Final Report

<u>Stage 2</u>

Barcoding, EDI and DNA Tools for Supply Chain Management

Food Safety Traceability - PRMS002A

A joint project between

Coles Supermarkets
Australian Country Choice
Meat and Livestock Australia

March 2001 – Preliminary Draft 4 - 31/3/01 9:00am
July 2001 - Release 1

Table of Contents
Volume 1

TABLE OF FIGURES

APPENDIX

ATTACHMENTS

A. VIDEO - Numbering, Barcoding and EDI for the Domestic Meat Industry Supply Chain

B. VIDEO - Numbering, Barcoding and EDI for the Export Meat Industry Supply Chain

C. VIDEO - DNA Validation Tools for Value Add, Offal and Trim Products

D. CD-ROM Power Point Presentations

E. Barcoding Workshop Package

1. Project Overview

1.1 Background

Throughout the meat industry there has been a growing need for the ability for producers and processors to provide evidence of food safety (product) traceability to consumers. Consumers world wide now have an expectation that retailers are able to identify the origin of the food they market. The growing pressure from consumers has forced the need for a review of the concepts and methods available to provide this evidence of traceability. This review of the industry has highlighted the concept of supply chain management and the importance of product identification through the supply chain.

For food safety traceability in the meat industry to sustain consumer confidence it must embrace a “Paddock to Plate” philosophy incorporating best practice strategies for supply chain management, food safety and food quality programs.

The principles of standardisation for terminology and numbering have been readily adopted in most other industries. The use of EAN numbering, bar-coding and EDI has been adopted internationally by over 900,000 manufacturing/ processing companies in over 90 countries and millions of companies world wide every day trade using this system. There are demands being placed on the meat industry by our international trading partners and domestically by the grocery industry for standardisation and the use of EAN numbering, bar-coding and EDI. The reason for the rapid and total adoption of EAN numbering, bar-coding and EDI through all other industries has been the huge cost saving that can be achieved by better supply chain management, both at an individual company level and at an industry level.

The first stage of the Supply Chain Management/ Food Safety traceability – Beef project was completed in October 1999. The project demonstrated the way EAN Numbering and bar-coding could be cost effectively implemented in any size processing facility to provide traceability pass forward through the supply chain. This demonstration showed that the system was scalable from very small facilities to very large facilities. The use of DNA fingerprinting systems for validation provided an absolute level of independent integrity. The level of implementation of EAN systems for pass forward/ track forward and DNA trace back systems can vary greatly. The systems can range from very complex to very simplistic. The chosen level of complexity is a management decision of the organisation to limit their exposure to risk. The more complex the system the higher the level of pass forward and the lower the cost for trace back. The more simplistic the system the lower the implementation and operating costs but the higher the cost for trace back. The project also resulted in the issue draft guidelines for Bar-coding in the meat industry.

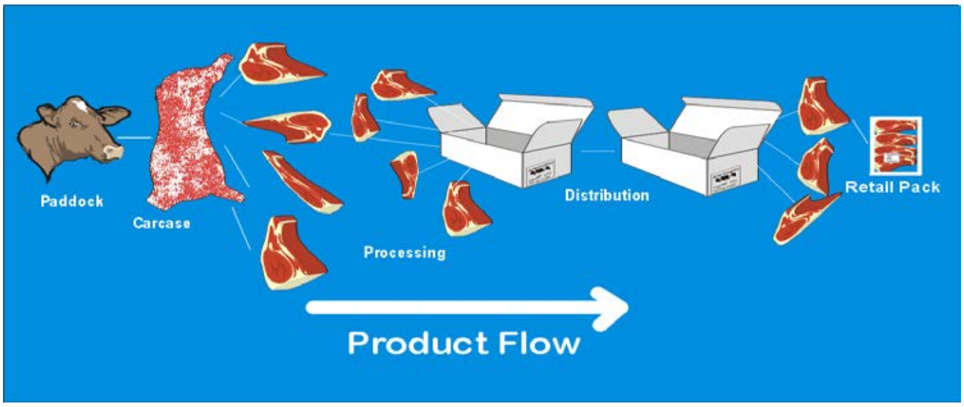


Figure 1– Graphical Representation of Product Flow

For a Food Safety Traceback system to be successful it must cover a broad scope of activities and can be made up of a number of segments that comprise the following:

- Birth ID, Property of Origin and veterinary/ feeding history records.
- Transport/ backgrounding/ feedlot ID and tracking records.
- Slaughter Floor linking of Live Animal ID/ history collection and linking to Carcass Body ID.
- Carcass body linking to Primal Cut by individual or batch.
- Primal Cut linking to Carton / Pallet by individual or batch.
- Carton cross linkage to Carcass Body by individual or batch.
- Value Add/ By Product (offal, etc) linkage to Carcass Body by individual or batch.
- Retail Packs (and Case Ready – Modified Atmosphere Packaging) linked to Carton linked to Carcass Body by individual or batch.

Each of these project segments must be able to operate independently as well as linking to each of the corresponding segments either in sequence or by passing intermediate segments.

The key points that need to be considered across the meat industry supply chain and for the implementation of a food safety traceability program include:

- The cost per kilo meat for implementation and maintenance of a traceability program.
- Practicality of implementation across different plants and operating methods.
- Compliance to the National ID Programs eg Current Meat and Livestock Australia project
- The reliability and accuracy of the program.
- The ability to audit the program.
- Verification of product identification and fraud detection.
- Robustness of the system to with stand external rigorous scrutiny.

1.2 Project Endorsement

The project involved many organisations, several of these organisations have stated their respective support for the adoption of EAN Numbering and Barcoding and the use of EDI through the meat industry supply chain.

