Prescribed or Non-prescribed exports?

Food export products can be grouped into two groups – *prescribed* and *non-prescribed*. A *prescribed product* is one listed in Australia's Export Control Act 2020 and Export Control Rules 2021 for *Plants* and for *Organic Produce*. These rules are controlled by the Department of Agriculture, Water and the Environment (AWE).

Prescribed goods under plant exports and organic produce include:

- Grain and legumes
- Fresh fruit
- Fresh vegetables
- Hay and straw
- Any other plants requiring a phytosanitary certificate from the import country.

As a prescribed export, organic goods requirements are additional to those required for non-organic plants, as follows:

- Producers, suppliers, processors, manufacturers and storage facilities to be certified as "organic certified operators" by an approved certifying body
- Be registered as part of an Approved Arrangement (AA) for export of prescribed goods
- Be exported with an Organic Goods Certificate (OGC)
- Be inspected prior to export by a Plant Export Authorised Officer (AO).

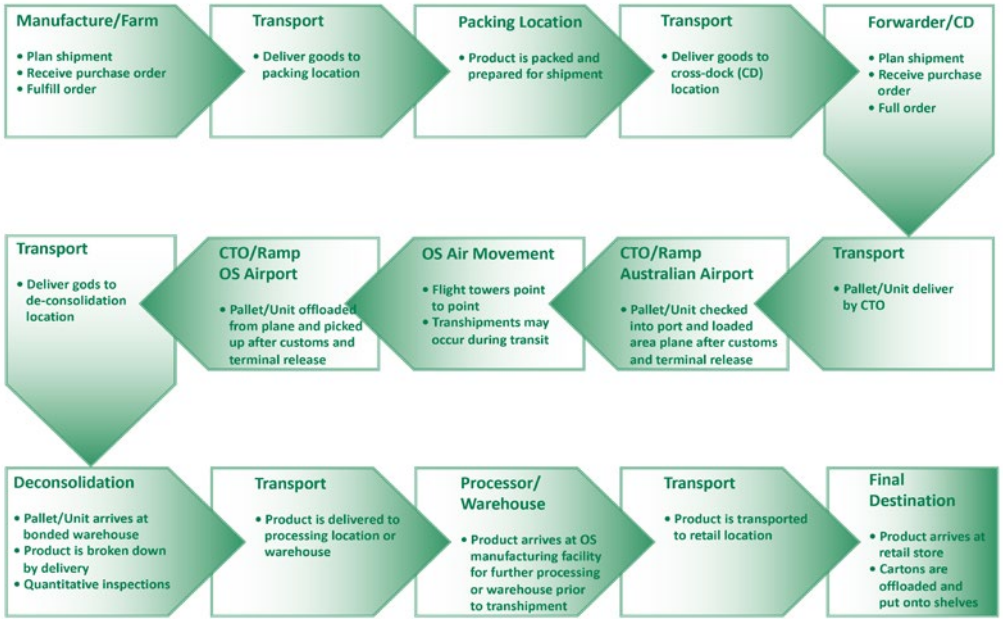
Air or Sea shipment?

Export processes tend to be strongly influenced by the mode of transport – air or sea freight-used for international carriage of freight.

Exports of high value fresh and manufactured products are commonly freight-favoured to airfreight, based on the availability of underbelly space in passenger aircraft. Pre-COVID, 80% of airfreight exports from Australia were via passenger aircraft. Air exports of food products normally make up around 12% of total Australian airfreight. They include vegetables, live animals, prepared foodstuffs and liquor, and animal and vegetable oils. The most prevalent airfreight foods are seafood and meat.

In terms of the physical movement from the farm or manufacturer, a typical airfreight export process is described as follows:

Indicative airfreight porcess



[1] nff.org.au

For the product to execute the physical movement, transactions and interactions with multiple players must occur.

Supply Chain Participant /Booking Initiator	Manufacture/Farm	Tansport to Forwarder	Forwader–Cros-Dock	Transport to CTO–Process Documentation	CTO–Receive and Prepare for flight	Ramp_–ransport to Plane Cargo Hold	Flight	Australian Border Force	Biosecurity	Shipping Equipment	Ramp–transport from Plane Cargo Hold	CTO–Receive from Flight and dispatch	Transport to Cros-dock	Customs Brocker Cross-dock	Transport to Importer	Importer	Overseas Customs	Overseas Quarantine
Manufacture/Farm		●	●				●			●								
Export/Trader	●	●	●				●	●		●								
Forwarder–Cross-dock		●		●			●	●	●	●								
CTO				●		●		●	●		●							
Export/Trader					●			●			●	●						
Overseas CTO																	●	●
Customs Broker						●							●		●	●	●	●
Importer						●								●	●		●	●

Incoterms

Incoterms is a key aspect of international trade. The terms of trade between the seller and international buyer determine the chain of custody of the product and the extent to which the Australian exporter coordinates the processes and transactions related to the product movement.

Processes covered in this module include:

1. Establishment data
2. Export sales contract and Incoterms
3. Packing and labelling to export country requirements
4. Preparing correct export documentation
5. Border clearance from Australia
6. Pickup and delivery to air/seaport
7. Storage and loading at port
8. In-transit monitoring
9. Arrival and clearance at final destination port
10. Pickup from port terminal and delivery to importer.

Establishment activities

Create master data for trading partners and locations

Creation of master data for exporter, importer and key nodes in the supply chain will enable unique identification of the entities and locations engaged in the product's journey.

Certify under the National Standard for Organic and Bio Dynamic Produce

Certification under this Standard will provide a Certificate Number for producers, suppliers, processors, manufacturers and storage providers. Becoming an Organic Certified Operator is a prerequisite for an Approved Arrangement for export of organic goods. If a business premises prepares organic goods for export, it must be approved by one of Australia's organic certifying bodies to this standard.

Growers may use a packhouse that is part of an Approved Arrangement held by an Exporter that offers storage and export inspection services by a Plant Export Authorised Officer (AO) as specified under the standard, or as required by the import country.

The role of Organic Certifying Bodies authorised by the Department of Agriculture, Water and the Environment is to:

- **Assess** organic and bio-dynamic operators to determine compliance to the National Standard and importing country requirements
- **Certify** the production systems, controls, and operations of an operator as organic/bio-dynamic and recognise this status through certification of the operations. Certification is based on at least an annual audit of all systems, the operator's Organic/Bio-Dynamic Management and/or Handling Plan, unannounced audits, and sample testing
- **Issue** organic goods certificates to facilitate the export of organic and bio-dynamic goods.

Exporter EXDOC/ NEXDOC registration and Export Licence

The exporter of organic goods will require a plant export licence, in addition to the organic goods requirements.

The Exporter must also be registered with the EXDOC/NEXDOC platform, which will supply export documentation as required, such as the phytosanitary certificate and import country-specific documentation. The EXDOC platform is progressively upgrading by commodity to the NEXDOC platform. It will automate more functions and integrate with other agencies to streamline access to export documentation.[2]

Plant export registered establishments

To meet traceability requirements, plant export registered establishments must:

- Ensure the integrity of goods being prepared at the registered establishment by putting measures in place to minimise the risk of infestation and contamination
- Have a documented system for traceability and integrity through the establishment including receival and dispatch records
- Keep goods that have passed inspection and goods that have not been inspected or failed inspection separate
- Have systems in place to minimise the risk of substitution (switching of goods) or tampering
- Complete transfer records for any incoming or dispatched horticulture goods with a phytosanitary status. [3]

Tasks related to traceability

- Create master data for key supply chain partner identities and locations
- Certify under the National Standard for Organic and Biodynamic Produce
- Register premises/establishment/s as plant export establishments
- Obtain export licence through EXDOC/ NEXDOC platform.

Key Participants

- Producer or manufacturer directly exporting
- Export company (non-producer/manufacturer)
- Department of Agriculture, Water and the Environment
- Authorised Organic Certifying body.

Export Sales Contract and Incoterms

Concluding an export sales contract is the activity that commences the process of exporting goods. The Terms of Trade determine the point at which the responsibility for the product transfers between the Exporter and Importer.

- Importer or country distribution agent requests quote from supplier
- Supplier provides pro forma invoice(quote)
- Agreement on *terms of trade* and price prepared in sales contract
- *Purchase Order* received from the customer confirming quote/pro forma invoice
- *Order Confirmation* issued to Importer/buyer
- *Customer Order* created.

Tasks related to traceability

- Purchase Order received
- Customer Order created by Exporter/Supplier.

Participants

- Exporter
- Exporter supplier
- Importer/Buyer.

Packing and labelling to export country requirements

Packing and labelling needs to be compliant with the country of destination. Every country has their own labelling requirements for food and beverage products.

Australia also has labelling guidelines for exported products, especially around 'country of origin' and 'Australian made' claims. Australian labelling standards do not apply for "export-only" products.

In relation to labelling of organic goods for export, the National Standard for Organic and Bio Dynamic Produce applies. The label information must be true for the product and verifiable – with no unsubstantiated health claims. Translation must be supplied for the import market label.

Tasks related to traceability

- Create picking/packing list
- Pick items for Customer Order
- Determine labelling and packaging requirements for destination country
- Determine cold chain management requirements
- Create labels for item, carton and pallet.

Key Participants

- Food product supplier
- Food export company/Wholesaler
- Department of Agriculture, Water and the Environment
- Authorised Organic Certifying bodies.

[2] www.agriculture.gov.au
[3] www.agriculture.gov.au

Correct export documentation

There are four important documents required prior to the goods commencing their journey. These are the *Commercial Invoice*, the Packing List, the *Certificate of Origin* and the *Bill of Lading*. For some food products, additional certificates and export licence requirements can form part of the export documentation e.g. phytosanitary certificate, manufacturer's declarations. For example, organic products imported into the EU must have the appropriate electronic certificate of inspection (e-COI). These are administered through the Trade Control and Expert System (TRACES). Equivalent countries' (including Australia) certificates are issued by the control bodies designated by Australian national authorities. [4]

Documentation must include evidence of current export permits as required by the Commonwealth Export Control Act (2020), and export certificates as required by importing country authorities. For example, *Free Trade Agreements* (FTAs) with Thailand, South Korea, China and New Zealand require Country of Origin Certificates to be certified by the relevant Chamber of Commerce based in Australia, in order for importers to claim reduced tariffs and duties associated with the FTAs. [5]

Organic Goods Certificate

Growers and processors may supply to an Exporter with an existing Export Licence. The Exporter will need to accompany the export permit with an Organic Goods Certificate (OGC) for the consignment, obtained from an authorised organic certifying body.

The organic goods certificate:

- Ensures that Australian organic goods have been subject to a regulatory system that guarantees the organic production system underpinning the organic claims;
- Provides assurance to the importing country that the goods have been produced in accordance with Australia's organic export regulatory framework and importing country requirements; and
- Is a mandatory export certificate and is required for each consignment.

End-to-end traceability requirements for foreign importers

For countries requiring traceability from source, Exporters need to provide foreign importers with documentation their policies and standard operating procedures (SOPs) for traceability, recall and sourcing. An example of such requirements is the US Food and Drug Administration Foreign Supplier Verification Program.[6]

Tasks related to traceability

Ensure completion of accurate documentation for shipment

- Commercial Invoice
- Packing List
- Bill of Lading
- Country of Origin Certificate as required
- Organic Goods Certificate for the consignment
- Manufacturer Declarations required by Micor www.micor.agriculture.gov.au
- Transfer Certificate (if product is stored off-site/indirect transfer to port terminal)

Document the Supplier policies and SOPs for traceability, recall and sourcing.

Key Participants

- Food Exporter
- Food Importer
- Food Supplier
- International Freight Forwarder
- Chambers of Commerce
- Authorised Organic Certifying bodies.

Border clearance - Australia

Unless specifically exempt, goods may not be loaded on a ship or aircraft for export unless they have been entered for export in the Customs and Border Protection Integrated Cargo System (ICS) and Customs has given approval to export. Exporters will require an *Export Declaration Number* from Australian Border Force (Customs).

For Exporters of *prescribed agricultural product* such as organic goods, Exporters use the EXDOC/NEXDOC platform to generate the correct documentation. NEXDOC platform is linked to the Australian Customs Single Electronic Window (SEW), which generates border clearance approvals and electronic documents. Exporters registered with NEXDOC can use this window to generate their Customs clearance documentation.

The *Request for Permit* (RFP) is provided by the exporter in the NEXDOC system. It describes product, when and where it was processed, its overseas destination, and other details such as consignor, consignee and transport company. RFPs contain equivalent information to that being provided to a department officer in a Notice of Intention to Export (EX28 or EX222). Once validated in the system, NEXDOC will generate an *Export Permit*.

Tasks related to traceability

- Receive Export Declaration Number
- Receive Export Permit.

Participants

- Food exporter
- Food Supplier
- International Freight Forwarder
- Department of Agriculture, Water & the Environment (NEXDOC)
- Australian Border Force – Customs.

[4] Member States shall ensure that the control system as set up allows for the traceability of each product at all stages of production, preparation and distribution in accordance with Article 18 of Regulation (EC) No 178/2002, in particular, in order to give consumers guarantees that organic products have been produced in compliance with the requirements set out in this Regulation."

[5] www.austrade.gov.au

[6] www.fda.gov

Pickup and delivery to port terminal

In order to transfer the goods for shipment, the Exporter or their International Freight Forwarder will prepare bookings to manage the chain of custody of the shipment. An *Air Waybill or Bill of Lading* are key documents that facilitate the shipment.

In order to prove the goods have transited via export-listed establishments (a traceability requirement for some import countries) a *Transfer Certificate* is required.

Organic fresh produce is typically shipped in refrigerated load units. The product Supplier or Distribution Centre/3PL will be instructed by the Exporter to prepare for and complete the pickup and delivery of the product from their premises for transit to the air/seaport terminal in a *Consignment Note* issued to the Transport Company and the Bill of Lading/Airway Bill issued to the Exporter by the air/shipping line, termed the Carrier.

For containerised product, goods specified in the packing list are picked and packed (often loaded onto a pallet) and a Transport Label affixed. The transport label contains details of the date of pickup required, the "ship from" and "ship to" details, equipment capacity required, transport company name and ID number, and a unique Serialised Shipping Container Code (SSCC) on the load unit. Once loaded into a container, the goods are now identified by the *Export Container Number*, which is visible on the outside surface of the container. For Full Container Load (FCL) shipments, the container is sealed prior to leaving the Exporter/Supplier DC facility. A container seal number is issued by Australian Border Force (Customs).

For less-than-container-load (LCL) shipments, the container seal is placed on the container by the freight consolidator, who may be an international forwarding company or a wholesale exporter.

Australian seaport *cargo terminal operators* (CTOs) use a *pre-receival advice* (PRA) to notify of incoming containers. This PRA number enables the CTO to issue a Vehicle Booking Slot to the terminal to the Transport Company delivering the container. The 1-Stop system notifies the International Freight Forwarder/Exporter when the PRA is accepted, the date and time the container is "gated-in" and when the container is loaded on the vessel. [7]

Tasks related to traceability

- Transport Certificate completed for interim transits between export establishments
- Export Container Number for the shipment advised by the shipping line
- Container seal secured and recorded
- PRA accepted by CTO
- Port cargo terminal operator gate-in recorded
- Bulk terminal notices.

Participants

- Shipping line
- International Freight Forwarder
- Exporter
- Supplier/packer
- Transport company
- Terminal operator/CTO.

In-transit monitoring

Location of a shipment is commonly supplied by the shipping line/airline in transit. This is particularly relevant where a transhipment is required. The international carrier is required to ensure goods are kept in a condition which is according to specifications whilst in transit, so for temperature or humidity-sensitive products, regular monitoring is vital to the shelf life of the product in the importing country. Monitoring may rely on use of GPS trackers, RFID data loggers/ IoT sensor technologies, smart containers with their own sensors and communications devices, data aggregators of shipping movements, or the long established Partlow chart on reefer containers. Telecommunications infrastructure may impact the ability to transmit at sea and in flight in real time.

Most airlines and shipping lines are able to advise location, which is generally accessible from the carrier's customer portal. International Freight Forwarders may also have tracking and condition reporting available to shippers.

Tasks related to traceability

- Location coordinates
- Condition of the goods real-near-time reporting.

Key Participants

- Airline or shipping line
- Data aggregators
- Technology suppliers
- International freight forwarder
- Exporter.

Arrival and clearance at final destination port

For ocean shipping, generally 24 hours' notice is required from the ship's Master or Agent that the vessel is arriving in port, in order to prepare for biosecurity inspection. On arrival at the port of discharge/final destination, the nominated party on the Bill of Lading (Customs Broker, Importer) is notified of the discharge of the container and once clearance is completed, the availability of the container for collection. Biosecurity inspection may be required. This may be undertaken at the port of discharge, or once the container is transported to a facility that is licensed for inspection.

Documentation for import clearance includes –

- Commercial invoice
- Bill of Lading
- Packing list
- Certificate of Origin
- Certificates related to the product type
- Tax and duties paid.

[7] 1-Stop Comtrac system www.1-stop.biz

Pickup from port terminal and delivery to importer

The Incoterms of the transaction between Exporter and Importer determine the responsibility for port clearance and subsequent delivery to the Importer. Arrangements will be made via the Exporter (often via an International Freight Forwarder and their international partnering Customs Broker) to hire a Transport Company to collect the container from the terminal and deliver at the instruction of the Importer to a nominated warehouse/DC. Shipping lines may arrange the transport delivery (carrier haulage) or the Exporter or Importer may take this responsibility (merchant haulage).

An electronic *Import Delivery* Order which the Airline/Shipping Line issues as per the Bill of Lading/Air Waybill enables the container/unitised load device to be loaded on the transport and leave the terminal. "Gate Out" date and time stamp at the port terminal are recorded.

On leaving the port, tracking of the transfer to the Importer premises or Distribution Centre is typically undertaken using a Transport Booking reference issued by the Transport Company, or via GPS tracking.

On arrival at the delivery destination, a Proof of Delivery by the Transport Company is signed by the Importer. The Importer will then check and remove the container seal at the instruction of a Biosecurity inspector, examine the goods as listed on the Bill of Lading/Airway Bill, packing list and commercial invoice and advise the Exporter of any variances.

Tasks related to traceability

- As per Bill of Lading, Shipping Line/Exporter/Importer or Forwarder will book transport to collect the container from the port terminal
- An Import Delivery Order will enable the transport (road or rail) to clear the terminal
- The CTO records "gate out" details
- Proof of Delivery is signed by the Importer/DC
- Goods delivered are inspected and scanned/recorded in Importer goods receival system/Warehouse Management system.

Critical Tracking Events

For each of the identified freight transport activities, **critical tracking events (CTEs)** establish identity and enable traceability and compliance with traceability-related regulation are summarised as follows:

Critical Tracking Events (CTEs) are events that relate to the identity, movement and transformation of the food product.

Export Activity	CTE Code	Critical Tracking Events (CTEs)
Establishment Activities	**OEX CTE1A** **OEX CTE1B** **OEX CTE1C** **OEX CTE1D**	• Create master data for key supply chain partner identities and locations • Certify under the National Standard for Organic and Biodynamic Produce • Register premises/establishment/s as plant export establishments • Obtain export licence through EXDOC/NEXDOC platform
Sales contract and Purchase Order	**OEX CTE2A** **OEX CTE2B**	• Receipt of Importer Purchase Order • Create Packing List
Picking, labelling and packing to import country requirements	**OEX CTE3A** **OEX CTE3B**	• Affix unique identifiers and compliant organic goods labels for product lots • Affix unique identifiers to trays, cartons, and pallets
Export documentation	**OEX CTE4A**	Prepare shipping documents • Commercial Invoice • Packing List • Bill of Lading/Airway Bill • Country of Origin Certificate as required • Manufacturer Declarations required by Micor e.g. lab reports, treatment records • Organic Goods Certificate. Document the Supplier policies and SOPs for traceability, recall and sourcing
	OEX CTE4B	Document the Supplier policies and SOPs for traceability, recall and sourcing
Border clearance – Australia	**OEX CTE5**	Receive Export Declaration Number Receive Export Permit (NEXDOC)
Pickup and delivery to port terminal PUD of empty container from container park nominated by shipping line for packing Packing of container by Exporter/supplier/processor/DC For LCL shipments, pickup and delivery to a consolidator for packing		

Export Activity	CTE Code	Critical Tracking Events (CTEs)
Transport to port booked – booking reference number issued for tracking Pre-Receival Advice accepted by CTO Record Export Container Number (ECN) Container seal placed and number recorded on Bill of Lading PRA acceptance message received by Exporter/Forwarder	**OEX CTE6**	Product departs warehouse location to port
Receipt at port terminal	**OEX CTE7**	Terminal Gate-In details recorded
Container loaded on vessel. Notice to Exporter/Forwarder that container is loaded on the vessel	**OEX CTE8A**	VContainer/ULD loaded on vessel/aircraft
Notice of departure from airline/shipping line	**OEX CTE8B**	Vessel departs port terminal
In-transit monitoring	**OEX CTE9**	Monitoring of containers/product whilst in transit • In-transit location coordinates • Condition of the goods real-near-time reporting (as required)
Arrival at final destination port and clearance procedures Importer/Customs Broker submits all documents for port clearance All taxes and duties paid Container Status Advice or Underbond Approval from Customs to CTO/consignee/Importer	**OEX CTE10** **OEX CTE11**	Vessel arrives at destination port Container cleared for pick up

Export Activity	CTE Code	Critical Tracking Events (CTEs)
Pickup from port terminal and delivery to importer As per Bill of Lading, Shipping Line/ Exporter/Importer or Forwarder will book transport to collect the container from the port terminal An Import Delivery Order will enable the transport (road or rail) to receive custody of the goods and clear the terminal Original Bill of Lading accompanies cargo to Importer The CTO records "gate out" details	**EX CTE12**	Container picked up from port by importer
Proof of Delivery is signed by the Importer/DC once goods unloaded and received	**OEX CTE13**	Cargo leaves final destination port
Goods received, inspected and reconciled.	**OEX CTE14**	Cargo delivered to Importer

Key Data Elements

Event Code	CTE	Key data elements
	Establishment activities	
OEX CTE1A	Create master data for key supply chain partner identities and locations	• Global Location Number • PIC code (growers) **Request for GLN** **Who**: Exporter, Issuing Agency **What**: Exporter company, location, business entity **When**: Date/Time of Issuance **Where**: Issuing Agency **Why**: Requirement for Global location numbers
OEX CTE1B	Certify under the National Standard for organic and Biodynamic Produce	• Certified Organic number • Authorised Certifying body • Audit date (YYMMDD).
OEX CTE1C	Register premises as plant export establishments (DAWE NEXDOC)	• Export Establishment number **Export Establishment licence** **Who**: Exporter, Issuing agency **What**: Exporter company, location, business entity **When**: Date/Time of Issuance, Expiry date **Where**: Issuing Agency **Why**: Plant Export Establishment registration
OEX CTE1D	Obtain Export Licence	• Export Licence number (NEXDOC) **Information to be shared to a traceability platform** • Global Location Number • PIC code (growers) • Certified Organic number • Name of Authorised Certifying body • Audit date • Plant Export Establishment number • Export Licence number
	Sales Contract and Purchase Order	
OEX CTE2A	Receipt of Importer Purchase Order	• Purchase Order number (Supplier ID; Supplier Contact Details; Supplier Location; Buyer ID; Buyer Contact Details; Buyer Location; Product Name/Description; Quantity; Unit Type; Unit Price; Total Cost; PO placement date; Customer Order Delivery Date; Shipping Terms/Incoterms code)
OEX CTE2B	Customer Order and Packing List created	• Customer Order number (Date; Customer Name/ID; Product Code; Pack size; Description; Quantity; Units; Price)
	Picking, labelling, inspection and packing to import country requirements	
OEX CTE3A	Affix unique identifiers and compliant organic certified information to product items/ lots	• Unique identifiers assigned and organic compliant labels attached (Name, location and Certified Organic number of producer, certifying body, % organic production)
OEX CTE3B	Affix and record unique identifiers for logistics assets e.g. tray, pallet	• Logistics Asset ID
OEX CTE3C	Inspection by Authorised Officer	• Inspection Result record – product and container (PEMS/NEXDOC)

Event Code	CTE	Key data elements
OEX CTE3D	Transport Certificate for movement between Export Establishments with Organic Certification	• Transfer Certificate number (Despatching establishment name and ID; Receiving establishment name and ID; Date of dispatch and arrival; Description of goods; Serial/batch numbers and processing dates; Type of package; Number of packages; Weight (L,kg,T); Transport Company; Driver's name; Temperature; Container seal number; Declaration signature and date (dispatcher); Attestation signature and date (receiver)
		Export Order Preparation **Who** Exporter, Customer **What** Product ID, Batch, Quantity Export Order number, Logistics Unit ID (SSCC), Container Number, Transfer Certificate, Bill of Lading **When** Date/Time of load preparation **Where** Warehouse **Why** Export Order Preparation, stock picking **Information to be shared to a traceability platform** • Inspection record • Transport Certificate number • Tray/Pallet ID
	Export documentation	
OEX CTE4A	**Prepare shipping documents**	• Commercial Invoice number • Packing List number • Bill of Lading/Air Waybill number • Country of Origin certificate number • Product Declaration name and number/s as required • Organic Goods Certificate/Organic Transaction Certificate • Name of Authorised Organic Certifying body • Purchase Order number • Customer Order number.

Event Code	CTE	Key data elements
OEX CTE4B	**Document the Supplier policies and SOPs for traceability, recall and sourcing**	• Traceability, recall and sourcing SOP and Policy document codes The information related to traceability covered in a policy or SOP may vary according to each country requirement – check Micor www.agriculture.gov.au **As an example Australia requires –** • a name or description of the food sufficient to indicate its true nature • batch or lot identification for the food • name of the person, business name, street address and telephone number or email address of the producer of the food • name of the person, business name, street address and telephone number or email address of customers that have received the food • the date the food was received and the date when it was dispatched to customers • the volume or quantity of the food involved in each transaction. **Information to be shared to a traceability platform** • Commercial Invoice number • Packing List number • Bill of Lading/Air Waybill number • Country of Origin certificate number • Product Declaration name and number/s as required • Organic Goods Certificate • Authorised Organic Certifying body • Purchase Order number • Customer Order number • Supplier policy/SOP document codes – traceability; recall; sourcing.
	Border Clearance - Australia	
OEX CTE5	Receive Export Declaration Number	• Export Declaration Number

Event Code	CTE	Key data elements
	Receive Export Permit	• Export Permit Number Export Certificates from the NEXDOC system that are issued on paper. Users can scan the QR code to see an overview of the certificate. They can use it to confirm details such as: • certificate number • product types • current certificate state • exporter • Importer/consignee • departure date

Customs Clearance

Who	Exporter Customs
What	Product ID, Batch, Quantity Export Order number, Logistics Unit ID (SSCC), Container Number, Transfer Certificate, Bill of Lading, Shipment ID
When	Date/Time of customs/border release
Where	Warehouse or Port
Why	Border Clearance

Information to be shared to a traceability platform

- Export Declaration Number
- Export Permit Number
- Bill of Lading/Airway Bill
- (Product ID; Batch ID; Quantity; Customer; Exporter ID; Carrier ID)
- Export Container number/BIC Code of shipping container/ULD

Event Code	CTE	Key data elements
	Pickup and delivery to port	
OEX CTE6A	**Load and seal container**	• SSCC of transport labels scanned at loading • Time and date stamp of pickup from Exporter
	Record Export Container Number (ECN)/ BIC code unique to this voyage	• Export Container Number (ECN) BIC code (owner prefix) + equipment identifier + serial number + check digit
	Container seal placed and number recorded on Bill of Lading	• Container seal number – a unique ID • Transport company ID • Vehicle registration number

Event Code	CTE	Key data elements
OEX CTE6B	**Receival at Container Terminal** Pre-Receival Advice acceptance message received from terminal operator by Exporter/ Forwarder/ Transport Company	• PRA acceptance • Gate-In details

Event Code	CTE	Key data elements
OEX CTE6C	**Notice to Exporter/ Forwarder that container is loaded on the vessel/aircraft**	• EDI message from CTO

Delivery to Port

Who	Exporter Transport Company
What	Product ID, Batch, Quantity Export Order number, Logistics Unit ID (SSCC), Container Number, Transfer Certificate, Bill of Lading, Shipment ID, Carrier ID
When	Date/Time of delivery
Where	Warehouse dispatch location
Why	Delivery to Port

Receipt at Port

Who	Transport Company Port/Terminal
What	Product ID, Batch, Quantity Export Order number, Logistics Unit ID (SSCC), Container Number, Transfer Certificate, Bill of Lading, Shipment ID, Carrier ID
When	Date/Time of receipt
Where	Port/Terminal Location
Why	Receipt at Port

Transfer to Vessel

Who	Port/Terminal
What	BIC Number, Vessel ID, Bill of Lading
When	Date/Time of transfer
Where	Port/Terminal Location
Why	Transfer to Vessel

Information shared to a traceability platform

- ECN/BIC Number
- Bill of Lading signed by carrier
- Receipt Date
- Shipment ID (carrier portal)
- Port ID
- Vessel ID.

Event Code	CTE	Key data elements
OEX CTE7	**Vessel Departs**	• ECN/BIC number • Bill of Lading • Vessel ID • Shipment ID (carrier portal).

Vessel Departs

Who	Port/Terminal Vessel ID
What	BIC Number, Vessel ID, Bill of Lading, Destination
When	Date/Time of departure
Where	Port/Terminal Location
Why	Vessel departs port

Information shared to a traceability platform

- Vessel ID
- Date of Departure

In-transit monitoring

OEX CTE8	**In-transit location coordinates**	• GPS coordinates
	Condition of the goods real-near-time reporting (as required)	• Temperature (Degree Celsius in container or product) • Humidity (RH).

In Transit Monitoring

Who	Vessel ID
What	Container ID, Vessel ID
When	Date/Time of monitoring
Where	Vessel – GPS Co-ordinates
Why	Monitoring

Information to be shared to a traceability platform

- GPS coordinates
- Date and time
- Temperature ^{0}Celsius
- Humidity (RH)
- Vessel/Aircraft/Voyage ID
- ECN/BIC number of Container

Arrival and clearance at discharge port

Event Code	CTE	Key data elements
OEX CTE9	**Container Status Advice/ Underbond Approval message**	• Vessel ID • Container Status Advice/ Underbond Approval **Information to be shared to a traceability platform** • Vessel ID • Bill of Lading reference number • Customer ID • Date and time of arrival • Arrival Location
	Delivery to Importer	
OEX CTE10	Import Delivery Order	• Electronic Import Delivery Order (EIDO) number (Date and time; Consignee; Discharge voyage and vessel numbers; Arrival date; Bill of Lading number; Container number (ECN); Container type; Seal number; Gross weight; Port of Load/Discharge/Final Discharge; Container location; Container Status; Signature of issuing officer (shipping line); Date and time of signing; Transport Company; Driver signature; Container inspection report; Date and time of signing; EIDO pin number)
	Cargo leaves discharge port	• Gate out (Date and time; Vehicle registration; ECN)
	Cargo delivered to Importer	• Proof of Delivery EDI 861/EDIFACT Receiving Advice (Date and time; Job number; Freight paid by; Collected from; Delivered to; ECN (or if de-consolidated) number of pallets or cartons; Contact; Phone; Acceptance of terms and conditions; Signature)

Final Delivery	
Who	Transport Carrier
What	Customer Order, Bill of Lading, Logistics Units, Product ID, Batch
When	Date/Time of delivery
Where	Port/final destination
Why	Final Delivery

Information to be shared to a traceability platform

- EIDO number
- Original Customer Order number
- Gate out message
- Proof of Delivery number

Application of GS1 global data standards

Adoption of global data standards enables data sharing between businesses through using common formats. These formats allow a business to identify participants, locations, products, processes and events in the supply chain.

Foundational Elements

Location Identification (GLN)

The unique identification of locations is a critical component of traceability systems and is used to identify where specific transactions and events have occurred.

The Global Location Number (GLN) is the globally unique GS1 Identification Number for locations and supply chain partners. The GLN can be used to identify a functional entity (like accounts receivable or a bill back department), a physical entity (like a distributor location, shipping dock), or a legal entity (like a parent corporation or subsidiary).

The attributes defined for each GLN [e.g., name, address, location type (e.g., ship to, bill to, deliver to, etc.)] help users to assure that each GLN is specific to one unique location within the world.

Product Identification (GTIN)

The Global Trade Identification Number (GTIN) can be used to identify loose or pre-packed trade items, input materials, outputs, at any stage of the supply chain up to the end consumer.

In order to ensure traceability along the entire supply chain, the GTIN should be allocated as early as possible. The brand owner is normally responsible for the allocation of the GTIN. In case of non-branded items (which is typical, for example, in fisheries), the GTIN is assigned by the party which brings the product into the market; this can be the producer/processor or wholesaler.

When retailers, distributors, or operators ask suppliers for own-label products, they (the retailers, etc.) are the brand owner and are therefore responsible for identifying that product in the supply chain. The best practice is to identify these own-label items using the Global Trade Item Number (GTIN). In these cases, the retailers, distributors, or operators will provide the GTIN to use on the product's packaging.

If a company further processes and packages a product in the supply chain, such as the case with store-processed product, then that company becomes the manufacturer and is responsible for assigning a GTIN and traceability attributes. This may be achieved using a combination of human readable and scannable product information. This information should also be stored for future retrieval if necessary.

A separate GTIN must be assigned to every different variation of a product. Size, style, grade, colour, quantity etc are all considered separate variations and thus require separate GTINs. Each level of packaging should be numbered (and barcoded) separately to all other levels.

Attributes of Trade Items

Attribute information of trade items is any data over and above the item identifier, i.e. the GTIN.

Examples of this type of information include batch numbers, production, use by and best before dates and variable measure information such as length, weight etc. Attribute information is represented by GS1 Application Identifiers (AIs) and these ensure that the attribute information can be interpreted unambiguously by trading partners throughout the entire supply chain.

In order to enable cost-effective adoption by food processes and manufacturers, it is recommended the use of attribute data to provide traceability of product from the distributor or wholesaler for export, providing visibility and faster and more efficient recalls and food safety.

Suppliers, at their discretion, can also apply to trade items, any of the AIs available to them under the GS1 specifications. When using GS1-128 barcodes export food items, it is recommended that the following information should be encoded in the barcode on every level of packaging:

1. Item Identifier [Global Trade Item Number (GTIN)]
2. Date (Production, Packaging, Expiration or Best Before)
3. Production Information (Batch/Lot Number or Serial Number)

Batch/lot and serial identification

The minimum requirements for traceability rely upon a combination of the GTIN and batch/lot number and/or serial number.

Note: If both the batch/lot number and serial number are present, as sometimes happens, the batch/lot number takes precedence in case of a recall.

For more information regarding the use of AIs, please refer to the GS1 General Specifications: www.gs1.org

Note: Regarding Trade Item Attribute information:

- Attribute information cannot stand-alone; it must always be accompanied by a GTIN
- Attribute information must be encoded in a GS1-128 barcode/ EPC enabled RFID tag / GS1 2Dimensional Symbol.
- If an AI appears on the same item more than once (e.g. if two labels are applied to the same item) the AI must be followed by the same information on each label.

Asset Identification

The GS1 System provides a method for the identification of assets. The object of asset identification is to identify a physical entity as an inventory item.

Asset Identifiers may be used for simple applications, such as the location and use of a given fixed asset (e.g. a personal computer), or for complex applications such as recording the characteristics of a returnable asset (e.g. an Intermediate Bulk Container), its movements, its life-cycle history and any relevant data for accounting purposes.

GS1 System asset identifiers can be used to identify any fixed assets of a Company. It is left to the discretion of the issuer to determine whether the Global Returnable Asset Identifier (GRAI), AI (8003), or Global Individual Asset Identifier (GIAI), AI (8004), is more suitable for the application concerned. Asset identifiers must not be used for any other purpose and must remain unique for a period well beyond the lifetime of the relevant records.

Global Returnable Asset Identifier (GRAI) – AI (8003)

A Returnable Asset is a reusable package or transport equipment of a certain value, such as a beer keg, a gas cylinder, a plastic pallet, or a crate. The GS1 System identification of a Returnable Asset, the Global Returnable Asset Identifier (GRAI), enables tracking as well as recording of all relevant data.

A typical application using a GRAI is in tracking returnable beer kegs. The owner of the beer keg applies a barcode carrying a GRAI to the keg using a permanent marking technique. This barcode is scanned whenever the keg is supplied full to a customer and scanned again when it is returned. This scanning operation allows the beer keg owner to automatically capture the life-cycle history of a given keg and to operate a deposit system, if desired.

Global Individual Asset Identifiers (GIAI) – AI (8004)

An individual asset is considered a physical entity made up of any characteristics. The Global Individual Asset Identifier (GIAI) identifies a physical entity as an asset. It must not be used for other purposes and must be unique for a period well beyond the lifetime of the relevant asset records. Whether the assigned GIAI may remain with the physical item when changing hands depends on the business application. If it remains with the physical item, then it must never be re-used. This element string might, for example, be used to record the life-cycle history of a wine vat or barrel. By symbol marking the GIAI, using AI (8004), on a given vat, or barrel, wine manufacturers are able to automatically update their inventory database and track assets from acquisition until retirement.

Note: Whilst GS1 Asset Identifiers can be used to identify returnable assets such as Shipping Containers, it is recognised that globally accepted identifiers can also be used e.g. BIC code.

Logistics Units (SSCC)

The Serial Shipping Container Code can be used by companies to identify a logistic unit, which can be any combination of trade items packaged together for storage and/ or transport, for example a case, pallet or parcel.

The SSCC is a crucial key for it uniquely identifies each distributed logistic unit and its content.

- The SSCC enables companies to track each logistic unit for efficient order and transport management.
- The SSCC can be encoded in a barcode or EPC/RFID tag, ensuring the logistic unit can be accurately and easily identified as it travels between trading partners, anywhere in the world.
- When SSCC data is shared electronically via EDI or EPCIS, this enables companies to share information about the status of logistic units in transit, and reliably link it to related transport information such as shipment details.
- The SSCC enables companies to link to additional information about the logistic unit. This information can be communicated via a Despatch Advice or Advanced Shipping Notice (ASN) prior to the logistic unit's arrival. Upon receipt the SSCC will be scanned, providing the required information to speed up the receipt of goods as well as the subsequent invoicing process.
- THE SSCC IS FULLY COMPATIBLE WITH ISO/ IEC 15459 – PART 1: UNIQUE IDENTIFIERS FOR TRANSPORT UNITS. THIS IS OFTEN REFERRED TO AS THE ISO LICENCE PLATE AND IS A PREREQUISITE FOR TRACKING AND TRACING LOGISTIC UNITS IN MANY INTERNATIONAL SUPPLY CHAINS.

Global Identification Number for Consignment (GINC)

The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together.

Logistic units in a particular shipment may be associated with different GINCs during various transport stages; for example, when the shipment gets consolidated with other shipments during its journey, and deconsolidated again before it reaches the consignee. The GINC allows freight forwarders and transport providers to keep track of the logistic units being transported together.

- The GINC is typically used by freight forwarders to instruct transport providers; for example, on a Master Airway Bill (MAWB) or a Master Bill of Lading (MBL).
- The GINC can be encoded in a barcode or as text on a MAWB / MBL, or in addition to the Serial Shipping Container Code (SSCC), on a logistics label.
- The GINC can be electronically used in transport instruction and transport status messages between freight forwarder and transport provider.

Global Shipment Identification Number (GSIN)

The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together.

The logistic units keep the same GSIN during all transport stages, from origin to final destination. The GSIN identifies the logical grouping of one or several logistic units, each identified with a separate Serial Shipping Container Code (SSCC).

- The GSIN can be encoded by the shipper in a barcode or as text on a House Way Bill, or in addition to the SSCC, on a logistics label.
- The GSIN can be electronically used by a company in transport instruction and transport status messages between freight forwarder and transport provider, and also as a reference in the Despatch Advice.

THE GSIN IS FULLY COMPATIBLE WITH ISO/IEC 15459 – PART 8: GROUPING OF TRANSPORT UNITS. THE GSIN ALSO MEETS THE REQUIREMENTS FOR A UNIQUE CONSIGNMENT REFERENCE (UCR) ACCORDING TO THE WORLD CUSTOMS ORGANISATION.

Data standards that apply to key data elements and shared information are identified in this section.

Data Element	Examples	Valid Values	Data Type/ Format	Further information
Location	Manufacturing Plant Finished Goods Location Dispatch Dock	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	Production Date and/or time Use By date, Best Before Date Pack Date	Year -Month-Date	**YYMMDD**	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD.
Product Identifiers	Input materials such as raw ingredients and packaging, Outputs such as finished goods, packaged or processed goods.	Global Trace Item Number (GTIN)	**N14**	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org Information on how to allocate a GTIN to a variable weight or variable measure trade item www.gs1.org
Traceability Attributes	Batch/Lot code Serial Number		**AN20**	Traceability Attributes, such as Batch or Lot Number or Serial Number etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	Pallet of Finished Goods Crate or Box of finished Goods	Serial Shipping Container Code (SSCC)	**N18**	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Assets	Returnable assets Ie: IBC or individual assets Ie: A crate		**N13**	Can be identified as an asset type only or an optional serial number can be added to distinguish individual assets. www.gs1au.org
Consignment	Grouping of logistics units assigned by the transport company	GINC	**N30**	The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together. www.gs1.org
Shipment	Grouping of logistics units	GSIN	**N17**	The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together. www.gs1.org

See Module GS1 Global Data Standards.