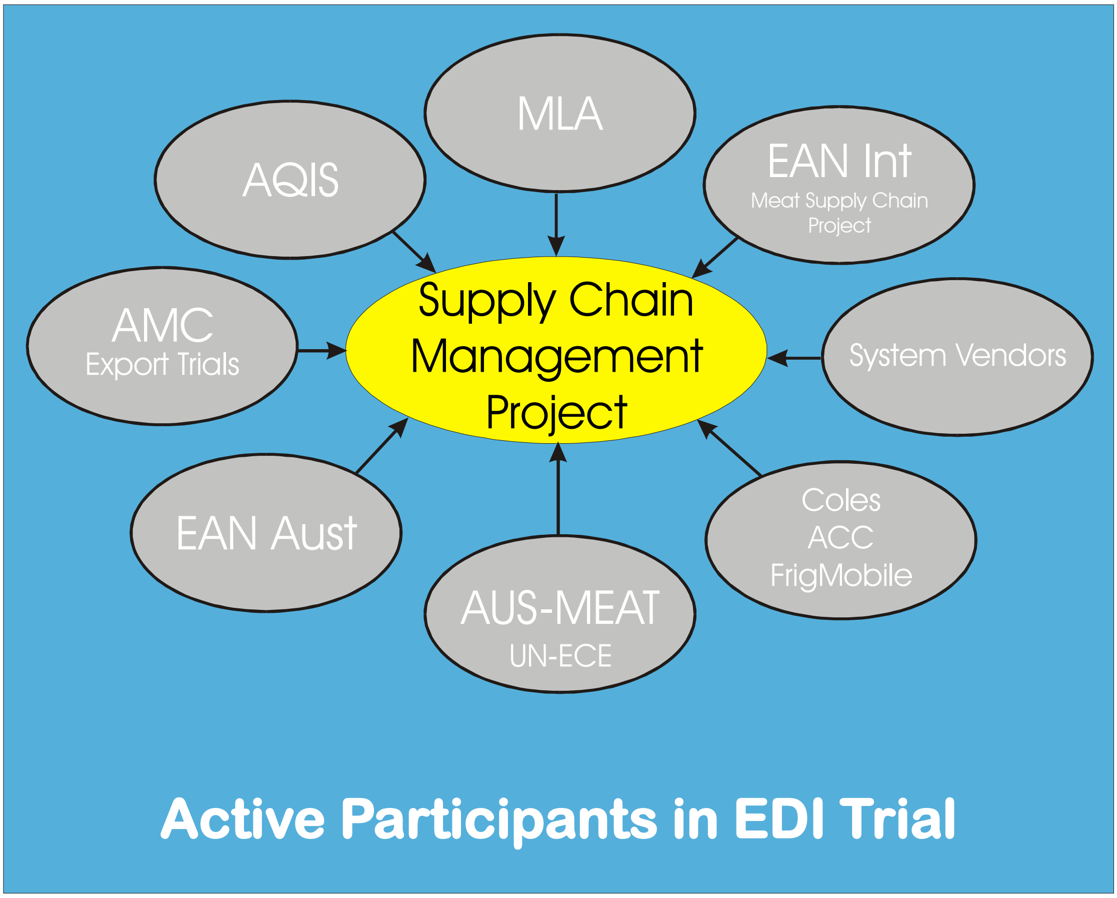


Figure 2– Active Participants in EDI Trial

The support can be seen from the level of interest, involvement and support that is occurring within the meat industry. Refer to the Appendix of this report for press releases, workshop contents and other supporting documents.

A number of letters of endorsement are held in the Appendix of this report.

1.3 Domestic EDI Project

The domestic EDI project included establishing EDI messaging through slaughter, boning, value add (retail ready) and then to retail distribution.

The project was demonstrated at the Australian Country Choice facilities at Cannon Hill, through Frigmobile at Hemmant to Coles Corporate network. The EDI messages for shipments are an EANCOM Dispatch Advice sent via email to Frigmobile. Refer to the Appendix for the details of the message.

1.3.1 Carton Primal Product

The basis of the information moved though EDI for the project, is carton product, either as primal cuts or as values added product.

All carton products produced in the boning room at Australian Country Choice have EAN compliant labeling and are stored in inventory before distribution. The carton picking is via the EAN barcode and the product is sent to Frigmobile or to the retail ready facility.

The system for carton product was addressed in the report for the first stage of this project.

The cartons necessary for retail ready product are picked and processed through the retail ready facility. The cartons are scanned into the retail ready facility to record the individual carton serial numbers. The date and time is recorded against each carton as used. This creates the traceability link into the Retail ready room.

1.3.2 Carton Retail Ready Product

The purpose of the retail ready and value added carton product food safety traceability portion of the project was to demonstrate the linkage through value add processes to the retail point of shelf stacking.

Source material for retail ready or other value added product is scanned into the retail ready room the date and time are recorded against the carton serial number. For sausage, beef stir-fry and diced beef the batch individual cartons go into a production batch. The number of individual retail packs or bulk packs (in the case of sausages) that are produced from a batch of source carton material vary greatly. As an example, there are 6250 sausages from a single 500 kg batch.

The individual retail ready packs and bulk sausages are packed into cartons. These cartons have an EAN complaint barcode added at the point of weighting.

Inventory is controlled and product picked by the use of the EAN barcoded carton labels. EDI messaging was used to send information from distribution to the cold store and then onto the retailer (eg Coles).

1.3.3 EDI Messaging

During the project Electronic Data Interchange was demonstrated through the retail ready system for cartons of value added products and retail ready products. Refer to the Appendix for examples of messages.