Useful links

Export Rules

www.legislation.gov.au
www.agriculture.gov.au
www.agriculture.gov.au
www.austrade.gov.au

Export premises

www.agriculture.gov.au
www.agriculture.gov.au

Business licencing and permits

www.foodstandards.gov.au

Incoterms 2021

www.export.business.gov.au

Border regulation

www.abf.gov.au

Micor

www.micor.agriculture.gov.au

International Freight Forwarders

www.ifcbaa.com

National Standard

www.agriculture.gov.au

Glossary

Air waybill (AWB)

An AWB is a document that controls the routing of an exporter's cargo while it is in the hands of the air carrier or a consolidator. It is a contract for carriage; however, it cannot be negotiated.

Bill of Lading (BL/BOL)

A bill of lading is a document issued by a carrier to acknowledge receipt of cargo for shipment. Although the term historically related only to carriage by sea, a bill of lading may today be used for any type of carriage of goods.

The bill of lading is a legally binding document that provides the carrier and shipper with all of the necessary details to accurately process a shipment. It has three main functions. First, it is a document of title to the goods described in the bill of lading. Secondly, it is a receipt for the shipped products. Finally, the bill of lading represents the agreed terms and conditions for the transportation of the goods.

Certificate of Origin (CO)

The Certificate of Origin (CO) is a document to certify the place of growth, production or manufacture of goods. It is required when exporting to specific countries, when requested by the consignee for customs clearance, or when it's stipulated in a letter of credit.

The CO identifies goods and contains an express certification by a government authority, or other empowered body, that the goods in question originate in a specific country.

Many overseas importers insist upon a CO when dealing with Australian exporters.

Although obtaining a CO is straightforward, it's important that specific procedures are followed:

- You must include an Exporters Information Form Update. This form has to be completed and forwarded to the appropriate issuing body (see below for a list), together with a list of signatories authorised to sign the certificates on behalf of your company.
- Evidence of origin (ie. copies of the invoice, a bill of lading, a letter of credit, or a statutory declaration) must be supplied prior to stamping.
- Exporters must provide a copy of the documents being stamped for Chamber records.
- Before submission for authentication, the exporter must sign all export documents on the bottom left-hand side under the exporter's declaration.
- Importantly, Certificate of Australian Origin forms can't be used for any other origin, other than Australian.
- Certificates of Origin must always be typed.

A list of Certificate of Origin providers:

- Ai Group issue certificates nationally
- **VIC:** Victorian Chamber of Commerce
- **NSW:** NSW Business Chamber
- **SA:** Business SA
- **QLD:** Chamber of Commerce & Industry Queensland
- ACT: ACT & Region Chamber of Commerce & Industry
- Canberra Business Chamber issues Certificates of Origin
- **WA:** Chamber of Commerce & Industry Western Australia
- **NT:** Chamber NT
- **TAS:** Tasmanian Chamber of Commerce and Industry
- AACCI Australia Arab Chamber of Commerce & Industry

Cargo Terminal Operator (CTO)

Air Cargo Terminal Operators and Sea Port Cargo Terminal Operators (stevedores) manage the interface between air and shipping lines, landside logistics and border agencies. They load and unload aircraft and vessels, load and unload rail, road and conveyor-delivered cargoes, provide security and a range of terminal services.

Export Declaration Number (EDN)

An Export Declaration Number is a nine-digit number issued through NEXDOC or Customs SEW system, which is based on an exporter declaring details of goods to be shipped.

It is used in the exporting and importing process for

- Identification of individual export consignments included in one consolidated consignment
- Acknowledgement of an exported consignment in an outward manifest
- Notification of release or return of the goods from or to a warehouse
- Notification of release or removal of goods from a wharf or airport.

Labelling

Words, particulars, trademarks, brand names, names of certifying organisations, pictorial matter or symbols appearing on any packaging, document, notice, label, board or collar accompanying or referring to a product specified in the National Standard for Organic and Bio Dynamic Produce.

Micor - Manual of Importing Country Requirements

Micor provides accurate advice on the import requirements for individual countries and trading blocks and any specific commodity requirements by country.

Organic is defined by the National Standard for Organic and Bio-Dynamic Produce (Edition 3.7, 2016) published by the Department of Agriculture, Water and the Environment (AWE).

In the National Standard, organic means the application of practices that emphasise the:

- Renewable resources
- Energy, soil and water
- Livestock welfare needs
- Maintenance and enhancement, while producing optimum quantities of produce without the use of artificial fertiliser or synthetic chemicals.

The National Standard sets out the prescribed organic management practices, being a set of authorised organic farming systems and operator practices.

Pre-Receival Advice (PRA)

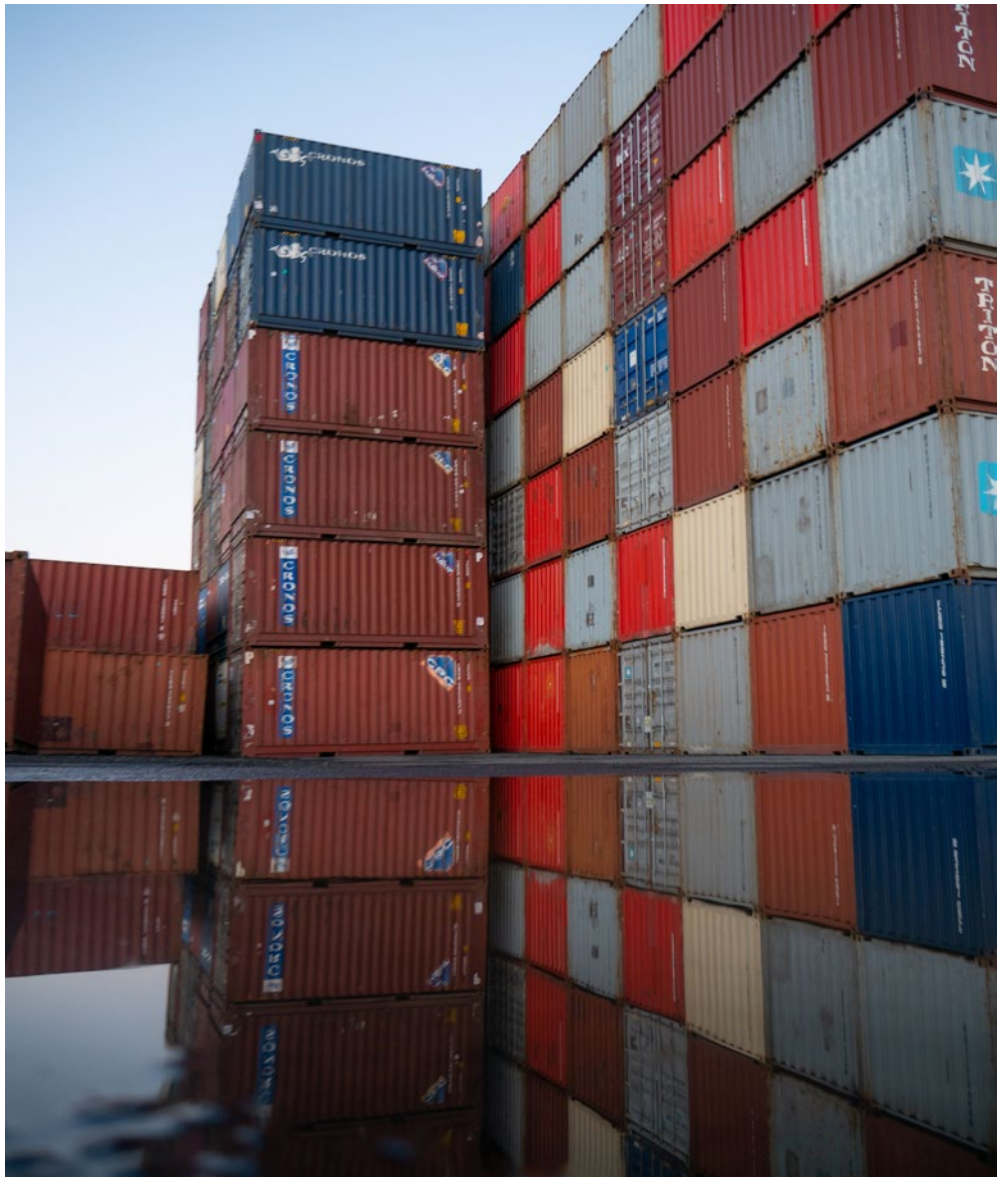
A PRA is a two-way communication between exporters and cargo terminal operators in which the Exporter provides details about the cargoes/containers to be shipped and the CTO responds with cargo acceptance. Only then, the goods are dispatched to the terminal for loading into the aircraft/vessel.

Proof of Delivery (POD)

A commercial document used by the Consignee or their Logistics Service Provider to notify the Consignor of the receipt and acceptance of a delivery. A signed POD enables the Transport Company to raise an invoice.

Purchase Order (PO)

A commercial document issued by a buyer to a supplier. This is a legally binding offer to buy product in return for payment. The terms and conditions for delivery and payment are detailed in this document, which also details the product quantity, price, terms and conditions, and product quality .



Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Consumer Information

Organic Produce Consumer Information

The US Global Centre for Food Integrity defines transparency as "... the rational offering of honest information that has the emotional appeal of inviting confidence and authentic connection."[1]

Using this definition, transparency can be viewed as an individual company's choice, rather than a supply chain-wide decision to reveal information. Some components of traceability may be incorporated into a transparency commitment by a company, such as disclosing suppliers. Conversely, a product can be robustly and digitally traceable without the company providing that information to their customers.[2]

Fresh organic produce sales are anticipated to grow from 2% of the domestic market to 5%, as consumer interest in the health properties of organic produce and ethical production methods increases. In 2020, nine million Australian households purchased an organic product. Almost one third believe they have been misled in the past by organic claims on product packaging.[3]

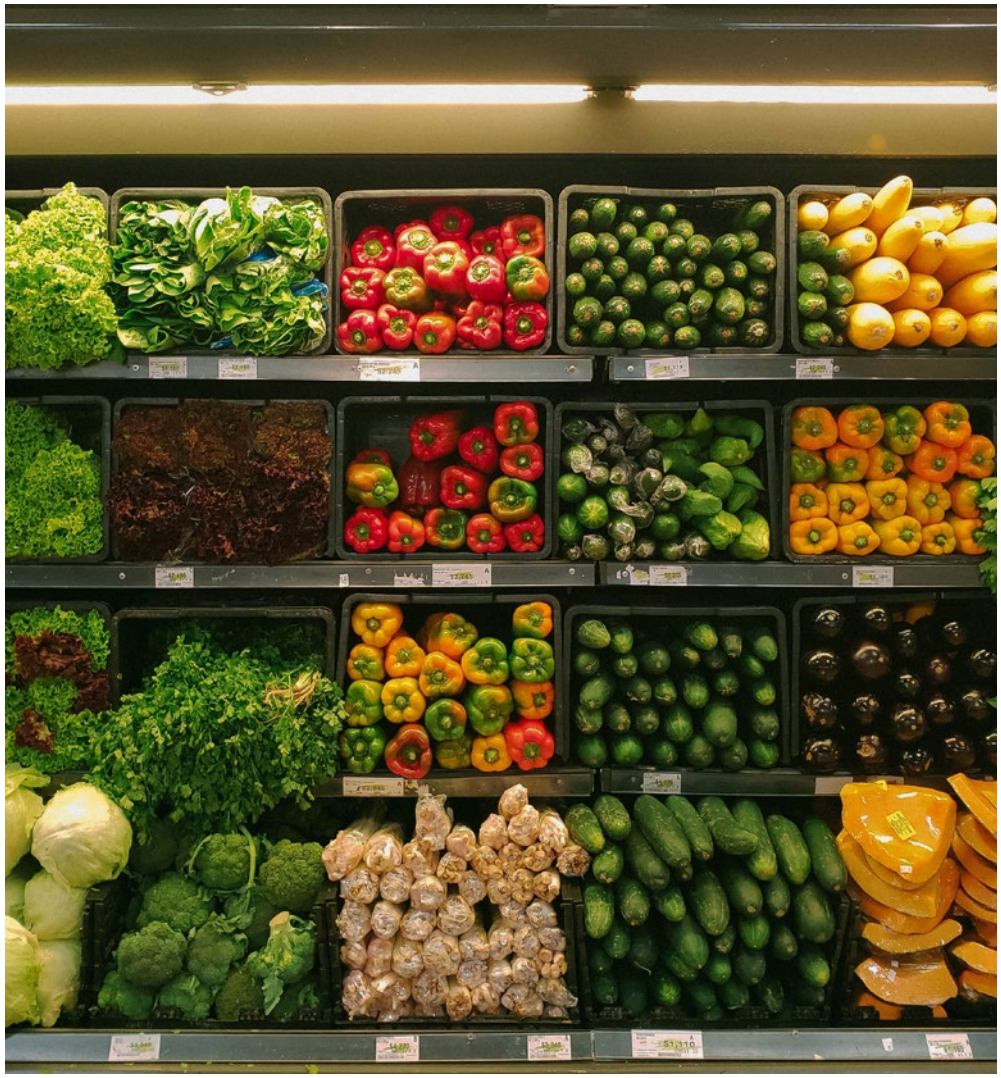
Currently in Australia, there is no requirement for "organic" produce to be certified for the domestic market. Product claims may be unsubstantiated without the ability to identify the source of the product or monitor its movement in a supply chain. In the case of fresh fruit, vegetables or herbs, that may be sold as harvested, in a consumer pack or sold as ingredients for manufactured food or meal preparation, verification of the organic status of the produce is difficult without supply chain traceability.

This module covers key activities related to the sale of the organic fresh produce to the end consumer via supermarkets, markets, convenience stores or on-line sales. The consumer makes a decision to purchase the product based on a range of information from price, product appearance, claims, certifications, content/ingredients, labelling design and nutritional value. Where the product cannot be clearly viewed, the label and packaging become critical to consumer information.

[1] www.foodintegrity.org

[2] www.ift.org

[3] Australian Organic Ltd, 2021, Australian Organic Market Report. austorganic.com



Source: Deloitte The Future of Food 2020[4]

Consumers of certified organic fresh produce or food product using certified organics produce have assurance that the following standards have been met and the grower/supplier has undergone an annual audit against the standards relating to labelling and consumer information:

All products, raw or processed, marketed as certified organic shall include the following details on all packaging bound for retail sale:

- **3.5.1.1** The name of the product or a description of the compound feeding stuff (ingredients list)
- **3.5.1.2** Appropriate reference to certification (e.g., Organic, Organic in conversion, etc.)
- **3.5.1.3** Certification Body (CB) name, certification number, and relevant Bud logo
- **3.5.1.4** Name and address and/or registered mark of the certified operator or owner of the product and/or label as required by law.
- **3.5.2** Failure to maintain compliant labelling and receive written confirmation from the CB as to the acceptability of such labels may result in mandatory removal from the marketplace of all product that is deemed to not comply with this Standard or that fails to achieve approval of the CB. A copy of all labels bearing market reference to organic products shall be kept on file by the CB and it is the responsibility of the operator to ensure that all current labels are sent to the CB.
- **3.5.3** In the case of bulk carrying, a transport declaration shall accompany all consignments and wherever feasible shall include all other measures such as labelling, signage and supply of certificate, to ensure the authenticity and control of the certified product is maintained.
- **3.5.4** The label for in conversion products shall be clearly distinguishable from the label for organic products. The Bud logo for in conversion products is clearly distinguishable from the Bud logo for certified organic products. Labelling reference to in conversion status of the product.

From a consumer perspective, the logo of certified organic product indicates that this product supply chain has adhered to a system of identification compliant to the Bud logo and that traceability is applied in this supply chain

In this module, processes/activities were identified to support consumer information and link with traceability:

- Identification of the product at origin
- Verification of provenance and organic status
- Smart Labelling and product information
- Feedback from consumers.

Identification of the product at origin

Providing a unique identifier for the origin of the product, the specific grow site, such as a vineyard, or orchid planting row can be achieved using a global location number or GLN. This can be encoded in the product label. Similarly, processors and manufacturers can record this origin code from their supplier and link this with the inputs or ingredients for the product they create. For some fresh produce the GLN and the state-issued Property Identification Code (PIC) are used as a basis of identifying the grower entity and the property location.

An additional key identifier of certified organic produce is the grower Certified Organic number, which must attach to the produce. This certified organic produce grower can be confirmed by consumers via the certifying body website.

For those receiving bulk products, use of a unique lot number can be used alongside the grower GLN to identify the sources of comingled product in a silo/bunker/bin.

These activities are a means to link provenance to the traceability data model described in the Implementing Food Traceability Guide.

There are multiple technologies available to capture data on the product origin and conditions of production, including Blockchain, Internet of Things (IoT), Radio Frequency Identification (RFID), Quick Response (QR) codes and Barcodes. In addition, there are software-based technologies that are able to capture the varied digital signals created when a critical tracking event (CTE) occurs in a device-agnostic manner, and from this create a holistic picture of the journey of the product. In the case of serialization, this can be done at a very granular (sell unit) level.

Combining suitable technologies and symbologies with the critical tracking events and key data elements and using global data standards, the entire supply chain can be made transparent, expanding the potential for consumer information.

[4] www.deloitte.com

Key tasks related to traceability

- Ensure certified organic product grower and handlers are identified on the produce labelling
- Use GLN and PIC codes to identify the entity and location of origin of the product or ingredient
- To identify the source of bulk product, use lot level identification combined with grower GLN PIC/Certified Organic grower number.

Key Participants

- Growers and suppliers
- State PIC issuing bodies
- GLN issuing organisation
- Organic certifying bodies
- Wholesalers
- Processors
- Manufacturers.

Verification of provenance

There are a range of technologies available to verify the provenance and integrity of a product. Food analysis laboratories conduct a range of tests. Some are able to link the product to the unique soil mineral or water "signature" of a region, or to test claims associated with organic production.

A certificate from an accredited laboratory can provide product claim and provenance verification. Creation of a unique identifier for these verification certificates, providing them to supply chain partners in a cyber-secure, encrypted and authenticated message, enables provenance verification to accompany the product. This information then becomes a product attribute that may be shared with end consumers.

Producers, processors and manufacturers often rely on vendor or supplier assurance programs to underpin product claims. However, these assurance symbols may be replicated on counterfeit product. In order to prevent this, a document code contained as a product attribute in a barcode or QR code can verify the accreditation is true and current.

Recording data from the critical tracking events (CTEs) in this Guide will enable detailed information to be accessed, from the preparation of grow sites, purchase of seeds, seedlings and root stock, identified in the *Organic Production* module. Certified Organic growers will have a Farm Management Plan and can detail all additives and inputs used.

This data is used for E2E or B2B transactions, to track the product's journey, to facilitate handovers of custody, to comply with regulatory regimes or buyer specifications. In recognition of the interest of growers in marketing the story of their product, AgriFutures has prepared a toolkit to assist primary producers in this task – *Provenance Storytelling for Success*.[5]

Key tasks related to traceability

- Embed test certificate codes related to provenance and integrity as an attribute of the product ID.

Key Participants

- Growers
- Accredited analytic laboratories
- Authorised organic certifying bodies
- Wholesalers
- Processors
- Manufacturers
- Retailers.

Smart labelling and product information

Requirements for food labelling are described by FSANZ and cover a variety of foods and circumstances, such as product labelling for E2E sales versus B2C sales. The Australian Government also has requirements for country of origin labelling, weights and measures and Australian product content.[6]

Despite large amounts of information being encoded on product packaging and item labels, there are opportunities for brand owners to provide additional product information for consumers through use of smart labels. These labels use QR codes, sensors, microchips to enable information to be generated from the brand owner of the product to the consumer.

Smart labels have a dual purpose in providing consumer information and in traceability of the product. They can indicate deterioration of the product, as they change colour or blister, detecting oxygen and bacteria levels. This helps to notify consumers and avert food waste. For high value items such as liquor, smart labels containing an IoT sensor using Near Field Communication/5G can enable anti-tampering and tracking in transit. These embedded devices can detect changes in temperature and humidity via packaging and labels, while the product is in transit or storage. They will also indicate any tampering with the bottle.

Consumers can use a specific Application (App), or scan a QR code or digital barcode on the product to access product information held by the brand owner/manufacturer or grower. They can also search via the Web, or conduct a product search on a registry of brands and products to gain additional information via smart phone, tablet or desktop.

Key tasks related to traceability

- Ensure compliant labelling on packaging and product item (FSANZ, Certified Organic standards, ACCC product labelling)
- Determine the business case for smart label application to the product as a dual consumer information and traceability tool.

Key Participants

- Grower/Supplier of organic fresh produce
- Manufacturer
- Retailer
- Solution provider.