The electronic messaging for the domestic trial was developed through consultation with the System Vendors, the Cold Store (Frigmobile), the processing plant (Australian Country Choice), the retailer (Coles Supermarkets), EAN Australia and representation from industry.

The message frame was demonstrated using EANCOM Dispatch Advice message. This has been in operation since 1st of November 2000.

A number of messages are sent from retailer to the cold store for order consolidation. The Cold Store forwards consolidated order requirements electronically to the Processor. The Processor produces the required product and dispatches to the Cold Store. An electronic message of very carton is sent to the cold store. Refer to the Appendix for an example of the EANCOM Dispatch Advice Message.

The trial demonstrated that the use of EAN numbering, barcoding and EDI messaging could successfully be used to track carton product through the distribution system to retail. Product records were maintained independently at each point in the supply chain and could be independently audited at each point in the supply chain.

1.3.4 DNA Validation for Value Added Product

The trial demonstrated that the use of DNA finger printing systems for value added products, trim carton products and retail ready products could provide evidence of individual animals or composite groups of animals (eg sausage mix) matching to retail cuts and value added products.

Value added products such as sausages and beef patties are composite mixes of many animals. Beef stir-fry, diced beef and trim are small piece of individual animals. The project undertook to examine different sampling and pooling protocols, and subsequent DNA traceback analysis to determine the lowest cost methods for providing traceability.

Initially, a theoretical study was carried out to model the distribution of individual animal pieces within batches of each product. By simulation, different sampling and pooling strategies were assessed in terms of cost, feasibility and efficiency. The objective was to obtain a representative sample of each batch of value added product with the minimum number of DNA analyses. The best protocols were evaluated using commercial batches of product.

The optimum sampling system was trialed on batches of certain products and the cost effectiveness determined. Estimates were derived for the power to exclude individual sausages, patties and boxes of trim as being composed of designated groups of animals. The objective was to determine a restricted batch size for value added products in order to be able to routinely traceback and thereby eliminate potential source material will be assessed.

1.4 Export EDI Project

Consumers, domestically and internationally, require meat producers and processors to be able to provide evidence of product traceability, whether it is for recall purposes or to be able to guarantee particular product claims. The EAN-UCC system, bar coding and scanning combined with electronic transmission of data enable business enterprises and governments to link the physical movement of goods to the movement of electronic data related to those goods. Consequently, trace forward and trace back of product becomes more efficient while the exchange of commercial information along the supply chain achieves productivity gains by reducing or eliminating the manual processing of paper documents and manual recording of product movement.

The export trial part of the project aimed to demonstrate to the Food Safety and Inspection Service (FSIS) and to other stakeholders how the use of bar coding and electronic data interchange can improve the current system of product certification and trace back and trace forward by:

1. improving individual carton and batch or lot identification
2. improving the linkage between product and its documentation
3. improving product recall
4. providing a more efficient inspection and certification process.

As a first step in this process, a container load of Australian manufacturing beef was shipped to the United States and was identified using the EAN-UCC system of numbering and bar coding. The shipment served as a pilot study to enable a formal proposal to be put to the FSIS to modify import inspection systems to incorporate the benefits offered by barcode technology and electronic data interchange.

1.4.1 Pilot Description

A container load of manufacturing beef was shipped to the United States with an EAN- Australian standard barcode applied to each carton of meat. The movement of the cartons of meat comprising the load, as well as accompanying documentation, including electronic information, was traced along the supply chain, from Australian packer to American processor. The Australian Quarantine and Inspection Service (AQIS) provided health certification in the usual manner, using the export documentation (EXDOC) system.

1.4.2 Methodology

A defined methodology was used for the export trial program. Refer to the Appendix of this report for details of the export trial.

1.4.2.1 Product shipment

AMH at Dinmor was the selected Australian meat exporter/packer to assist with the pilot. The meat exporter/packer has an established supply chain to an American processor and operated out of the port of Philadelphia.

One consignment of manufacturing beef was packed, with each carton in the consignment bar coded using the EAN-UCC numbering system as well as the traditional shipping mark and other labeling requirements.

The barcode uniquely identified each carton. The production records that are held in the exporter/packer's management system concerning production details, (batching details and producer information etc) was linked to each bar coded carton and thereby allowed for improved trace back or trace forward protocols for product. These production records contained batching information that linked to livestock identification and property of origin.

The load-out establishment scanned carton codes and an electronic record of the load details was created at the time of load out.

Once the container had been packed in its entirety, a Serial Shipping Container Code (SSCC) for the consignment (or lot) was created and a separate barcode made. The SSCC is a unique number containing company identification. That barcode was attached inside of the door of the container. An additional copy of the SSCC bar code was supplied to identify any skip lot samples that may have been removed for testing. The SSCC was given a unique identifier for the consignment and the EAN-UCC barcode gave a unique identifier to each component of that consignment. The cartons were still stenciled with a shipping mark so that the current system was maintained for verification purposes.

The existing AQIS approval process was followed and certification was provided using EXDOC generated certificates, including the health certificates to allow matching of data sets.

1.4.2.2 Bar code information transfer

The load out establishment (AMH) holds electronic records of the details of all barcoded cartons making up the consignment which was identified by its SSCC.

The SSCC(s) was forwarded with the Request for Permit (RFP) and was recorded on the Australian Government Health Certificate.

The load out establishment then forwarded this information electronically to the US customs broker that was nominated by the meat importer.

1.4.2.3 Import Inspection and Clearance

Existing paper documentation was lodged with the I-house using existing channels. The health certificate carried the SSCC number as well as the shipping mark.

Customs brokers then sent the load verification information electronically to the importing-warehouse so that the electronic information could be matched with the consignment as well as with the traditional documentation. This information was downloaded to a portable bar code scanner for the demonstration to FSIS personnel.