[6] www.business.gov.au

Feedback from consumers

Traceability is focused on monitoring the flow of the product to the consumer and the requirement to conduct product recall from the consumer back to the source of the threat in the circumstance of a food safety incident. Food safety must be the first priority, however, as consumers seek to engage with the upstream food supply chain beyond the food retailer or foodservice operator, the opportunity for feedback from consumers has expanded.

Point of Sale (POS) devices are able to capture large volumes of consumer data regarding preferences, sales volumes and consumer ratings of products. The use of QR codes also supports the opportunity for brand owners to gain valuable feedback. Customer loyalty schemes are also a tool to gather feedback on products. This capability is in addition to the use of social media as a feedback tool and is able to use the system interoperability created through use of product identification, business entity identification and the event history of the product created through the traceability data model, to transmit consumer feedback to upstream partners.

Many small and medium enterprises (SMEs) who are growers, producers and manufacturers, find consumer insights cost-prohibitive to purchase and they therefore miss out on valuable feedback. Use of the traceability data model enables them to receive consumer insights via system interoperability.

Key tasks related to traceability

- Determine with consumer-facing partners what consumer insights can be integrated in the traceability data model for the product.
- Participants
- Food retailers
- Foodservice operators
- Growers and primary producers
- Solution Providers
- Food manufacturers
- Wholesalers and distributors.

Critical Tracking Events (CTEs)

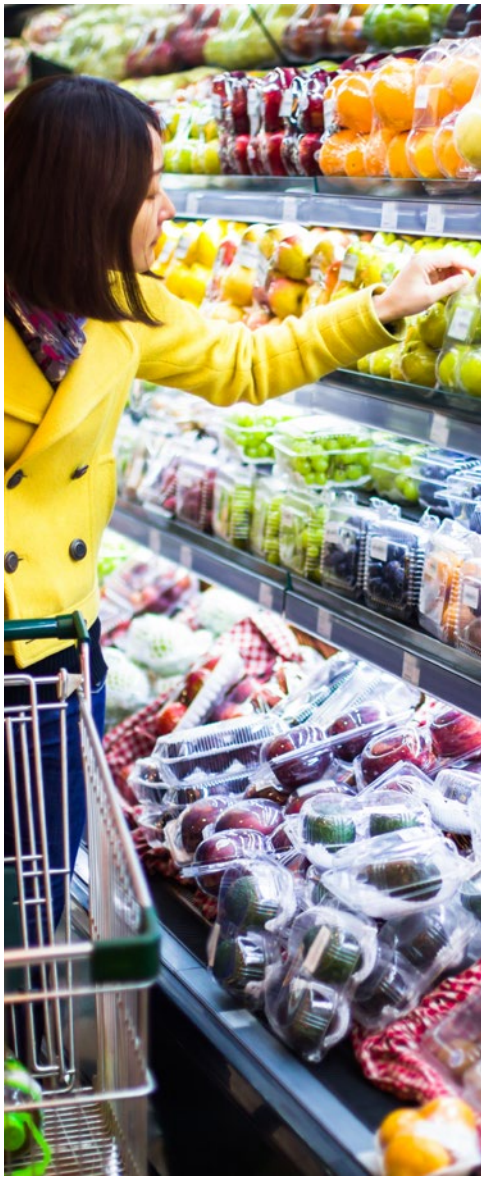
For each of the identified consumer information activities, **Critical Tracking Events (CTEs)** establish identity and enable traceability and compliance with traceability-related regulation. CTEs in this module relate to the transparency of the food product supply chain and supply of consumer information and consumer feedback.

On-farm activity	CTE Code	Critical Tracking Events (CTEs)
Identification of the product	OCI CTE1	Use GLN, PIC codes and Certified Organic numbers of growers and handlers to identify the entity and location of origin of the product or ingredient
	OCI CTE2	To identify the source of bulk product, use lot level identification combined with grower GLN/PIC
Verification of provenance	OCI CTE3	Embed test certificate codes related to provenance and integrity as an attribute of the product ID
Smart Labelling and product information	OCI CTE4	Ensure compliant labelling on packaging and product item Determine the business case for smart label application to the product as a dual consumer information and traceability tool
Feedback from consumers	OCI CTE5	Determine with consumer-facing partners what consumer insights can be integrated in the traceability data model for the product

Key Data Elements (KDEs)

Key Data Elements (KDEs) ensure that captured and recorded data can be interpreted and used as relevant and required by all supply chain partners. KDEs define Who, What, When, Where and Why for each CTE identified above.

CTE Code	Critical Tracking Events (CTEs)	Key Data Elements
OCI CTE1	**Product Identification** Use GLN, PIC codes and Certified Organic numbers of growers and handlers to identify the entity and location of origin of the product or ingredient	• Global Location Number • Property Identification Code • Certified Organic ID of grower and handlers • Country of Origin • Lot/batch number • Best before / Use-by date.
OCI CTE2	**Bulk product identification** Use lot level identification combined with grower GLN/PIC/ Certified Organic number	• Lot number • GLN • PIC • Certified Organic status, certifying body and expiry.
OCI CTE3	**Verification of Provenance** Embed test certificate codes related to provenance and integrity as an attribute of the product ID	**Test Certificate Links** **Who**: Grower, Processor, Retailer, Food Service operator **What**: Product ID, Lot/Batch, Test Certificate number, Quantity **When**: Date/Time of Testing **Where**: Location of testing **Why**: Linking Test Certificate to product lot or batch
OCI CTE4	**Product labelling** Ensure compliant labelling on packaging and product item	• Food Description • Use by Date/ Best Before Date • Lot/Batch Identification • Grower/handler name, Certified Organic number, certifying body and expiry • Contact Details of grower, processor • Cooking and storage instructions • Country of Origin • List of Ingredients • Percentage of Ingredients and certified organic content • List of Allergens.
OCI CTE5	**Consumer access to traceable information** Determine with consumer-facing partners what consumer insights can be integrated in the traceability data model for the product	**Potential data** • Link to grower or retailer website to tell production story • Harvest date • Consumer rating of the product • POS locations.



Application of GS1 global data standards

Data standards that apply to key data elements and shared information are identified in this section.

Data Element	Examples	Valid Values	Data Type / Format	Further information
Location	Manufacturing Plant, Finished Goods Location, Dispatch Dock	Global Location Number (GLN)	**N13**	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here:
Date/Time	Production Date and/or time, Use By date, Best Before Date, Pack Date	Year-Month -Date	**YYMMDD**	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD
Product Identifiers	Input materials such as raw ingredients and packaging, Outputs such as finished goods, packaged or processed goods	Global Trade Item Number (GTIN)	**N14**	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org Information on how to allocate a GTIN to a variable weight or variable measure trade item www.gs1.org
Traceability Attributes	Batch/Lot code, Serial Number		**AN20**	Traceability Attributes, such as Batch or Lot Number or Serial Number etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org

Useful Links

Organic standards

www.austorganic.com
www.infostore.saiglobal.com
www.agriculture.gov.au

Food testing laboratories

www.nata.com.au

Provenance and story telling

AgriFutures toolkit www.agrifutures.com.au

Food labelling

NMI Weights and Measures
www.business.gov.au

ACCC Country of Origin Food Labelling
www.accc.gov.au

Food Standards Code labelling
www.foodstandards.gov.au

Glossary

B2B

Business to Business transactions

B2C

Business to Consumer transactions

E2E

Exchange to Exchange transactions

IoT

Internet of Things. A description for a range of devices that can connect with each other and the Internet without human intervention.

Point of Sale (POS)

POS devices are evolved from cash registers and cover a range of cloud-connected or stand-alone enterprise systems for recording sales, managing inventory and enhanced customer engagement e.g. loyalty programs/ customer preferences.

QR code

A Quick Response code is a machine-readable code consisting of an array of black and white squares, typically used for storing URLs or other information for reading by the camera on a smartphone. It can store 7,000 characters.

Small and medium enterprise (SME)

The Australian Bureau of Statistics (ABS) uses the number of persons employed:

- a micro-business employs between 0-4 persons
- a small business, between 5-19 persons
- a medium business, between 20 and 199 persons; and
- a large business employing 200 or more persons.

Various Commonwealth agencies define SMEs differently, however it is recognised that SMEs make up around 98 percent of Australian businesses.

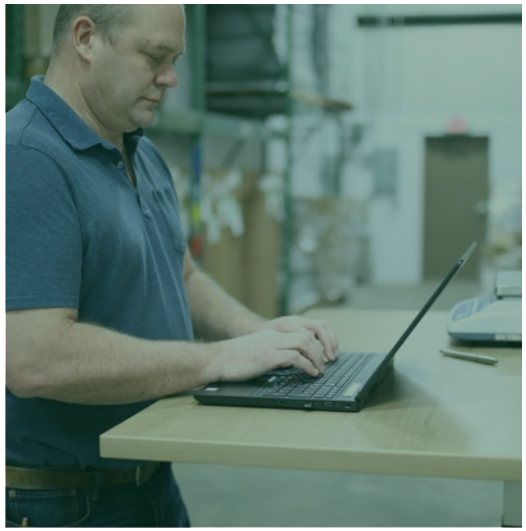
Smart labels

Smart labels include QR codes, Electronic Article Surveillance (EAS) tags and specially configured RFID tags. Smart labels are created by combining three technologies: plain text, radio code and optical character recognition. Smart labels are divided into chip labels, printable labels and electronic labels.

Smart labels such as data-embedded barcodes (GS1-128), QR codes, RFID tags, enable a much larger amount of information to be provided to consumers.

www.clearmark.uk

SmartLabel: Consumer Brands Association and Food & Consumer Products of Canada
www.smartlabel.org



Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Application of GS1 Data Standards

Application of GS1 global data standards for organic fresh produce supply chains

The following section provides details on both the definition of the GS1 Standards referenced in each module of the Organic Fresh Produce supply chain and the application and use of the standards.

Adoption of global data standards enables data sharing between businesses through the use of common formats. These formats allow a business to identify participants, locations, products, processes and events across the full the supply chain.

In February 2021, GS1 released a Guideline for use of global data standards for fresh fruit and vegetable traceability.
www.gs1.org

The following infographics from the GS1 Guideline indicate the four key nodes in the chain of custody of the fresh produce, being the grower, packer, distributor-trader and finally retail or foodservice operator.

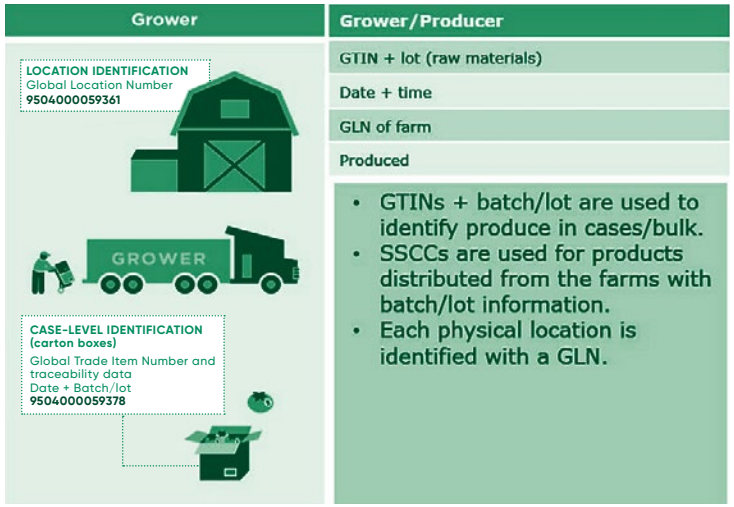


Figure 1: Grower

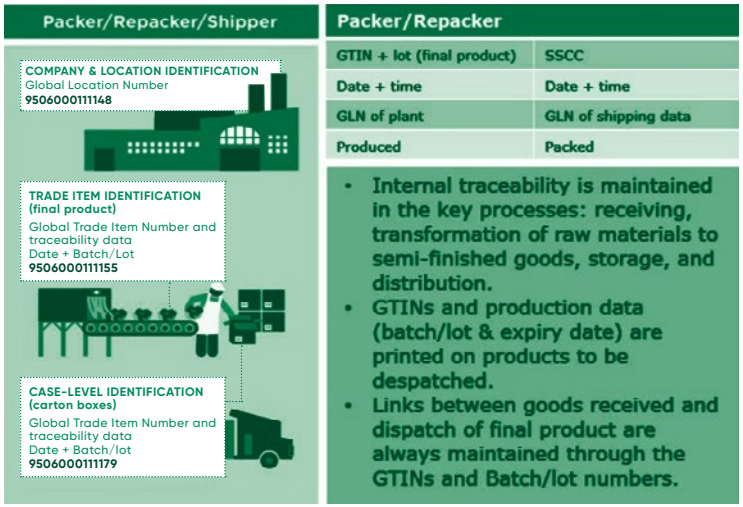


Figure 2: Packer/Repacker/Shipper

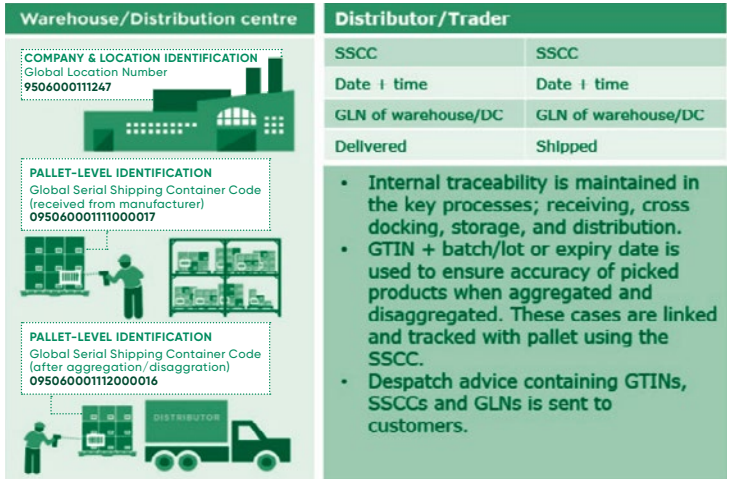


Figure 3: Distributor/Trader

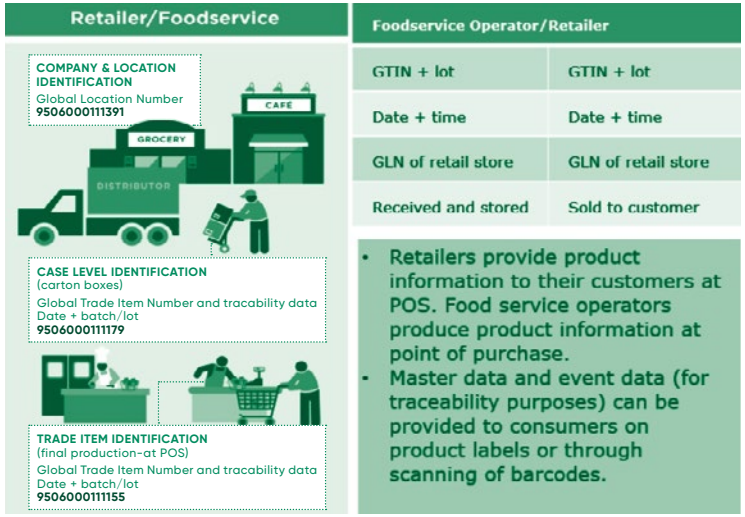


Figure 4: Retailer/Foodservice

Foundational Elements

Location Identification

The unique identification of locations is a critical component of traceability systems and is used to identify where specific transactions and events have occurred.

The Global Location Number (GLN) is the globally unique GS1 Identification Number for locations and supply chain partners. The GLN can be linked to existing location identifiers that may already be in use to identify properties, farms, field etc.

The GLN can be used to identify a functional entity (e.g. accounts receivable or a bill back department), a physical entity (e.g, raw material receiving location, farm, paddock, row within a field), or a legal entity (e.g. a parent corporation or subsidiary). The attributes defined for each GLN [e.g., name, address, location type (e.g., ship to, bill to, deliver to, etc.)] help users to assure that each GLN is specific to one unique location across the world.

Product Identification

The Global Trade Identification Number (GTIN) can be used to identify trade items (loose or pre-packed), input materials, outputs, at any stage of the supply chain up to the end consumer.

Most trade items have a trading partner (processor) allocated Global Trade Item Number (GTIN). Where the trading partner has multiple processing facilities the same GTIN is often used for the same product, irrespective of the processing facility.

To ensure traceability is maintained to the specific processing facilities the trading partner utilises Application Identifiers with the GTIN to maintain traceability back to the respective processing facility.

Where product is being packed for a specific third party such as a product brand owner, the product brand owner may allocate the GTIN to be used. This is likely to include utilising Application Identifiers with the GTIN to maintain traceability back to the respective processing facility. This is used to differentiate which processing facility the brand owner has used.

If a trading partner further processes and packages a product in the supply chain, such as the case with store-processed product, then that trading partner becomes the manufacturer and is responsible for assigning a GTIN or item reference and traceability attributes. This may be achieved by using a combination of human readable and scannable product information. This information should also be stored for future retrieval, if necessary.

It should be noted that governments and national trading partners may require additional business information to appear on the trade item labels and it is recommended that trading partners work closely with local regulatory authorities to ensure compliance.

A separate GTIN must be assigned to every different variation of a product. Size, style, grade, colour, quantity etc are all considered separate variations and thus require separate GTINs. Each level of packaging should be numbered (and barcoded) separately to all other levels.

Variable Measure Trade Items Not Scanned in General Retail at Point-of-Sale (Carton/Case Labelling)

Trade items in the fresh produce industry may include variable measure because the production process results in a wide range of weights for the same product packed in crates or boxes.

The barcode symbology used for variable measure trade items not scanned at Point-of-sale carton/case labels is the GS1-128. The GS1-128 barcode allows secondary attribute information over and above primary global trade item identification to be represented in the barcode.

The barcode symbology can also represent attribute information such as batch or lot numbers, serial numbers, expiry dates and weight in a standard format. This ensures that the attribute information encoded by one trading partner can also be scanned and interpreted by any other trading partner in the supply chain.

Additional country, market or customer requirements may be applicable in certain circumstances. Contact the applicable representatives in those markets to determine the current requirements.

Variable Measure Trade Items Scanned in General Retail at POS

Variable measure trade items that are scanned at Point-of-sale have two main GS1 applications that are available. In some instances, due to trading partners (e.g. Retailer) requirements both options may be applied to the one variable measure fresh food trade item.

Before implementation of any GS1 applications for variable measure trade items that are scanned at Point-of-sale mutual agreement should be obtained between the trading partners.

The two main GS1 applications for variable measure fresh food trade items are:

- Variable Measure Fresh Food Trade Items using a GTIN and additional attributes encoded with GS1 DataBar Expanded or Expanded Stacked.
- Variable Measure Trade Items using a Restricted Circulation Number (RCN) encoded with the EAN/UPC symbology family.

Trading partners should ensure that retailer labelling requirements are known and understood when following this guideline. Where a retailer specified requirement contradicts this guideline the retailer requirement should be followed.

Attributes of Trade Items

Attribute information of trade items is any data over and above the item identifier, i.e. the GTIN.

Examples of this type of information include batch numbers, pack date, use by and best before dates and variable measure information such as, weight or count, etc.

Attribute information is represented by GS1 Application Identifiers (AIs) and these ensure that the attribute information can be interpreted unambiguously by trading partners throughout the entire supply chain.

In order to enable cost-effective adoption by food processes and manufacturers, we recommend the use of attribute data to provide traceability of product from the supplier into the packing house, providing visibility and faster and more efficient recalls and food safety.

When using GS1-128 barcodes for fresh produce items, it is recommended that the following information should be encoded in the barcode on every level of packaging:

1. Item Identifier [Global Trade Item Number (GTIN)]
2. Date (e.g. Pack date, harvest date)
3. Production Information (Batch/Lot Number or Serial Number).

Batch/lot and serial identification

The minimum requirements for traceability rely upon a combination of the GTIN and batch/lot number and/or serial number.

Note 1: If both the batch/lot number and serial number are present, as sometimes happens, the batch/lot number takes precedence in case of a recall.

For more information regarding the use of AIs, please refer to the GS1 General Specifications: www.gs1.org

Note 2: Regarding Trade Item Attribute information:

- Attribute information cannot stand-alone; it must always be accompanied by a GTIN
- Attribute information must be encoded in a GS1-128 barcode/ EPC enabled RFID tag / GS1 2Dimensional Symbol.
- If an AI appears on the same item more than once (e.g. if two labels are applied to the same item) the AI must be followed by the same information on each label

Logistics Units (SSCC)

The Serial Shipping Container Code can be used by companies to identify a logistic unit, which can be any combination of trade items packaged together for storage and/ or transport purposes; for example a case, pallet or parcel.

The SSCC is a crucial key for traceability as it uniquely identifies each distributed logistic unit and its content.

The SSCC enables companies to track each logistic unit for efficient order and transport management,

- The SSCC can be encoded in a barcode or EPC/RFID tag, ensuring the logistic unit can be accurately and easily identified as it travels between trading partners, anywhere in the world.
- When SSCC data is shared electronically via EDI or EPCIS, this enables companies to share information about the status of logistic units in transit, and reliably link it to related transport information such as shipment details.
- The SSCC enables companies to link to additional information about the logistic unit. This information can be communicated via a Despatch Advice message (also referred to as Advanced Shipping Notice (ASN) prior to the logistic unit's arrival. Upon receipt the SSCC will be scanned, providing the required information to speed up the receipt of goods as well as the subsequent invoicing process.

Example of SSCC Application

Pallet

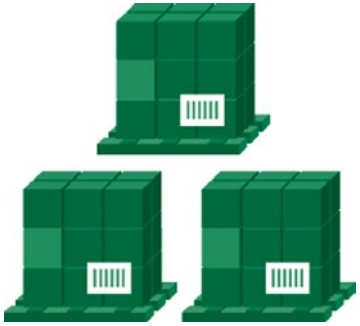
Trade Unit

Global Identification Number for Consignment (GINC)

The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together.

- Logistic units in a particular shipment may be associated with different GINCs during various transport stages; for example, when the shipment gets consolidated with other shipments during its journey and deconsolidated again before it reaches the consignee. The GINC allows freight forwarders and transport providers to keep track of the logistic units being transported together.
- The GINC is typically used by freight forwarders to instruct transport providers; for example, on a Master Airway Bill (MAWB) or a Master Bill of Lading (MBL).
- The GINC can be encoded in a barcode or as text on a MAWB / MBL, or in addition to the Serial Shipping Container Code (SSCC), on a logistics label.
- The GINC can be electronically used in transport instruction and transport status messages between freight forwarder and transport provider.

Example of GINC Application



Global Shipment Identification Number (GSIN)

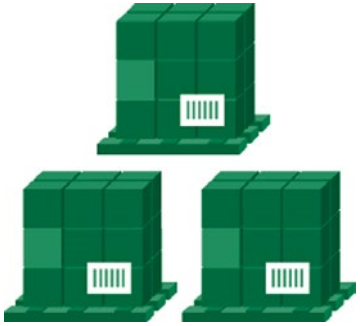
The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together.

The logistic units keep the same GSIN during all transport stages, from origin to final destination. The GSIN identifies the logical grouping of one or several logistic units, each identified with a separate Serial Shipping Container Code (SSCC).

- The GSIN can be encoded by the shipper in a barcode or as text on a House Waybill, or in addition to the SSCC, on a logistics label
- The GSIN can be electronically used by a company in transport instruction and transport status messages between freight forwarder and transport provider, and also as a reference in the Despatch Advice.

THE GSIN IS FULLY COMPATIBLE WITH ISO/IEC 15459 – PART 8: GROUPING OF TRANSPORT UNITS. THE GSIN ALSO MEETS THE REQUIREMENTS FOR A UNIQUE Consignment Reference (UCR) ACCORDING TO THE WORLD CUSTOMS ORGANISATION.

Example of GINC Application



Asset Numbering

The GS1 System provides a method for the identification of assets. The object of asset identification is to identify a physical entity as an inventory item.

Asset Identifiers may be used for simple applications, such as the location and use of a given fixed asset (e.g. a personal computer), or for complex applications such as recording the characteristics of a returnable asset (e.g. a Intermediate Bulk Container), its movements, its life-cycle history and any relevant data for accounting purposes.

GS1 System asset identifiers can be used to identify any fixed assets of a Company. It is left to the discretion of the issuer to determine whether the Global Returnable Asset Identifier (GRAI), AI (8003), or Global Individual Asset Identifier (GIAI), AI (8004), is more suitable for the application concerned. Asset identifiers must not be used for any other purpose and must remain unique for a period well beyond the lifetime of the relevant records.

Global Returnable Asset Identifier (GRAI) – AI (8003)

A Returnable asset is a reusable package or transport equipment of a certain value, such as a beer keg, a gas cylinder, a plastic pallet, or a crate. The GS1 System identification of a returnable asset, the Global Returnable Asset Identifier (GRAI), enables tracking as well as recording of all relevant data.

A typical application using a GRAI is the tracking of returnable crates. The owner of the crate applies a barcode carrying a GRAI to the keg using a permanent marking technique. This barcode is scanned whenever the crate is supplied full to a customer and scanned again when it is returned. This scanning operation allows the crate owner to automatically capture the life-cycle history of a given crate and to operate a deposit system if desired.

Global Individual Asset Identifiers (GIAI) – AI (8004)

An individual asset is considered a physical entity made up of any characteristics. The Global Individual Asset Identifier (GIAI) identifies a physical entity as an asset. It must not be used for other purposes and must be unique for a period well beyond the lifetime of the relevant asset records. Whether the assigned GIAI may remain with the physical item when changing hands depends on the business application. If it remains with the physical item, then it must never be re-used. This element string might, for example, be used to record the life-cycle history of a wine vat or barrel. By symbol marking the GIAI, using AI (8004), on a given vat, or barrel, wine manufacturers are able to automatically update their inventory database and track assets from acquisition until retirement.

GS1 Application Identifiers relating to fresh produce:

(For a full list of GS1 Application Identifiers visit www.gs1.org)

All GS1 Application Identifiers indicated with (FNC1) are defined as of variable length and shall be delimited unless this Element String is the last one to be encoded in the symbol.

AI	Data Content	Format	FNC1 Required
00	SSCC (Serial Shipping Container Code	N2+N18	
01	GTIN (Global Trade Item Number)	N2+N14	
02	GTIN of the Contained Trade Items	N2+N14	
10	Batch or Lot Number	N2+X..20	(FNC1)
11 (**)	Production Date (YYMMDD)	N2+N6	
13 (**)	Packaging Date (YYMMDD)	N2+26	
15 (**)	Best Before Date (YYMMDD)	N2+N6	
17 (**)	Expiration Date (YYMMDD)	N2+N6	
21	Serial Number	N2+X..20	(FNC1)
251	Reference to Source Entity	N3+X..30	(FNC1)
254	GLN extension component	N3+X..20	(FNC1)
30	Count of items (variable measure trade items)	N2+N..8	(FNC1)
310 (***)	Net weight, kilograms (variable measure trade items)	N4+N6	
320 (***)	Net weight, pounds (variable measure trade items)	N4+N6	
330 (***)	Logistic weight, kilograms	N4+N6	
37	Count of Trade Items	N2+N..8	(FNC1)
410	Ship to – deliver to global location number	N3+N13	
411	Bill to – invoice to global location number	N3+N13	
412	Purchased from global location number	N3+N13	
413	Ship for – deliver for – forward to global location number	N3+N13	
414	Identification of a physical location – global location number	N3+N13	
415	Global location number of the invoicing party	N3+N13	
422	Country of origin of a trade item	N3+N3	(FNC1)
423	Country of initial processing	N3+N3+N..12	(FNC1)
425	Country of processing	N3+N3	(FNC1)
426	Country of disassembly	N3+N3	(FNC1)
7002	UN/ECE Meat Carcases and Cuts Classification	N4+X..30	(FNC1)
7003	Expiration Date and Time	N4+N10	(FNC1)
7006	First Freeze Date	N4+N6	(FNC1)
7007	Harvest Date	N4+N6..12	(FNC1)

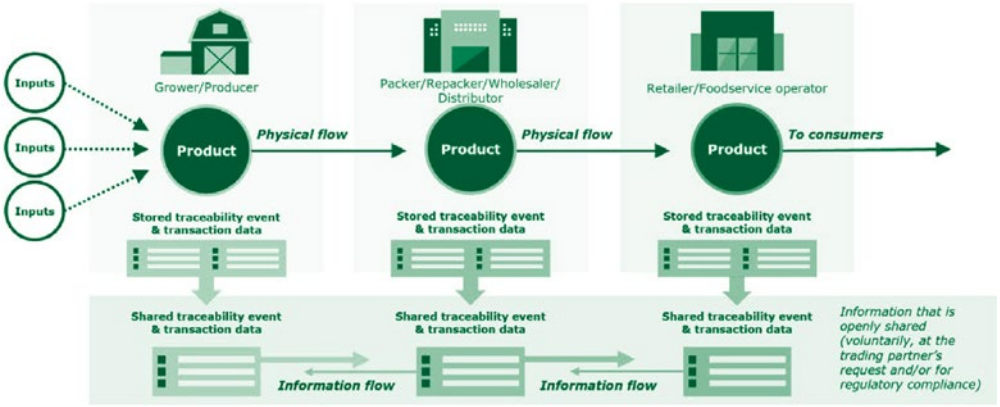
(**): If only year and month are available, DD must be filled with two zeroes.

(***): The fourth digit of this GS1 Application Identifier indicates the implied decimal point position.

Example:

- 3100 Net weight in kg without a decimal point
- 3102 Net weight in kg with two decimal points.

Traceable Objects and Parties



Summary of Data Standards Applicable in the Organic Fresh Produce Supply Chain

Data standards that apply to key data elements and shared information are identified in this section.

GS1 has recently released a Guide to data standards for fresh produce. This Guide can be accessed from the link www.gs1.org

Data Element	Examples	Valid Values	Data Type / Format	Further information
Location	**Farm location, Field location**	**Global Location Number (GLN)**	N13	Further information on Global Location Numbers (GLN), their structure, use, creation can be found here: www.gs1.org
Date/Time	**Date of registration, Date of planting, Date of harvest Date of processing**	**Year -Month -Date**	YYMMDD	Whilst human readable date formats can vary e.g. 21 December 2020, December 21 2020, the structure of the date format to be encoded into systems and barcodes requires a consistent approach. The globally adopted standard for date recording is YYMMDD.
Product Identifiers	**Input materials such as Chemicals, Fertilisers, Seeds, Outputs such as harvested grains, fruits, vegetables Animal**	**Global Trade Item Number (GTIN)**	N14	Unique product identification of all traceable objects is a foundational element of any traceability system. Information on how to allocate a GTIN: www.gs1.org Information on when to change a GTIN www.gs1.org
Traceability Attributes	**Batch, Serial Number, Production Date, harvest date, pack date**		AN20	Traceability Attributes, such as Batch or Lot Number, Serial Number, Production Date etc. can be encoded into barcodes along with the Global Trade Item number enabling capture information along the supply chain. Also referred to as Application Identifiers, each has its own unique identifier and format. List of Application Identifiers: www.gs1au.org
Logistics Units	**Batch, Serial Number, Production Date, harvest date, pack date**		N18	Logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. Logistic units take many forms, a single box containing a limited number of products, a pallet of multiple products, or an intermodal container containing multiple pallets. www.gs1au.org
Assets	**Returnable assets like IBC, crate, pallet Individual assets like transport vehicle, trailer, vessel, transport equipment etc**	**Global Returnable Asset Identifier (GRAI) Global Individual Asset Identifier (GIAI)**	N13	Can be identified as an asset type only or an optional serial number can be added to distinguish individual assets. www.gs1au.org
Document Identifiers	**Food transport Business licence, Vendor declarations, transport messages**	**Global Document Type Identifier (GDTI)**		Can be encoded in a barcode or printed directly on the document. Companies can use the GDTI as a method of identification and registration of documents and related events. www.gs1.org
Consignment	**Grouping of logistics units assigned by the transport company**	**GINC**	N30	The Global Identification Number for Consignment can be used by companies to identify a consignment comprised of one or more logistic units that are intended to be transported together. www.gs1.org
Shipment	**Grouping of logistics units**	**GSIN**	N17	The Global Shipment Identification Number (GSIN) is a number assigned by a seller and shipper of goods to identify a shipment comprised of one or more logistic units that are intended to be delivered together. www.gs1.org

How to capture the KDEs

The following section details how information is to be collected via the use of barcodes and/or other identification methods e.g. EPC/RFID.

The use of barcodes and scanners to capture key data elements for each defined Critical Tracking Event greatly enhances data quality and speed of data capture.

Marking/barcoding traceable objects

Traceable objects —and in some cases also parties, locations, transactions and documents— will need to be physically identified to enable traceability. Physical marking is usually in the form of a barcode applied at either individual item level, crate level of pallet level.

Traceability systems can use GS1-approved barcode symbologies and EPC/RFID tags to encode GS1 identification keys that uniquely identify products, trade items, logistic units, locations, assets, and service relations worldwide. Additional information such as best-before-dates, serial numbers, and lot numbers may also be encoded into barcodes or EPC/RFID.

Other carrier-based technologies (such as digital watermarks) and carrier-less technologies (such as image recognition) may also play a role depending on the environment and nature of information that is required to be captured as part of a Critical Tracking Event.

In addition to the data that is captured when scanning barcodes, data provided by the equipment used to scan or read the data —such as date & time, read-point and user (operator)— will be important in determining the **Who** completed the data capture, **Where** the data capture took place, **When** and **Why** e.g. receipting transaction, picking.

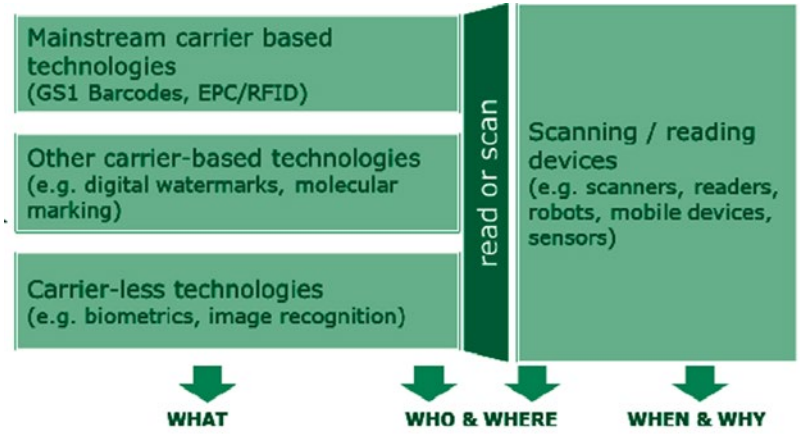
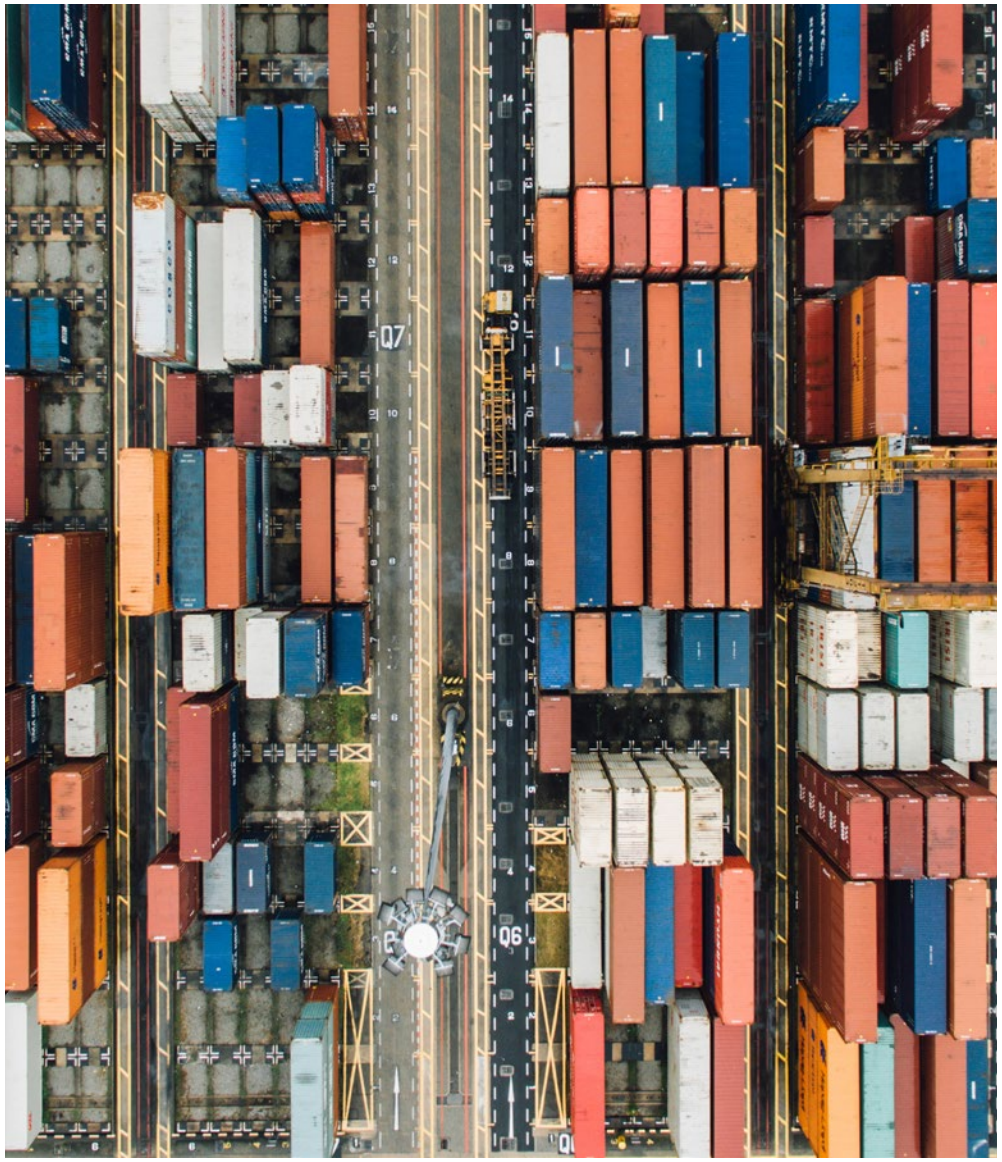


Figure 5: Data Capture technologies used to capture the KDEs



Barcodes

Barcodes are symbols that can be scanned electronically using laser or camera-based systems. GS1 refers to barcodes as data carriers

The marking of traceable objects is driven by the level of identification. Batch/lot-level or serialised identification are dynamic data and therefore need to be printed on-demand at the time the traceable item needs to be identified and the label is applied.

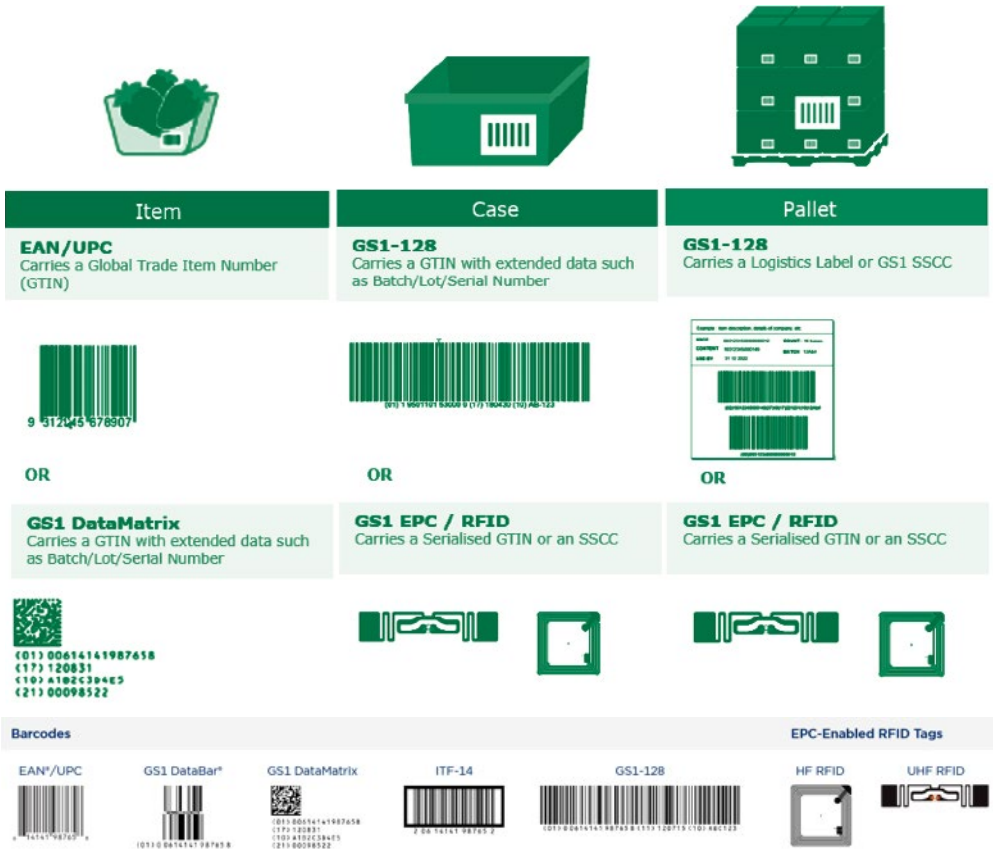


Figure 6: GS1 Data Carriers

GS1 manages several types of barcodes. Each is designed for use in a different situation. Besides the batch/lot ID and/or serial ID these may also include the pack date, best before date, weights, etc. The proper linkage of the barcode, the related data and the produced instances of the trade item, is a key aspect.