The container load could be verified against the health certificate electronically and visually by:

- verifying the contents of the container by checking the SSCC number and the container seal number on the health certificate;
- verifying the identity of the container (consignment) against the electronic information contained in the SSCC bar code;
- verifying the contents of the container (ie the cartons), which can be identified by their unique EAN-UCC bar code, being those cross referenced with the SSCC;
- verifying the total load by scanning all cartons; and
- verifying the SSCC number against individual cartons using a print out.

1.4.2.4 Stakeholders

Interested stakeholders that attended and viewed the pilot, included the following:

- Food Safety and Inspection Service (FSIS)
- Meat Importers Council of America (MICA)
- Meat and Livestock Australia (MLA)
- Warehouse Association
- Nominated end user in USA
- Australian Quarantine and Inspection Service

1.4.3 Evaluation Process

The trial shipment was designed to evaluate;

- Hardware and software and EDI systems were adequate and reliable
- EAN –UCC barcodes uniquely identify shipments and products
- The link between product and documentation was improved
- Recognition that the use of bar codes could form the basis of improved product inspection and recall systems.
- Practical issues that related to these systems being able to be integrated into the present import inspection and documentation procedures.

The first trial shipment was not intended to be a demonstration of a final proposal for changes to product identification and inspection systems. The trial was designed to test and demonstrate the use of EAN barcodes and Electronic Data Interchange [EDI] systems. It is proposed that a trial be ongoing subject to evaluation of the results of the first shipment.

2. Objectives/ Out Comes

The project had three primary objectives/outcomes to be achieved. In summary these were:

- Successful demonstration and 3 month trial for EAN numbering, barcoding and EDI for domestic value added products though the supply chain
- Successful demonstration trial for EAN numbering, barcoding and EDI for export carton product though the supply chain
- Successful demonstration and commercial trial of DNA finger printing methods for traceability validation for trace back of product coded using the EAN numbering, barcoding and EDI for domestic value added products though the supply chain.

The three primary objectives and outcomes were successfully achieved for the project.

The domestic demonstration projects were undertaken by Australian Country Choice with assistance from Meat and Livestock Australia and support from Coles Supermarkets.

AMH Dinmore undertook the export demonstration project with assistance from Meat and Livestock Australia and support from AMC, AQIS, USDA, FSIS and other related organisations.

The project included defining and demonstrating a supply chain management program (EAN numbering, barcoding and EDI) that provided a Food Safety Traceback System that addresses the above requirements. This was conducted within a framework that was commercially viable and through the use of DNA finger printing to provide an absolute level of independent integrity.

The project outcomes have been recorded in this report, the attached supporting documents and three short videos.