Figure 7: GS1-128 Barcode capturing GTIN, Use By Date and batch/Lot number.

Figure 8: GS1-128 Barcode capturing GTIN, production date and batch/Lot number.

Figure 9: GS1-128 Barcode capturing variable weight GTIN, use of application identifiers (AIs) net weight in kilograms, packaging date and serial number date.

Figure 10: Trade item fresh produce carton/Case label examples.

For **logistic units** the barcodes have always been based on the SSCC, which is a serialised identifier. This means that logistics labels will be printed when the goods are packaged, and that the link between data and label will be secured that way.

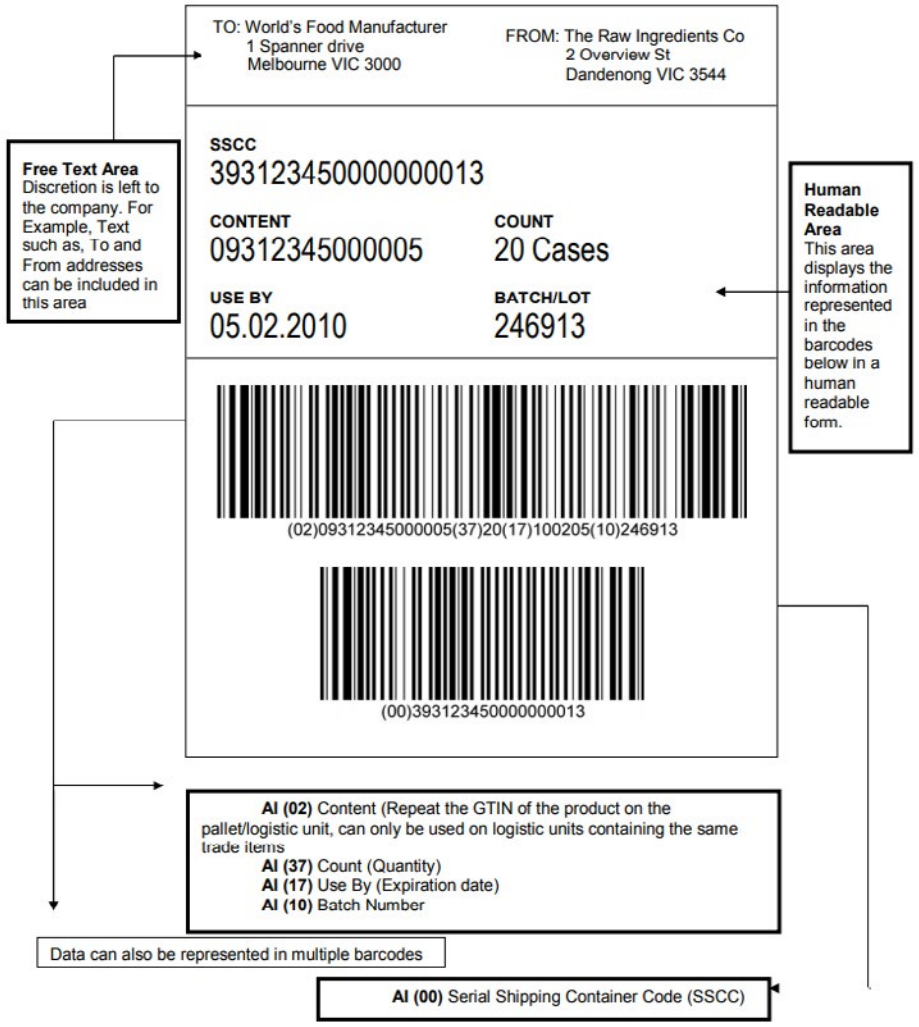


Figure 11: GS1 Logistics Label for homogenous pallet.

Assets

Assets can be identified as either returnable assets or internal assets. Returnable assets are typically those that travel through the supply chain containing products e.g. crates, pallets. Internal assets, such as farming equipment, computers are classified as internal assets.

When identifying returnable assets, the Application Identifier 8003 should be used.

Figure 12: GS1 Logistics Label for fresh produc.

Figure 13: Global Returnable Asset Identifier, AI (8003), represented in a GS1-128 Barcode.

When identifying internal assets, the Application Identifier 8004 should be used.

Figure 14: Global Individual Asset Identifier, AI (8004), represented in a GS1-128 Barcode.

How to capture data/events

An important principle is the separation of data content from the way the data is exchanged (the communication method).

Best practices for maintaining traceability is to capture 'all agreed to traceable information' and store it within their systems by scanning the information directly from the trade item / case / input barcodes.

Scanning enables data to be captured, stored, and retrieved without the need to visually review the human readable information and manually key that information into systems. This typically involves the use of a scanning device, usually a barcode scanner.

Product can be scanned for Critical Tracking Events e.g. as it enters the packhouse; as it is shipped out of the packhouse as it is received at a processing facility or abattoir or as it is opened for further processing.

More and more suppliers, processors, distributors and wholesalers are putting processes in place to collect and store at least the minimum product information required to support traceability.

When it comes to capturing the data, the main questions are:

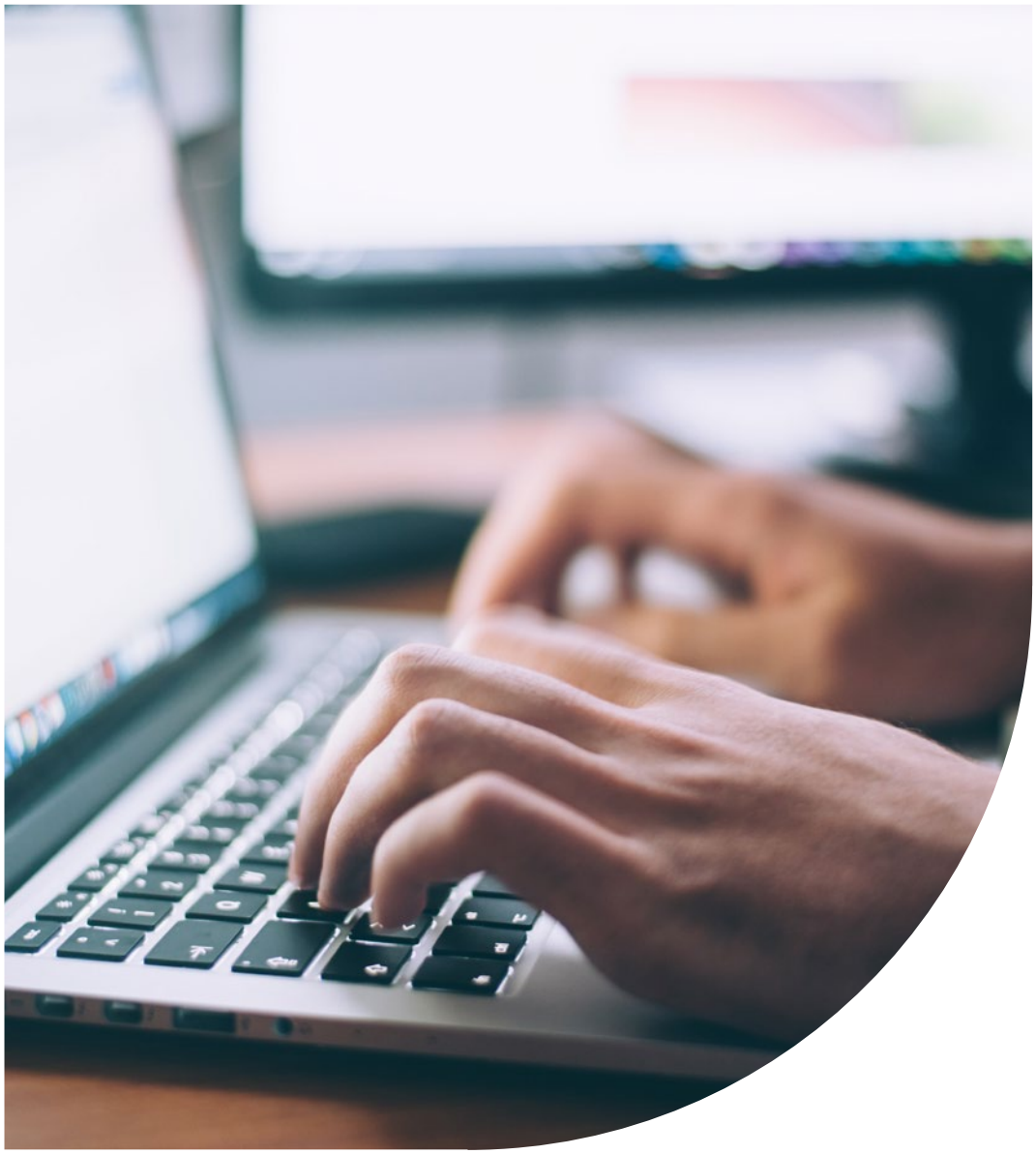
1. Which process steps need to be captured?
2. What is the most cost-effective way to capture the data?

Usually the first step will be scanning of inputs, livestock etc upon receipt. Where barcodes are present, this usually done using handheld devices or fixed mount scanners. For EPC/RFID tags both handheld and fixed readers can be used.

Other process steps where data will be captured are harvesting, storing, picking, packing, shipping, transporting, selling. Often a combination of fixed mounted scanners or readers and handheld devices will be applied to capture the critical tracking events.

The emergence of mobile devices deserves a special mention here since it increases the availability of scanning capability (making scanning as pervasive as the barcode) and so may make it feasible to record additional events at limited additional cost.

Figure 15: range of scanners that read liner, 2D and RFID tags.



Australian Guide to Implementing Food Traceability (AGIFT):

Organic Produce

Cybersecurity, Privacy & Data Sharing

Cyber Security, Data Sharing, Privacy

Global supply chains are becoming increasingly dependent upon digital technologies. Understanding, evaluating, and mitigating the cyber risks impacting supply chain critical business activities and trading data is thus of increasing importance. This module puts forward a comprehensive list of security concerns, threats, and mitigation strategies for constituents of a supply chain (e.g., trade companies, service providers, etc.) to discuss and analyse when developing their overall security posture. In that pursuit, we present a generic architecture of traceability that is divided into four main layers, namely data carrier, data capture, data sharing, and application layers (see Section 2 for details). We present a description of core elements (or technologies) of each layer and outline threats and mitigation strategies based on the STRIDE threat model (see Section 4 - 7). STRIDE is widely used for analysing systems for different vulnerabilities and their potential countermeasures. Finally, we present a description of best practices for managing cyber-risks in supply chains (see Section 8) and for ensuring privacy of data shared amongst the trade partners (see Section 9).

Disclaimer: This is not a risk assessment report. Hence mitigation strategies and threats described herein are neither ranked nor sorted in terms of their impact, severity or risk to a given organisation. This module is intended to be used as a generic guide for business owners to determine the best security controls available to their organisations.

Introduction

Digital technologies are being increasingly adopted in modern supply chains. This brings many benefits such as ease of data sharing amongst the trade partners, access of product related data whenever needed and end-to-end traceability of products. It also helps end-users to have product specific data and make more informed decision when purchasing a product. However, the interconnection of trade partners using digital technologies brings cyber threats to the spotlight, with the potential to leak business data, disrupt business operations, and provoke financial, intellectual and reputation losses. Understanding and analysing those threats is the goal of this report. To accomplish this, we present a generic data flow architecture for supply chains that is comprised of four layers (see Figure 1), and then identify the assets associated with each layer. For ease of exposition and analysis, we adopt the STRIDE threat model to present potential mitigation strategies against common threats, such as spoofing, tampering, repudiation, information disclosure, denial of service, and elevation of privileges.

Figure 1 shows a four layered food traceability data flow architecture, which comprises the data carrier layer, data capture layer, data sharing and application layer. The data carrier layer is comprised of means (e.g., barcodes, RFID (Radio Frequency Identification) tags, IoT (Internet of Things) devices used to carry information (e.g., identification keys) related to products and other entities within the supply chain. The data capture layer records the identification data from the various physical identification techniques attached to the products moving in the supply chain. The data sharing layer contains a central repository of master data recorded for the products as well as a distributed repository that can be accessed by various participants of the supply chain. The application layer comprises software systems that access traceability data to provide services.

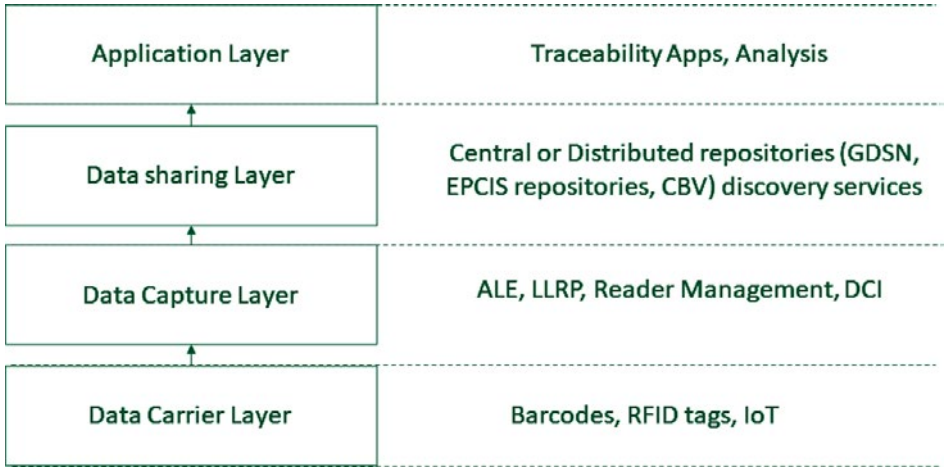
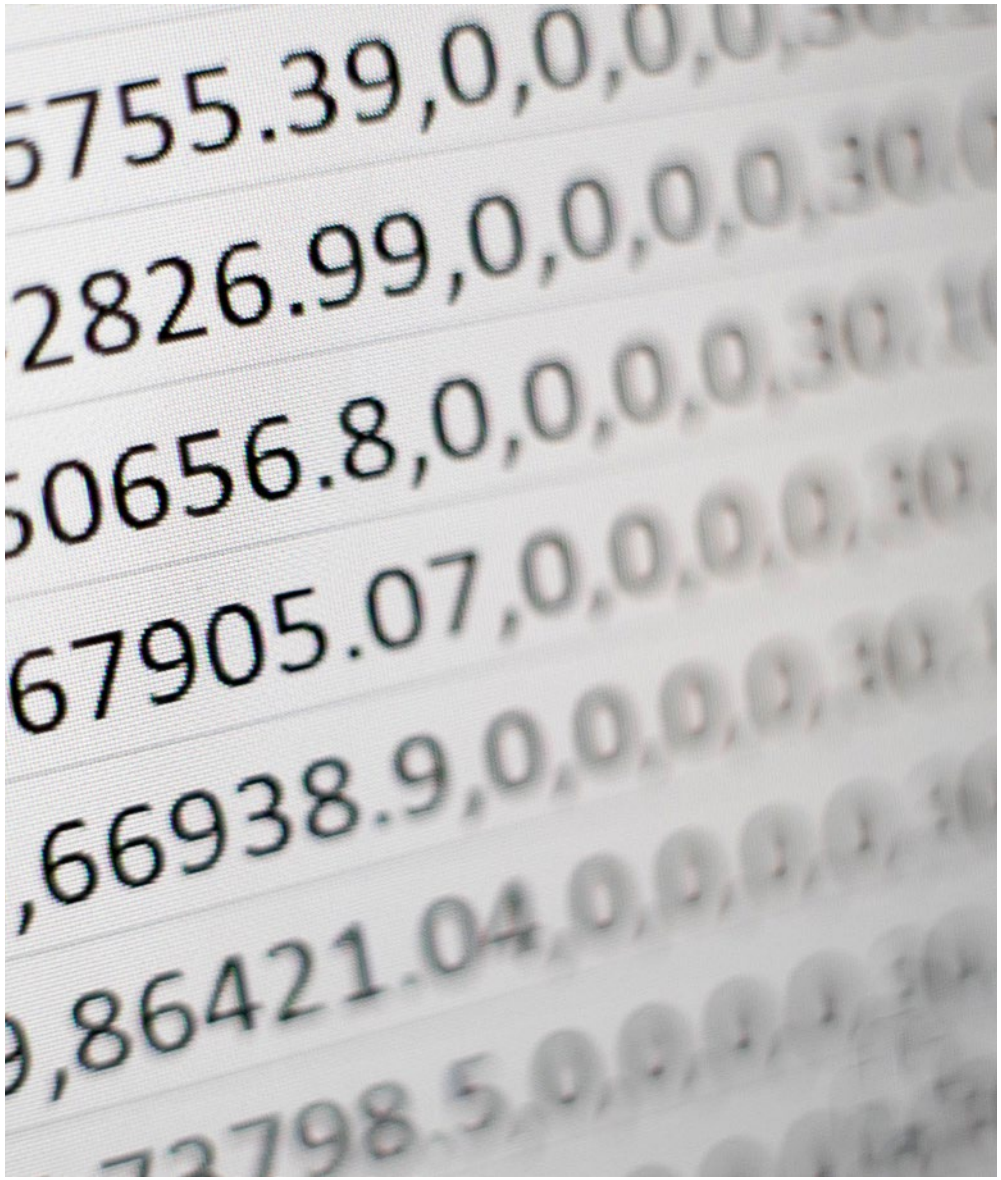


Figure 1: Food traceability data flow architecture

The mitigation strategies presented in this report are based on the Microsoft's STRIDE threat model. Although other threat models exist, such as Open Web Application Security Project (OSWAP), Process for Attack simulation and Threat modelling (PASTA), and Operationally Critical Threat, Asset and Vulnerability Evaluation (OCTAVE), the STRIDE model was chosen due to its simplicity and the broad categories of threats it covers. The six major threats considered in STRIDE are listed below.

- **Spoofing** – aims to subvert the authentication mechanism of the system by using fake or cloned credentials.
- **Tampering** – targets the various components of the system where the ICT components and data stored in them are tampered with.
- **Repudiation** – targets the system's vulnerability in logging and tracing activities to prevent detection and identification of malicious activities.
- **Information Disclosure** – aims to access unauthorised information from the system and disclose it to unauthorised parties.
- **Denial of Service** – disrupts system operation and service availability.
- **Elevation of Privileges** – allows users to increase their level of access to the system resources without authorisation.

The next four sections in this document are dedicated to an analysis of aforementioned threats within each of the layers comprising the food traceability data flow architecture. The analysis identifies the assets an organisation may want to protect, main threats to those assets, and potential mitigation strategies.



1. 1 Data Carrier Layer

This layer focuses on the identification and description of various assets that carry the product data and are physically attached to the assets to track and monitor the product locations and conditions. Table 1 shows the three main assets in the data capture layer that contain product information and/or monitor products in the food supply chain.

Table 1: Assets in Data Capture Layer

Assets	Descriptions
Barcodes	Barcodes capture various product related information such as Global Location Number (GLN) and Global Trade Item Number (GTIN).
RFID tags	Hardware RFID tags used to store the EPC.
IoT devices	Hardware sensor devices used to monitor and track products and packages.