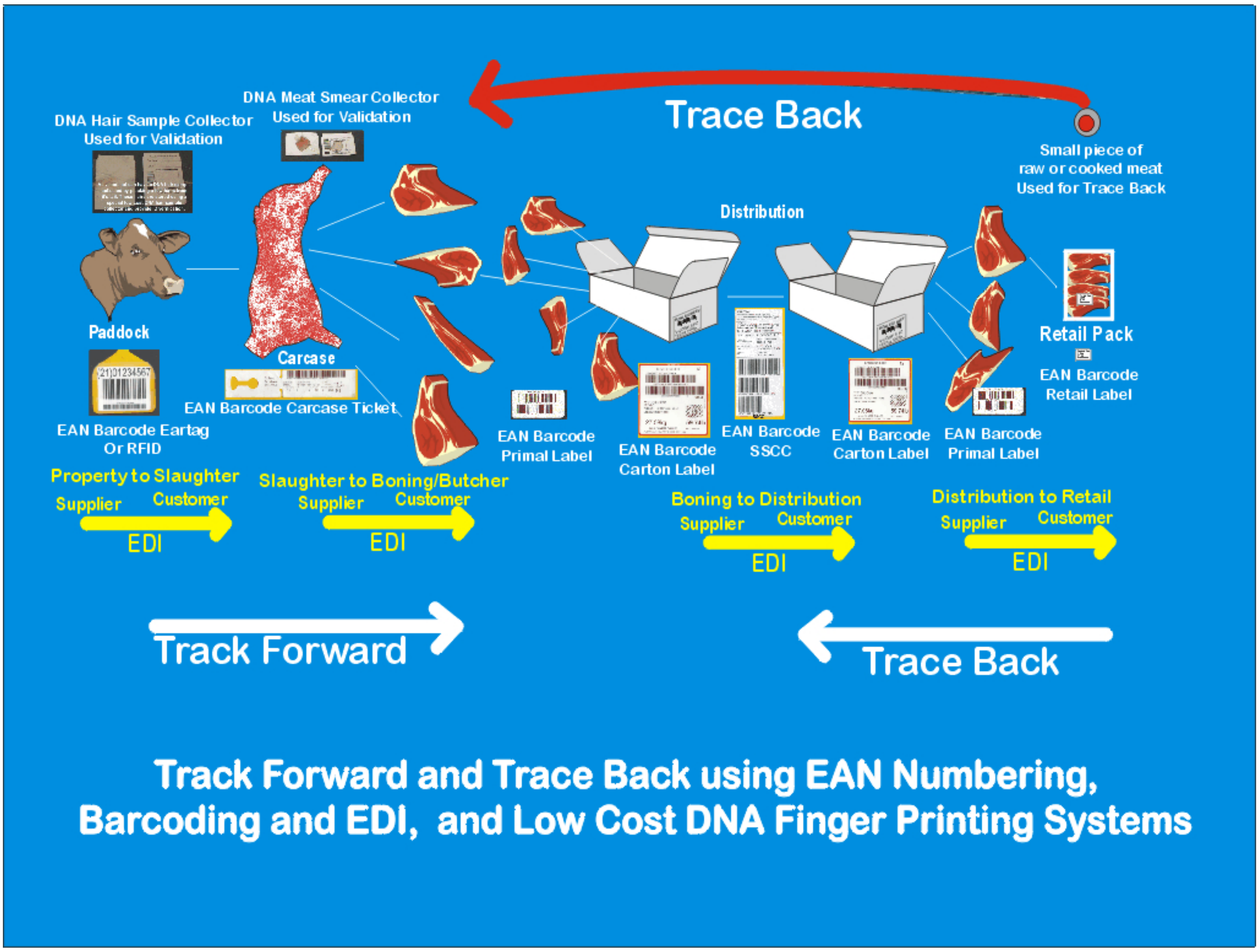


Figure 3– EAN and EDI Process Flow for Meat Industry

The results of the project showed that a food safety traceability system based on EAN Numbering and Bar–coding, and DNA fingerprinting could be readily implemented into any processing organisation. The system is totally scaleable from simplistic to complex. The use of EAN numbering and bar-coding provided tools to facilitate easy linkage between live cattle and primal cuts and forms the basis of tracking through the supply chain. The decision on the level of complexity is a management choice based on the level of risk the organisation is prepared to carry. This equates to a management decision on “spend now and save later” or “save now and spend later” depending on the amount of pass forward infrastructure and if a DNA trace back is required.

The demonstration project included a number of aspects as follows:

- EAN numbering and bar-coding for Ear Tags for Live Cattle ID at Slaughter
- DNA hair sample collection and archiving for validation of live cattle ID
- EAN numbering and barcodes for Carcase tickets (carcase ID)
- DNA meat smear sample collection and storage for carcase ID validation
- Barcode scanning and sequence recording of carcases into the boning room
- EAN numbering and bar-coding for primal cuts (unique serial numbers)
- EAN numbering and bar-coding for carton product (unique serial numbers)
- EDI (Electronic Data Interchange) transmission of shipment details and generation of SSCC for shipments Processing to Cold Storage.

- DNA finger printing validation of retail product to source carcase and live animal ID.

The supply chain management needs to address the live animal on a property through to the retail cut. The stage 1 project only covered the processing sector and labeling forward to retail. Stage 2 and stage 3 of the project covers the use of EDI and EAN numbering from live animal through to retail. I.e. Stage 2 is Supply Chain Management – Carton to Customer and Stage 3 is Supply Chain Management – Live Animal to Slaughter. The project is intended to quantify and demonstrate the saving to industry that can be achieved through the use of EAN numbering, bar-coding (RFID for Live animals) and EDI.

As a result of the project a number of sub-projects were identified as necessary for stage 2 and stage 3, these included the following:

Stage - 2
- EDI research and development of a model for best practice for perishable products – Carton to Retail
- Investigation and documentation of current methods for data pass forward for current industry position from Processing to Retail including working with industry bodies
- Development and implementation of a demonstration plan for EDI for processors, transportation, cold storage, and distribution to retail and export distribution.

Stage – 2a
- DNA Traceback for value added system model determination and trial design.
- Sampling methodology trial and evaluation for optimization
- Preparation of a video and report on DNA food safety Traceback for Value Added products.

Stage - 3
- EDI research for best practice for live animal and development of EDI model for Meat Industry Property to Slaughter while working with industry representatives.
- Implementation of a demonstration system for EDI for property, transportation, back grounding, feedlot and slaughter and operation of a trial for a 3 month period for testing and recording results.
- Preparation of a video and report on EDI from property to slaughter and processing to retail (including export trial) project out come.

The benefit to industry is multifold. The efficiencies that can be realized by the adoption of the EAN•UCC system have been demonstrated across many industries and is well documented. Refer to the Appendix for support documents in this area. The EAN•UCC system also creates the basis for food safety traceability on a global basis.

This project undertook a research/demonstration project with Australian Country Choice and industry representative organisations. The project includes defining and demonstrating supply chain management by use of EAN numbering, bar-coding (and RFID for live animals – As per NLIS) and EDI that addresses the above requirements in a framework that is commercially viable and provides an absolute level of independent integrity. This includes a trial for export product being shipped to the US.

The demonstration project had the following objective and/ or out comes:

- Development and demonstration of a cost effective supply chain management system, from the carton product through all stages of distribution including domestic and export shipments.
- Development and demonstration of a cost effective supply chain management system, from the property of origin to the location of slaughter.
- Development and demonstration of a cost effective DNA Food Safety Traceback methodology for Value Added Products.

3. Supply Chain Analysis for EDI

3.1 Historic Product Codification, Barcoding and EDI

During the 1980s and early 1990s processors started to implement barcoding for slaughter tickets and carton labels. These systems were mostly proprietary and to a large extent were only usable within the facility.

The various system vendors during this period developed their own barcoding standards. This approach proliferated the use of proprietary systems of codification and barcoding.

During this time standards were emerging for the use of barcoding and electronic messaging on a global scale. The Retail and many other industries took up these standards.

Product coding systems within the meat industry have always been company based and to a small degree some coding system have been based on the AUS-MEAT product codes.

Much of the development of the standards occurred from the retail end of the supply chain. Over the last few years there has been a concerted effort by the retail industry to push the barcoding standards back up the supply chain. There are very good commercial reasons for the adoption of such a multi-industry supply chain approach.

All grocery product line manufacturers have already adopted EAN standards for barcoding and EDI, likewise the small goods manufacturers and the diary manufacturers have also adopted the standards to a great extent. It seems that the meat industry, along with fresh produce have been the last to adopt the EAN standards.

Recently regulators have started demanding traceability and identification systems. The use of the suitable global based standards for codification, barcoding and EDI have formed the basis of many of these regulator requirements. This was evidenced by the French government appointing the French EAN organisation to administer the development of their new national livestock identification system. The USDA has sponsored a forum on the use of XML standards in the US meat industry.

The first stage of this project that was completed in October 1999 identified the use of the EAN codification and barcoding as the only globally adopted commercial standard.

The difficulty that faces the meat industry is one of adoption of the EAN•UCC system within the operational issues that the meat industry creates.

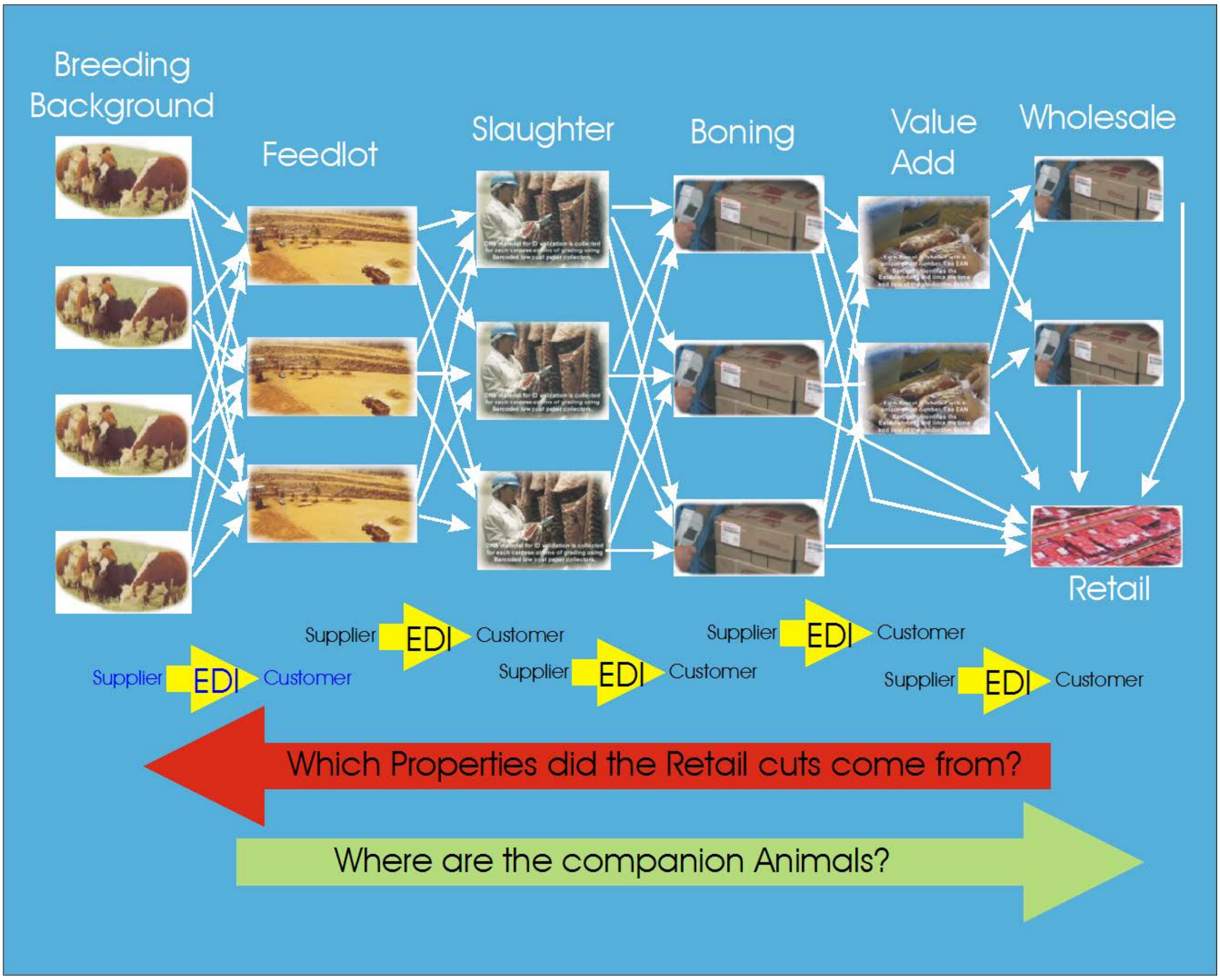


Figure 4– Track Forward and Trace Back Problem

The meat industry is a complex environment in which to operate. There are many players within the supply chain and often that are geographically isolated. The above diagram shows the complexity of the problem to be solved and the interrelationships that involve the need to EDI.

3.2 Best practice models for EDI

The project undertook to conduct a detailed analysis of the world best practice for EDI (Electronic Data Interchange) and the use of EAN barcoding within EDI. The scope covered the use of standards based EDI, no proprietary methods or systems were considered.

The analysis identified that the Supply Chain Management has become a strategic initiative for companies who are committed to strengthening their business. With the rapid growth of Electronic Commerce, the use of the EAN•UCC codification and barcoding, and EDI systems are fast becoming an essential component of business regardless of a company's size, turnover, industry sector or level in the supply chain.

The EAN•UCC system offers the foundation for improved Supply Chain Management practices by providing international standards for **item identification, data capture and electronic messaging.**

Through the automation of business processes, the EAN•UCC system enables the fast, efficient and accurate flow of information between trading partners, which is fundamental to the success of any business.

Numbers are used to identify many things. Many organisations have developed their own in-house numbering systems but the problem is they don't make any sense to anybody outside the company. Others have identified numbering systems which are common to their industry but that is limited to those who operate within it. Today's trading environment demands a universal numbering system that is understood by everyone. The EAN•UCC system is the only truly international system, which provides a global language for trade.