1.2 Security Requirements and Threat Mitigation Techniques for the Data Carrier Layer

1.2.1 Barcodes

Threat	Threat Description	Potential Mitigation
Spoofing	Copying/printing legitimate barcodes to spoof the product identities and insert fake goods or legitimize fake products in supply chains.	Use of anti-copying and unclonable barcodes such as 2D barcodes versus the 1D barcodes to prevent copying or cloning of barcodes. Use of special printing material, physical unclonable functions, digital water marking and high-density black and white blocks for preventing illegal copying of barcodes[1] [2].
Tampering	Preventing access to traceability information by manipulating barcodes. Embedding harmful commands within barcodes to be executed by barcode readers. Attaching counterfeit barcodes to products with the purpose of manipulating prices and traceability information.	Use of tamper-resistant and durable materials for making the barcode labels with additional security of voiding tampered labels is suggested to prevent tampering attacks. Similarly, tamper detection for barcodes (i.e., QR codes) can be implemented to integrate the digital signature of a barcode content in the error correcting area by leveraging stenographic techniques[3].
Repudiation	Preventing unauthorised operations from being traced and attributed to the malicious user.	Repudiation attacks are difficult to defend as barcodes are non-electronic and any logging of actions (e.g., modifications) is not possible.
Information Disclosure	Perform unauthorised scanning and read barcodes and fetch information stored in them (e.g., unprinted information in case of QR codes).	Use of security enhanced barcodes such as Secret-function-equipped QR codes (SQRC) that carry an additional confidential information that may be accessible through a purpose-built scanner with the correct cryptographic key[4].
Denial of Service	Damaging barcodes to make them unreadable (e.g., damaging checksum bits). Disable or hijack host device through malicious embedded codes leading to buffer overflow.	• Use of tamper-proof materials for printing barcodes to prevent any damage to barcodes which may lead to DoS (Denial of Service) attacks • Use of limit on the data that is being read to block any potential buffer-overflow attack.
Elevation of privileges	Performing unprivileged actions by embedding malicious commands in barcodes (e.g., targeting database systems by embedding SQL statement)[5]	Incorporate security features in scanners or host device to block the execution of malicious commands or loading of malicious URL – e.g., incorporation of threat signature library as indicated in.[6]

[1] www.arxiv-vanity.com
[2] arxiv.org
[3] patents.google.com
[4] delivr.com/faq/1468/what-is-sqrc
[5] link.springer.com
[6] patentimages.storage.googleapis.com

1.2.2 RFID Tags

Threat	Threat Description	Potential Mitigation
Spoofing	• Detaching tags from products and attaching to fake products (Tag Snatching). • Creating replica of tags through reverse engineering (Tag counterfeiting). • Reading data from cheap items and uploading it to some other tags and attaching to expensive items.	• Use tamper evident and tamper alarm RFID tags that alerts if tags are detached from an expensive item and are unusable after their removal[7]. • Use of anti-counterfeiting techniques such as physical unclonable functions, chip-less RFID tags[8], and distance bounding protocol that utilize broadcast and collisions to find the cloned tags[9]. • Allow only authorized physical access to the RFID tags.
Tampering	Inserting malicious information to cause harm to tag readers and systems connected to it (e.g., Virus[10]). Physical tampering to damage tag data.	• Use RFID authentication protocol and lock all memory banks (that may be unlocked with correct access password) to protect against any illicit manipulation of data. • A middleware that can detect the presence of any malicious data being read from a tag may be helpful against insertion of harmful viruses. • Allow only authorized physical access to the RFID tags.
Repudiation	Tampering tag data without logging the manipulation performed.	• Allocate sufficient memory to log/track all manipulations on tag data.
Information Disclosure	Revealing tag data related to traceability that are not protected by encryption and authentication mechanism.	• Use mutual Reader/Tag authentication and encryption to protect against the unauthorized access to the stored information. • Use shielded enclosures to protect against any unauthorized access to tag data outside the legitimate access area.
Denial of Service	• Killing of tags to make them unusable. • Manipulation of tag data to some arbitrary values unrecognizable to backend system.	• Enable Reader/tag authentication so that kill command may not be issued by a malicious reader or it may not manipulate data such that it leads to DoS attacks. • Allocate sufficient memory to kill passwords so that they are hard to brute force. • Use strict access control mechanisms to manipulate the tag data.
Elevation of privileges	Installing malware on RFID tags to steal information or gain unauthorized access to the system.	• Security features in reader/middleware to detect the presence of any malicious viruses and malware in tag memory, such as memory attestation.

1.2.3 IoT Devices

Threat	Threat Description	Potential Mitigation
Spoofing	Impersonating the device credentials to connect to supply chain IoT Network. Use cloned IoT devices to bypass authentication mechanism and access the important data or feed incorrect data.	• Use authentication mechanisms that rely on unclonable information – e.g., device-characteristics-based mutual authentication between the communicating devices. • Use multi-factor authentication to counter any potential compromise of credentials. • Use of strong credentials and regular updates of device's access passwords.

[7] atlasrfidstore.com
[8] minerva-access.unimelb.edu.au
[9] www.sciencedirect.com
[10] cdn.intechopen.com

Threat	Threat Description	Potential Mitigation
Tampering	• Tampering traceability data stored in IoT devices such as GPS coordinates to manipulate traceability data. • Installing malwares on IoT devices to access traceability data. • Tampering IoT firmware.	• Encrypt and digitally sign the firmware binaries to preserve their confidentiality and integrity[11]. • Enforce a secure boot process to prevent from modifying/replacing back doored firmware[12]. • Mutually authenticate the device firmware and cloud update pool using PKI[13]. • Do not hardcode encryption key in firmware as reverse engineering may reveal it, and an attacker may use it to tamper the memory content[14] as per their needs. For example, it may allow an attacker to modify passwords, replace certificates, and download back doored versions of the firmware[15]. • Protect IoT devices from an unauthorized physical access that may allow the installation of malicious software[16]. • Only allow the administrator to manipulate critical information, such as geo-coordinates (after verifying the multi-factors of authentication). • Regular security patching of IoT firmware to prevent vulnerabilities.
Repudiation	Denying of unauthorised actions by erasing IoT device logs and memory contents.	• Use cloud locations to store critical event logs on IoT devices to trace actions on it. • Enforce strong authentication mechanisms prior to deleting logs or IoT traceability data.
Information Disclosure	Revealing sensitive information stored on the IoT devices such as credentials, digital certificates, product details and traceability data.	• Encrypt all stored data on IoT devices, and do not hardcode keys in firmware. • Use light weight encryption techniques that do not exhaust device battery and do not require complex CPU cycles to encrypt data on IoT devices.
Denial of Service	• Denial of traceability service by physically damaging or disabling the IoT device used for traceability. • Sending unnecessary communication requests to battery operated devices to drain their batteries and disable device[17].	• Protect against the unauthorized physical access to IoT devices to avoid any damage to these devices that may lead to DoS attacks. • Detect and prevent anomalous communication with the IoT device.
Elevation of privileges	Gaining unauthorized access to the IoT firmware and executing unauthorized commands to impact the traceability.	• Protect against the unauthorized access to firmware by encrypting the binaries[18]. • Detect and disable malicious or compromised IoT devices. • Disable unnecessary services running on IoT devices.

[11] infosys.com
[12] infosys.com
[13] infosys.com
[14] blog.securityinnovation.com
[15] infosys.com
[16] trendmicro.com
[17] ieeexplore.ieee.org
[18] infosys.com

1.3 Data Capture Layer

Data capture layer focuses on assets and interfaces that facilitates the capturing of product data encoded in carriers attached to the product, and its subsequent conversion to a format that is suitable for different applications and storage in repositories. Following are the assets related to data capture layer:

Assets	Descriptions
Barcode printers and Scanners	Devices used for printing several types of barcodes, and scanners used to read the data encoded in a barcode attached to a product.
Barcode Reader Application (Host system)	Barcode host system application used to decode and act on the data read from barcodes.
Tag writers/Readers	Devices used for writing data into tag memory, and readers used for reading data from the tags.
RFID Air Interfaces	The air interfaces provide a common Radio Frequency (RF) operating range and a standard communication protocol to facilitate the tag and reader to communicate. The readers identify the tags and access the stored data using the air interfaces. Two air interface standards are discussed below: **UHF Gen2 Air Interface** - The latest UHF Gen2 standard proposed by GS1 is the Gen2 V2.0 which defines an operating range of 860 – 960 MHz UHF range. **HF Air Interface** - A protocol operating at 13.56 MHz frequency defining the requirements of a RFID Tag and reader specifying the passive-backscatter, Interrogator-talks-first (ITF) for RFID communication.
RFID Software Interfaces	These interfaces form the middleware between the RFID tags and the applications that access RFID data and help in transforming the RFID stored data into format required by the upper layer applications. These interfaces include: **Low level Reader protocol (LLRP)** - Defines the control and delivery of raw tag reads from Readers to the Filtering & Collection role. **Application-Level Event (ALE)** - Defines the control and delivery of filtered and collected tag read data from Filtering & Collection role to the EPCIS Capturing Application role. This is one of the critical components of the RFID system as it sits between the RFID readers and the ERP (Enterprise Resource Planning) tools.

1.4 Security Requirements and Threat Mitigation Techniques for Data Capture Layer

1.4.1 Barcode Scanner / Writer/ Reader Application

Threat	Threat Description	Potential Mitigation
Spoofing	Impersonating authorised scanners to scan barcode data	Authentication must be enabled between the barcode scanners and the host computer system so that unauthorised scanners cannot be attached to the host system.
Tampering	• Tampering Software / Firmware of barcode scanners • Remotely controlling the host computer using backdoors in reader applications.	• Access to firmware should be restricted to authorised individuals using strong authentication techniques • The firmware updates need to be digitally signed and encrypted to prevent tampering of scanner software [19]. • Wi-Fi connected handheld barcode scanners need to be physically secured from unauthorised usage and prevent tampering.
Repudiation	Denying malicious actions by clearing logs of scanner events and reader software application:	Logging needs to be enabled and secured at all the scanner devices and reader applications to enable tracking of events in the supply chain.
Information Disclosure	• Compromising scanners/host applications and reveal traceability information. • Eavesdropping on Wi-Fi connected handheld scanners to disclose scanning data.	• Communication between the scanners and host applications need to be secured. Access to data stored on the host system needs to be protected with strong authentication mechanisms. • Especially handheld barcode scanners need to encrypt the communication between scanner application and the backend systems.

[19] .designnews.com

Threat	Threat Description	Potential Mitigation
Denial of Service	• Disabling scanners using malicious barcodes to cause DoS. • Exploiting Wi-Fi enabled scanner OS/ Firmware vulnerabilities to cause DoS[20].	• The scanner firmware, reader applications need to be regularly patched to remove open vulnerabilities. • Data scanned from barcodes need to be verified for malicious content to prevent damaging the scanners or the reader application[21] [22]. • Communication mechanisms used by wireless handheld barcode scanners need to be secured and patched to prevent DoS attacks[23].
Elevation of privileges	Launching attacks on connected components of the supply chain system.	Host systems should contain access control levels to prevent reader applications from having privileged access to other parts of the system and isolate compromised host systems from affecting other parts of the supply chain.

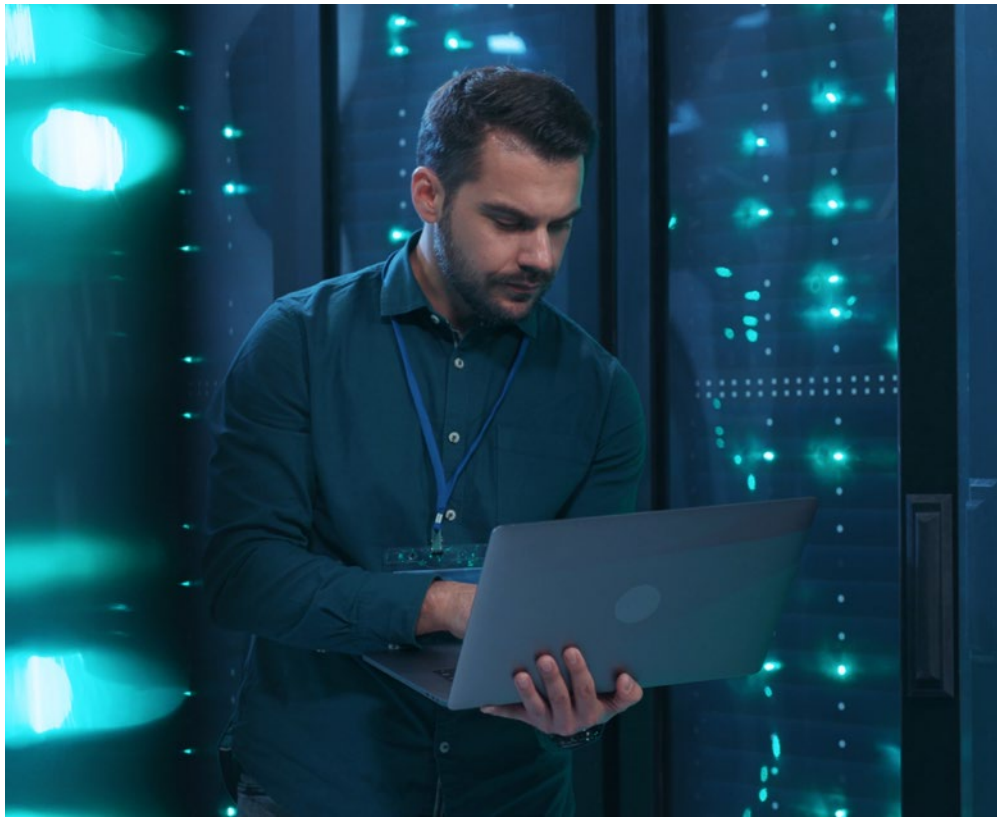
1.4.2 RFID Reader/Writer/Air Interface

Threat	Threat Description	Potential Mitigation
Spoofing	• Extracting or modifying product information using unauthorized readers/ writer to read/write RFID tags. • Feeding incorrect traceability data using previously recorded communication between reader and tag.	• Use reader/writer authentication before allowing them read data from a tag or write data to a tag's memory. • Use timestamps, counters, and challenge response cryptography to protect against the replay attack[24].
Tampering	• Modifying traceability data by tampering or reverse engineer the readers/ writer firmware. • Tampering tag data using unauthorized RFID tag writers.	• Encrypt and digitally sign the firmware updates to protect against the unauthorized firmware update[25]. • Enable writer/tag authentication so that malicious writer cannot tamper the tag data.
Repudiation	Causing repudiation by exploiting the limited memory and logging capability on tags.	Enable a secure logging at all readers/ writer for tracking all actions conducted with these devices.
Information Disclosure	• Eavesdropping to listen to unencrypted communications between the reader and the tag. • Launching Side channel attacks to analyse the memory access and power fluctuations to extract authentication keys or steal information. -Launching MiTM (Man in the Middle) attacks that divert communications to malicious devices and steal information.	• Encrypt the communication between tag and reader to protect against the eavesdropping. • Use the RFID authentication protocol that are resistant to MiTM attacks[26]. • Filter the power signal or delay the computation randomly to make power analysis difficult[27].
Denial of Service	• Killing tags using malicious writers causing DoS. • Launching Jamming attacks blocking the communication between tag and reader.	• Use mutual authentication such that attacker cannot launch desynchronization[28] attacks and kill command attacks. • Use external noise/radio shielded enclosure to protect against the RF jamming attack[29].
Elevation of privileges	Performing unprivileged actions using compromised readers/writer on connected applications.	• Built security features in reader so that malicious data stored in the tags that can potentially compromise the reader be detected (e.g., check for buffer overflow if appropriate). • Reader/Writer firmware be protected against the unauthorized update.

[20] cvedetails.com
[21] patentimages.storage.googleapis.com
[22] ieeexplore.ieee.org
[23] cvedetails.com
[24] link.springer.com
[25] designnews.com
[26] link.springer.com
[27] cdn.intechopen.com
[28] ieeexplore.ieee.org
[29] cdn.intechopen.com

1.4.3 RFID Middleware

Threat	Threat Description	Potential Mitigation
Spoofing	• Connecting to RFID middleware applications as LLRP lacks authentication mechanism using spoofed RFID reader identities. • Replaying previously captured communication from the reader device and gain unauthorized access to middleware application.	• Mutual authentication between readers and ALE middleware. • Use sequence numbers and timestamps to protect against the replay attacks[30] between reader and client.
Tampering	• Inserting unauthorized code into middleware applications. • Tampering traceability data by exploiting vulnerabilities of the LLRP protocol used in middleware applications.	• Build security feature in middleware that can check for insertion of any malicious data such viruses. • Enable strong authentication before allowing a change in LLRP parameters.
Repudiation	Denying unauthorised access by deleting logs and associated traces.	Enable activity logs in middleware and ensure that deleting logs is not possible.
Information Disclosure	Eavesdropping and listening to unencrypted LLRP communications to reveal traceability information.	• Use of encryption to protect against the eavesdropping between a reader and filtering and collection role. • Use authentication such that MiTM attacks are blocked.
Denial of Service	• Disabling middleware applications by inserting malicious values in the reader protocol causing buffer overflow attacks. • Corrupting the ALE interface with malicious reader values.	• Use programming languages that offer bound checking to protect against the buffer overflow[31]. • Allow only authenticated reader's data in proper format to flow through ALE interface. • Use load-balanced ALE middleware to prevent availability issues due to flooding attacks.
Elevation of privileges	• Gain unauthorized access to the backend traceability applications or supply chain system using a compromised ALE interface. • Exploiting the weakness in input data validation mechanism to launch SQL injection attacks using malicious characters or values stored on RFID tags. • Gaining unauthorised access to the system to reveal traceability information using stolen accounts and credentials to bypass the RBAC access control policies.	• Build a security features in readers and middleware that accepts data only in pre-defined format to protect against the code injections. • Protect against the buffer overflow that may lead to elevated privileges[32]. • Incorporate a layer on top of middleware component that helps controlling the collection done by clients (i.e., capture application)[33].



[30] inderscienceonline.com
[31] veracode.com
[32] veracode.com
[33] link.springer.com

1.5 Data Sharing Layer

To support traceability of products, GS1 provides global traceability standards which support the identification, capturing and sharing of traceability data such as the master data, transactional data and the event data related to the products. GS1 defines three different standards for data exchange amongst the trading partners within the supply chain. These include Global Data Synchronization Network (GDSN – used for sharing Master Data), Electronic Product Code Information Services (EPCIS – used for sharing Visible-Event Data), and Electronic Data Interchange (EDI – used for sharing Transactional Data) as highlighted in Figure 2.

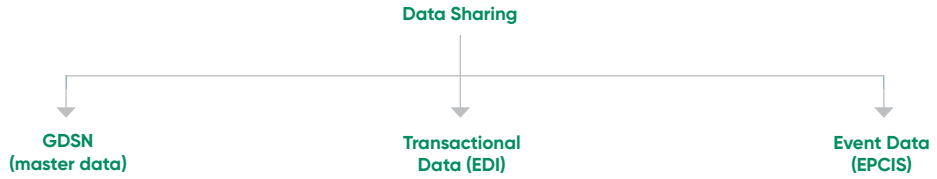


Figure 2: GS1 traceability data sharing standards

Master Data - refers to data that is shared by one trading partner with many others and contains the description of attributes of real-world entities identified by GS1 ID keys. Examples include trade items and physical locations.

Transactional Data - refers to execution of a business process function such as a supply contract, custom processing, order placement, and final settlement using the GS1 identification keys.

Visibility-Event Data - refers to details of physical activity of products (or other assets) identified by keys within the supply chain, detailing where and why products are at a time within and across the organizations.

Assets in this layer include:

Assets	Descriptions
GDSN Data Pools	The data pools contain the product information (product catalog and product prices) which is shared among the trading partners. The data pools can be either maintained by a third-party or can be deployed internally by the trading partner.
GDSN Registry	The GS1 global registry is a directory of registered parties and products which also federates between data pools. It also serves as the pointer for data pools with respect to the master data of products and parties.
EPCIS Capture Interface	With this interface, visibility event data in accordance with EPCIS data model is delivered from capturing applications to a receiver (e.g., persistent repository of EPCIS data).
EPCIS Repository	A persistent store of visibility event data, comprising all EPCIS events generated internally within the organization and received from other trading partners, and makes them available to be used by the EPCIS Accessing Application
EPCIS Query Interface	With this interface, EPCIS event data may be requested by and delivered to a business application or a trading partner
AS2	Communication protocol used for GDSN synchronization and sharing EPCIS event data with trade partners.
Object Naming Service (ONS)	ONS is DNS based discovery service used to discover data and services related to the GS1 identification key.

1.6 Security Requirement and Threat Mitigation Techniques for Data Sharing Layer

Potential mitigation steps that can help on protecting the various assets at data sharing layer are described next.

1.6.1 GDSN Data Pools/ EPCIS Repositories

Threat	Threat Description	Potential Mitigation
Spoofing	Accessing sensitive product data in GDSN data pools or GS1 global registry using stolen or spoofed credentials.	Enable strong authentication (e.g., multifactor authentication) prior to giving access to critical data stored in GDSN data pools.
Tampering	• Pushing tampered event data to EPCIS repositories of all trade parties by compromising a single weak trading partner. • Tampering the GDSN data related to the products such as the GTIN, GLN or product descriptions causing errors in traceability data.	Allow only authorized individuals to make changes to product related information after verifying their identity.
Repudiation	Denying unauthorised actions either due to Improper logging or logs being removed by adversaries.	Enable secure logging both on GDSN data pools and EPCIS repositories.

Threat	Threat Description	Potential Mitigation
Information Disclosure	Leaking sensitive traceability data from EPCIS repositories using SQL injection attacks or by transacting with malware infected repositories.	• Ensure that correct data is being shared only with authorized partners. • Enable protection against virus and malware. • Accept data only in pre-defined format to protect against any malicious data fed to EPCIS repositories.
Denial of Service	Denying service to legitimate users by using malicious XML files, or oversized XML documents.	Protect against several types of XML attacks as mentioned in[34].
Elevation of privileges	• Gaining unprivileged access to registries and data pool services. • Gaining unprivileged access to EPCIS event data stored in EPCIS repositories (e.g., stolen access token). • Enabling unauthorized access to EPCIS repositories using malicious payload in AS2 (e.g., malware) or data from RFID tags.	• Ensure that access tokens for EPCIS event data is shared with correct partners. • Allow data pool access only to authorized partners. • Protect against malicious XML payloads that may lead to unauthorized data retrieval as indicated in[35].