With the advent of electronic communication, and particularly EDI, the need for the identification of parties and locations has become more acute. The use of numeric identification instead of full alphanumeric names and addresses is the key for implementation of an EDI project.

An EAN location and electronic commerce number is an EAN 13 number which you allocate out of your pool of numbers in the same way you allocate other EAN 13 numbers.

This number is quite simply used to identify either legal entities such as registered companies, functional entities such as a specific department within a legal entity or physical entities such as the door of a warehouse or a particular room in a building. Being that these are EAN numbers, they are also unique world wide.

Companies that are not members of EAN Australia can still use EAN location and electronic commerce numbers.

EAN•UCC numbering, barcoding and scanning, combined with EDI, enable organisations to link the physical movement of goods to the movement of electronic data related to those goods. EDI then becomes a true facilitator of business-to-business electronic commerce. When the whole supply chain is linked - from raw material supplier to manufacturer, distributor, transport agent, retailer and financial institution - electronic commerce illustrates true supply chain management.

EANCOM is a set of international EDI messaging guidelines specifically developed to support supply chain management. Developed as a subset of the UN-EDIFACT messaging standard, EANCOM provides succinct implementation guidelines for the trade and distribution sectors. It emphasizes the use of item and location numbering, barcoding and automatic data capture to link the physical movement of goods to the electronic data related to those goods.

EANCOM, administered globally by EAN International, has been adopted in many of the 90 countries using the EAN system.

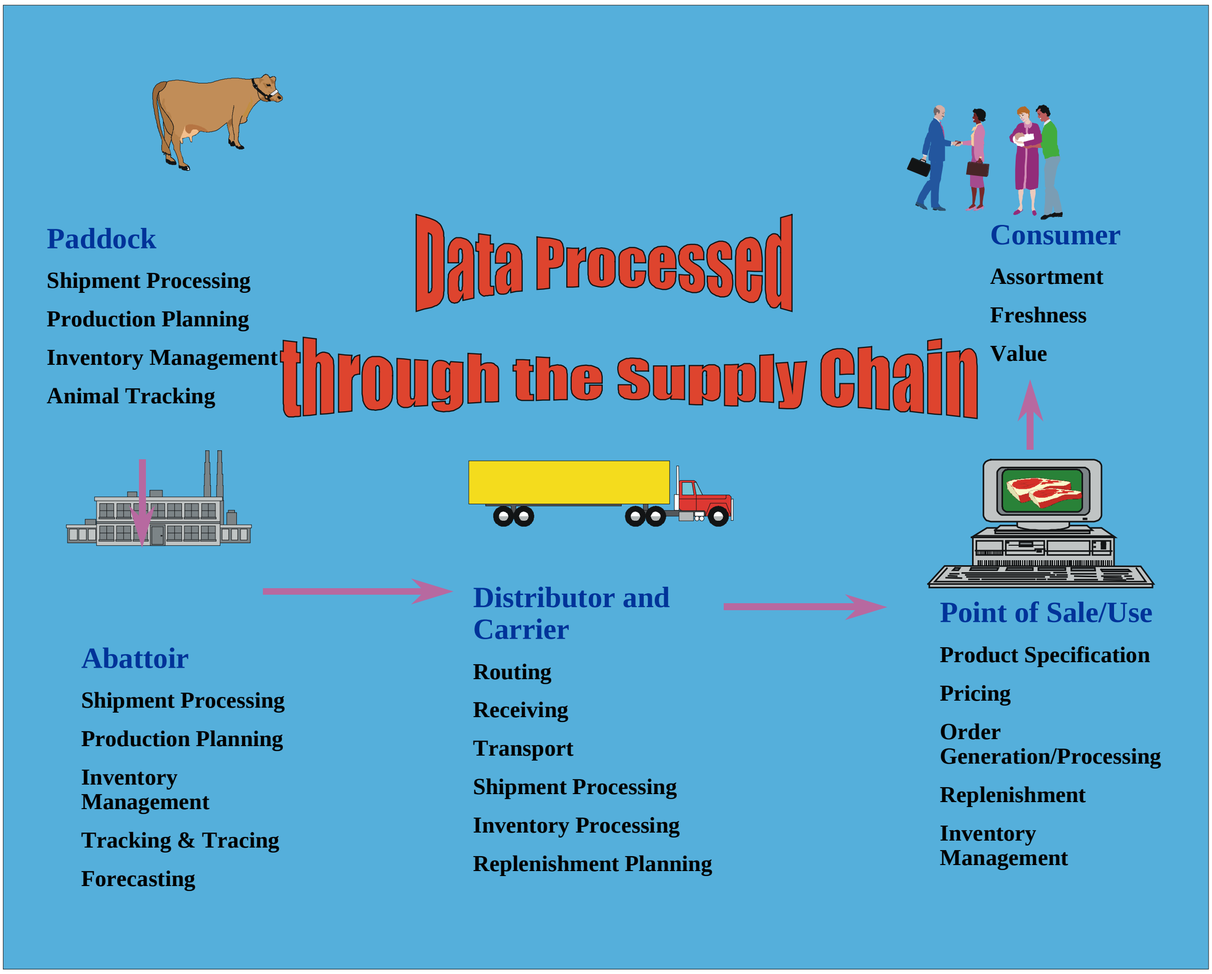


Figure 5– Simplified View of the Information Flow for Meat Industry

The information that needs to be supplied through the meat industry in a best model approach is shown above. The information needs change through the different links of the supply chain. It was identified during the analysis that the information required by one party, was not the same as that required by another party.