1.6.2 EPCIS Capture/Query Interface

Threat	Threat Description	Potential Mitigation
Spoofing	Feeding corrupted data to EPCIS repositories using spoofed middleware credentials or due to lack of mutual authentication between a middleware and repository.	• Enable mutual authentication between capture application, accessing application, repositories, and repository and trade partners.
Tampering	Tampering data in EPCIS repositories by exploiting the vulnerabilities in EPCIS capturing application.	• Accept data only from authenticated readers/trade partner in proper format so that capture/query interfaces are not corrupted. • Allow only authorized individuals to makes changes to data stored in EPCIS repositories or GDSN data pools.
Repudiation	Denying malicious actions due to Improper logging or logs being removed by adversaries.	Enable activity logging.
Information Disclosure	• Gaining unauthorised access to traceability data due to lack of encryption between capture application, repositories, and trade partners. • Disclosing sensitive information by exploiting the lack of mutual authentication between capturing application and EPCIS repositories.	Encrypt the communication between middleware, accessing application, repositories, and repository and trade partners.
Denial of Service	Denying service to legitimate users by corrupting capture and query interface by sending malicious data from reader or from trade partners.	Accept data only in pre-defined form from data carriers to alleviate the chances of corrupting EPCIS capture interface that can lead to DoS.
Elevation of privileges	Gaining unprivileged access to EPCIS repositories by conducting SQL injection attack.	• Enable mutual authentication between capture application and repositories so that malicious readers cannot feed data to repositories. • Accept data only in pre-defined form from data carriers and trade partner so that capture and query interfaces be corrupted leading to elevated privileges of an attacker. • An EPCIS service should be incorporated to conduct proper redaction to alleviate the unauthorized access to data (redaction refers to denying a data request or restricting the amount of data requested by a trade partner)[36].

[34] opswat.com
[35] opswat.com
[36] gs1.org

1.6.3 AS2 Communication Servers

Threat	Threat Description	Potential Mitigation
Spoofing	Spoofing credentials of legitimate users and access trade data using stolen digital certificates and bypassing AS2 authentication.	• Keep digital certificates in secure locations such as on an encrypted device and hardware security module. • Keep the OS and antivirus up to date and avoid running any suspicious program.
Tampering	Tampering traceability data by modifying AS2 communication parameters or the AS2 payload.	• Use strong hash algorithms so that collision attacks are not possible and any attempt to tamper the sent data be detected (e.g., SHA-2 instead of SHA-1 which is recommended AS2 transport communication guidelines available on GS1 official website[37]).
Repudiation	Denying malicious actions on AS2 servers by removing traces of adversarial actions or targeting weak AS2 server software that do not log connections and activities performed.	Enable secure logging of all operations.
Information Disclosure	• Disclosing sensitive data by launching attacks such as DNS cache poisoning or using stolen digital certificates to get access to the EDI data sent over AS2 protocol. • Revealing private keys or AS2 service credentials in public domain.	• Ensure that digital certificates are kept in secure locations. • Use strong public-private keys for asymmetric encryption. For example, consider using 2048 bits keys instead of 1024 bits recommended AS2 transport communication guidelines available on GS1 official website. Weak keys are likely to be compromised as demonstrated in[38]. • Protect against MiTM attacks through DNS poisoning by enabling DNSSEC[39].
Denial of Service	Denying service to legitimate users by corrupting capture and query interface by sending malicious data from reader or from trade partners.	Prevent HTTP/S flooding attacks by incorporating techniques such as traffic profiling, computational challenges, firewall, and constant monitoring of threats[40].
Elevation of privileges	Gaining unprivileged access to EPCIS repositories by conducting SQL injection attack.	Check for malicious payloads such as XML injects attacks as mentioned in[41].

1.6.4 ONS

Threat	Threat Description	Potential Mitigation
Spoofing **Tampering**	• Spoofing identity of legitimate ONS servers to redirect clients to malicious web address. • Corrupting ONS data by poisoning the cache to point or return incorrect query response. • Tampering DNS NAPTR records to point to malicious services.	Enable authentication and signing the DNS requests using DNSSEC that can protect the integrity of DNS queries. In addition, blockchain technology such as BlockONS can be used to prevent tampering attacks[42].
Repudiation	Denying malicious actions due to lack of logging or tampering with logs.	Enable extensive logging of ONS requests to prevent repudiation attacks.
Information Disclosure	Leaking service details by reading insecure DNS queries.	Cryptographic techniques to prevent leaking of information through DNS queries can be applied[43].
Denial of Service	Flooding servers or launch DNS amplification attacks on ONS server[44].	Increase the redundancy of DNS hosting servers to prevent availability issues. Also, DNS query monitoring techniques can be used to detect malicious ONS request.
Elevation of privileges	Gaining unprivileged access to ONS servers and launch attacks to modify the ONS data.	Strong authorisation mechanisms must be used on the DNS servers to prevent escalation of privileges.

[37] gs1.org
[38] arxiv.org
[39] icann.org
[40] netscout.com
[41] opswat.com
[42] ieeexplore.ieee.org
[43] hindawi.com
[44] link.springer.com

1.7 Application Layer

The application layer is the uppermost layer in the data flow architecture where end-user applications access traceability data to perform various tasks. Traceability data is accessed by various end-user applications such as Enterprise Resource Planning (ERP) tools, Supply Chain Management (SCM), audit applications, consumer applications, monitoring and analytics tools[45] [46]. These applications accessing traceability data can be broadly categorised into business to business (B2B), business to government (B2G) and business to customer (B2C)[47]. Due to complex interrelationship between food producers, supply chains, consumers, financial institutions and government organisations, weakness, or vulnerabilities in any one domain can lead to cyber security risks to the entire food traceability system[48].

Assets		Descriptions
B2B	ERP, SCM	Various ERP systems of manufactures to supply chain traders access traceability data for inventory management, order management, shipping, transportation, and financial transactions related to food products[49]. SCM systems are used to manage the flow of products from source to destination[50].
	Traceability/ Supply chain Analytics	Such applications are used in the supply chain industry to use traceability data for conducting exploratory analysis.
	Audit Applications	These applications are primarily used for ascertaining the compliance of traceability standards and regulations.
B2C	Consumer Application	These applications enable consumers to access the information related to the products they purchase in terms of the origins for food products.

[45] origintrail.io
[46] gs1.org
[47] patentimages.storage.googleapis.com
[48] patentimages.storage.googleapis.com
[49] gs1.org
[50] iict.bas.bg

1.8 Security Requirement and Threat Mitigation Techniques for Application Layer

1.8.1 B2B Applications

Threat	Threat Description	Potential Mitigation
Spoofing	Accessing ERP/SCM systems using compromised credentials.	Protect ERM/SCM systems with strong authentication mechanisms such as 2FA (2 Factor Authentication)[51].
Tampering	Tampering data in ERP/SCM systems or launch an insider attacker to alter sensitive data. ERP/SCM applications can also be impacted by malwares.	• Enable anti-virus/malware protection to alleviate chances of any tampering to B2B applications. • Allow only authorized individuals to modify the traceability data.
Repudiation	Denying malicious actions by deleting logs and associated traces.	Enable secure logging of all operations.
Information Disclosure	Disclosing sensitive information by exploiting weak authentication mechanisms in ERP systems. An ERP/SCM system impacted with malware can leak sensitive product and pricing information.	• Protect all communication with encryption to alleviate chances of any unauthorized access to data. • Enable robust authentication and enable fine-grained access control. • Use privacy preserving techniques such as differential privacy for protecting personal data if any.
Denial of Service	• Disrupting ERP/SCM services by using ransomwares. • Exploiting vulnerabilities in the ERP/SCM software to disable the software.	• Train staff on ransomware and how they impact system[52]. • Scan systems regularly with state-of-the-art anti-virus software.
Elevation of privileges	• Gaining unprivileged access to ERP/SCM system by exploiting weak access control mechanisms in ERP/SCM systems. • Gaining unprivileged access to ERP/SCM system by deploying viruses in ERP/SCM systems. • Exploiting known software vulnerabilities to launch different attacks.	• Enable fine grained access control. • Protect against virus/malwares. • Update software as soon as they are made available to patch any known security vulnerabilities.

1.8.2 B2C Applications

Threat	Threat Description	Potential Mitigation
Spoofing	Accessing traceability data using stolen client credentials or forged client identities.	Enable multi-factor authentication to protect against any potential subversion of first factor of authentication.
Tampering	Tampering client and backend consumer facing applications or traceability data (e.g., Leaving a backdoor or inserting a malware)	• Allow only authorized individuals to modify traceability data. • Protect against malware.
Repudiation	Denying malicious actions due to insufficient logging capabilities or adversary's ability to delete logs on client applications and the backend servers.	Enable secure logging of all operations.
Information Disclosure	Revealing sensitive information by targeting insecure communication channel between client applications and the backend servers.	Encrypt communication with backend server.
Denial of Service	Denying service to legitimate clients by spamming or by sending unnecessary requests to the backend servers causing heavy resource utilisation.	Incorporate a reliable DoS detection and mitigation solution as indicate in[53].
Elevation of privileges	Compromising client applications or backend servers to launch cyber-attacks on other connected applications and services.	• Update client application and server software regularly to fix any know security vulnerabilities. • Regularly scan system for virus/malware

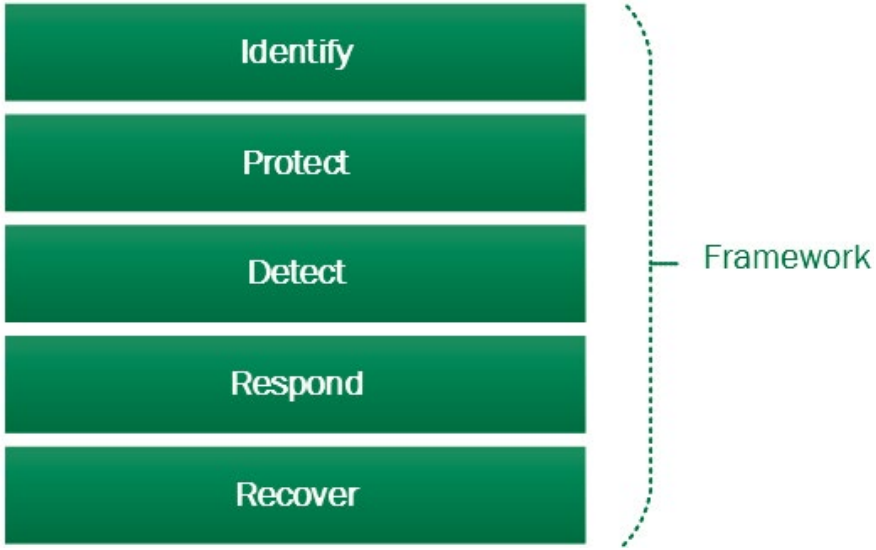
[51] iict.bas.bg
[52] solutionsreview.com
[53] phoenixnap.com

Best Practices for Managing Cyber Risks in Supply Chains

Managing cyber security risks in a supply chain system which involves various stakeholders and those that span multiple countries with different regulations is a challenging task. Nevertheless, risk can be effectively managed by following industry best practices that can be used by organizations to better plan, prepare and act during cyber security incidents. The best practices presented in this section are provided as a guide for supply chain stakeholders to plan their security strategies and aid their preparation in securing the traceability systems.

Research conducted in [54] suggests several best practices for managing cyber risks in supply chains. To pinpoint the best practices for managing cyber risks in supply chains, authors interviewed 30 senior executives who manage the complex global supply chain and several solution providers in supply chain. The suggested best practices include the following.

- **Catalogue and Map Process** – Cataloging the cyber inventory may be considered as a first step towards understanding cyber risks. Mapping of supply chain (i.e., cataloging hardware and software) nodes gives visibility into people and processes that leverage IT systems and current defense mechanisms (e.g., firewall). This knowledge can help in devising effective risk protection mechanism. Organizations should first identify all the assets or use the assets described under each traceability architecture layer that needs to be secured from cyber threats. Consequently, the mitigation steps provided for each identified threat should be considered when securing the supply chain network.
- **Clear Cyber Strategy** – An effective and clear cyber risk management strategy should be in place to counter any threats. For example, one of the possible approaches that may serve as a basis for developing comprehensive cyber strategy is the NIST Framework shown below. *Identify* in below figure refers to the organizational understanding of potential cyber threats to different systems, assets, data, and capabilities. *Protect* refers to organizational approach to defend against different perceived threats. *Detect* refers to organizational ability to identify the occurrence of any cyber incident. *Respond* refers to a set mechanism in place to act against a particular cyber incident. *Recover* refers to the mechanism that may help in resuming the services and capabilities impacted by a particular cyber incident.



[54] haslam.utk.edu

- **Identify Critical Systems** – As a part of cyber risk management, organizations may identify the critical systems that hold important business data and place a robust mechanism to protect such systems. Aggressive cyber risk management strategy for such systems may be incorporated. For example, this may include, unplugging such system from the Internet, have qualified personnel to manage those systems, incorporate multi-factor authentication, and mandate software updates immediately when they are available.
- **End-to-End Integration** – Instead of treating cyber strategy as an isolated operation within the four walls of an organization, it must be extended to end-to-end supply chain by collaborating with trade partners (thorough strategic principles such as collaboration, integration, and synchronization).
- **State-of-the-art Defense Systems** – Organizations must adopt the latest defense mechanisms such as firewalls, endpoint security, and IDS. Ensure that software is updated regularly to patch any known vulnerability that can lead to data breaches, critical systems are installed with latest anti-virus/anti-malware and updated regularly to protect against virus/malware[55] , and Incorporate IDS for detecting any potential cyber-attacks.
- **Wise Use of Contemporary Technologie**s – Businesses now-a-days are heavily reliant upon artificial intelligence and machine learning for analyzing the enormous amount of data to provide insights to the business leaders. Similarly, they are often used within the cyber strategy – e.g., in intrusion detection system. However, these technologies open a whole new vector of cyber threats, that may be considered and mitigated accordingly.
- **Continuous Training and Awareness** – Often, a misconception in organizations is that the cyber incidents are the responsibilities of IT people. However, this is not the case, as effective strategy needs awareness amongst the entire workforces. Ongoing training on regular basis must be conducted to effectively prepare against the potential cyber-attacks. The training and awareness can also prove to be pivotal against the insider misuses. For example, not all cyber risks come from cyber attackers. Often, they are associated with personnel within the company's supply chain, with no adversarial motives. For example, an accidental sharing of sensitive business information with someone can lead to sophisticated social engineering or phishing attacks. Appropriate employee training and awareness can help mitigating such insider misuses.
- **Cyber security Information Sharing:** Most supply chains partners are SMEs which are often targeted due to their weaker cyber security posture, making them a weak link in the supply chain system. [56] One of the means to mitigate cyber security risks in a heterogenous supply chain IT systems is by sharing information and intelligence related to cybersecurity threats the organizations face. [57] This information sharing can be done directly between trading partners or using a trusted third-party.
- **Manage security of IoT devices and CPS systems**: As automated supply chains heavily rely on IoT devices and CPS systems; it is essential that organizations have effective strategies to manage and establish security policies to safeguard devices and the data stored in them. As traditional security tools cannot be implemented on constrained devices, it is essential to use IoT specific measures that can play a critical role in securing the access and communication to these devices, such as light-weight authentication protocols[58] and encryption schemes suited to IoT devices.[59] Physical security of all the devices used within the supply chains is also an important aspect that needs to be considered.
- **Security Compliance:** In a supply chain, trading partners should ensure that they and their peers are security compliant to established standards such as NIST, ISO27001, PCI, or HIPPA etc. This can be leveraged by organizations to create a strong security posture and increases trust among the trading partners.
- **Incident response:** An incident response plan should be developed by supply chain organizations to create an action plan in the event of cyber security breach. This allows supply chain trading partners to quickly resolve cyber security issues and restore normalcy in the supply chains.
- **Insider Threats:** Immediately terminate the system access to any employee leaving the organization under any circumstances [60] (e.g., fired). A disgruntled employee with access to company resources can pose serious threats to the business.
- **Data Back up:** Back up your data regularly as in case of a cyber-incidents erasing all the data from the systems may be needed. [61]

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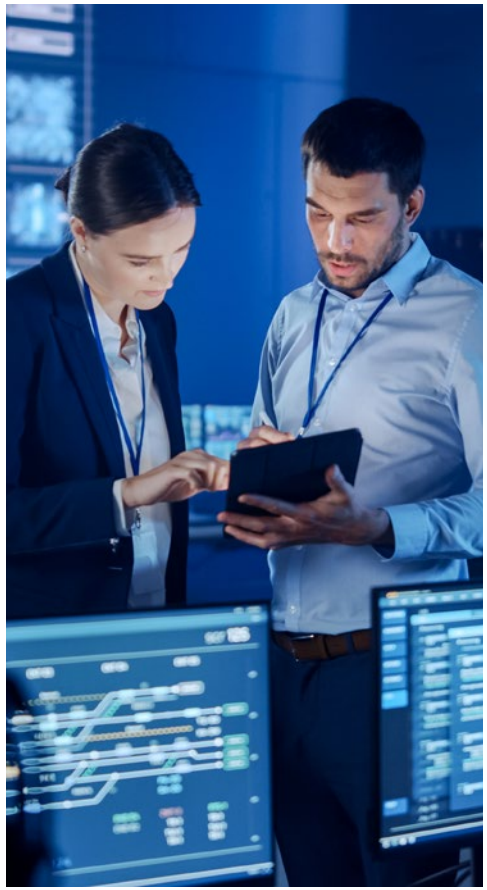

Best Practices for Ensuring Privacy of Shared Data

When analyzing the data sharing layer, we highlighted various threats and mitigation strategies that were worth considering. Certainly, with multi-party supply chains data is shared with many trading partners, raising data confidentiality and privacy concerns[62] with implications on the business confidentiality agreement.[63] In view of this, companies must not only emphasize on what information can be shared and with whom it can be shared, but they also need to ensure that their own confidential data and the data shared by other trade partners remains secure. To ensure this the following recommendations can be helpful.

- **Data Protection:** Always encrypt data be it in rest or in transit. [64] Especially the use of Secure Multi-Party Computation (MPC) is recommended for securing data between several trading partners . This necessitates that all the trading partners update their security mechanisms and adopt the same security standards as their counterparts.
- **Anonymization**: Incorporate privacy-preserving publication techniques, such as k-anonymity and differential privacy, when making personal information available to stakeholders or to the public. In this case it is paramount important to test and evaluate the inherent utility vs privacy trade-off resulting from the application of these techniques.
- **Multi-party secure computation:** Consider multi-party secure computation protocols tailored to supply chain data-sharing needs, combining inputs by different entities in a privacy-preserving manner.
- **Identity Establishment Prior to Data Access:** Enable multi-factor authentication on systems that hold important data. In addition, make sure that the system access of an employee leaving the organization is terminated immediately to alleviate the data breach threats posed by the disgruntled employee.[66] Furthermore, consider using continuous authentication for enabling the periodic identity establishment beyond the entry-points.
- **Data Release:** Ensure fine-grained role-based and time-bound access control [67] [68] such that unauthorized individuals cannot access important confidential data.
- **Principle of least privilege:** Enforce the principle of least privilege on traceability system models, ensuring that traceability and provenance data are accessible to authorised parties only.
- **Decentralization**: De-centralized data sharing techniques such as blockchains provide a secure network to share data with added security of immutability, resilience to cryptographic attacks and updated only with peer consensus. [69] The use of such technologies can allow supply chain partners to share data related to traceability in a transparent way.
- **Data Cleanrooms:** Sharing sensitive product information among peers for demonstrating the competitive advantage over others is a challenging task. Solutions such as data cleanrooms and digital marketplaces have been suggested as means to securely share such sensitive information. [70] [71] These methods can enhance the quality of the shared data and introduce transparency among the supply chain peers which are essential for competitive intelligence. An example of digital cleanroom was setup by A.T. Kearney for a fast-food chain where the sensitive information was shared among the trading partners, allowing them to optimise their supply chains. [72]
- **Audit:** Always log the requests made to access critical data and conduct regular audit on those logs.
- **Secure Data Storage:** Store critical data on secure locations with proper protections (i.e., authentication and access control). Destroy any data that is not used anymore and maintain its record.
- **Avoid Credentials Sharing:** Ensure that employees are not sharing login credentials for accessing important resources.
- **System Security Settings:** Allow only authorized individuals to change approved security settings on critical systems. [73]
- **Unauthorized Data Sharing:** Ensure that data is not being shared with unauthorized persons.
- **Protection of Work Areas:** Ensure that work area in only accessible to authorized individuals.
- **Report Cyber Incidents:** Immediately report any cyber incidents to all involved trade partners so that any corrective measures can be taken to avoid any subsequent damages.

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