The analysis showed three clearly defined elements of the supply chain model. These elements related to the following areas:

- Information that was required to be passed through the supply chain.
- The models for codification and barcoding of product through the supply chain
- The models for distribution through the supply chain.

Once the EAN•UCC system for codification/ numbering/barcoding is adopted for all levels of traded units then the efficiency of Electronic Commence can start to be considered. The fact that each traded unit (carton, carcase, etc) of meat is to be treated uniquely (by carton number, carcase number, etc) then a system of electronically passing the information about each of these unique traded units need to be implemented. The EAN•UCC system has a means to codify this information and pass it electronically through the meat supply chain. The method used for this electronic transfer of information is called EDI

(Electronic Data Interchange) based on the EAN•UCC guidelines called EANCOM[1]. EANCOM has a suite of commercial messages suitable for the meat industry, which could be exchanged electronically. These include the Despatch Advice message for advance shipping notification.

The vital key used in EANCOM Despatch Advice for identification of each transport unit (eg traded unit) is the SSCC (Serial Shipping Container Code), which is a number made up of the company's unique EAN/UCC company prefix and a unique serial number for the transportable unit.. The company applying the label/ identity generates this 18-digit SSCC number for each traded unit (carton, carcase, pallet, shipment, etc), where it is also treated as a unique transportable unit.

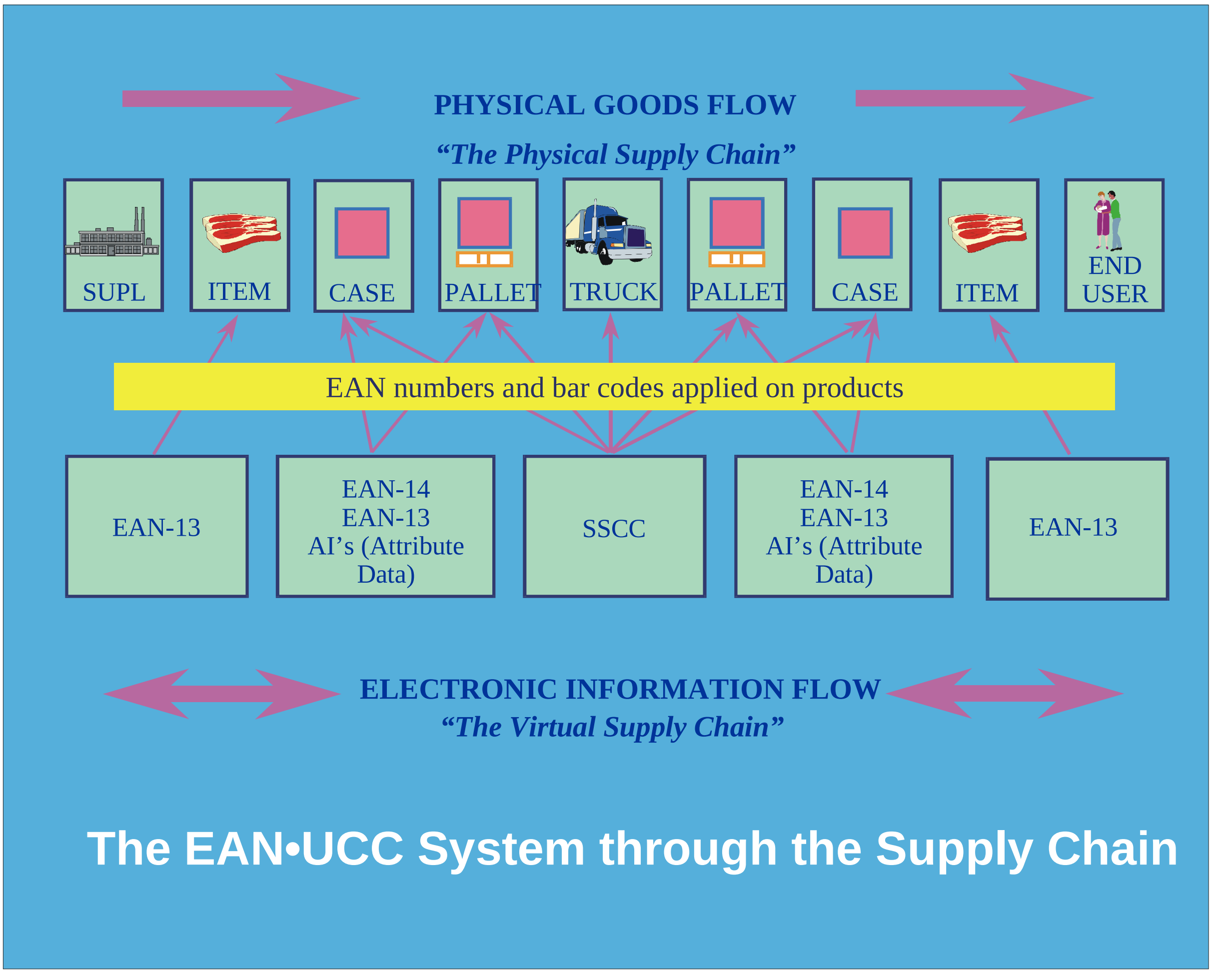


Figure 6– EAN and EDI System through the Supply Chain

The above diagram shows the three elements in a simple view. The element of codification relates to the numbers chosen for the items at the various stages of the supply chain. The means to machine read these item codes is the use of EAN barcodes. The appropriate information to be sent through the supply chain exists at the "Virtual Supply Chain" or electronic commerce level.

Each of the pieces of information may be sent in different messages. The simple example of the information contained in a purchase order relates but is different to the information that is contained in a dispatch advise.

The information contained in messages for product related to a domestic supply chain is different from the information contained in messages for an export supply chain.

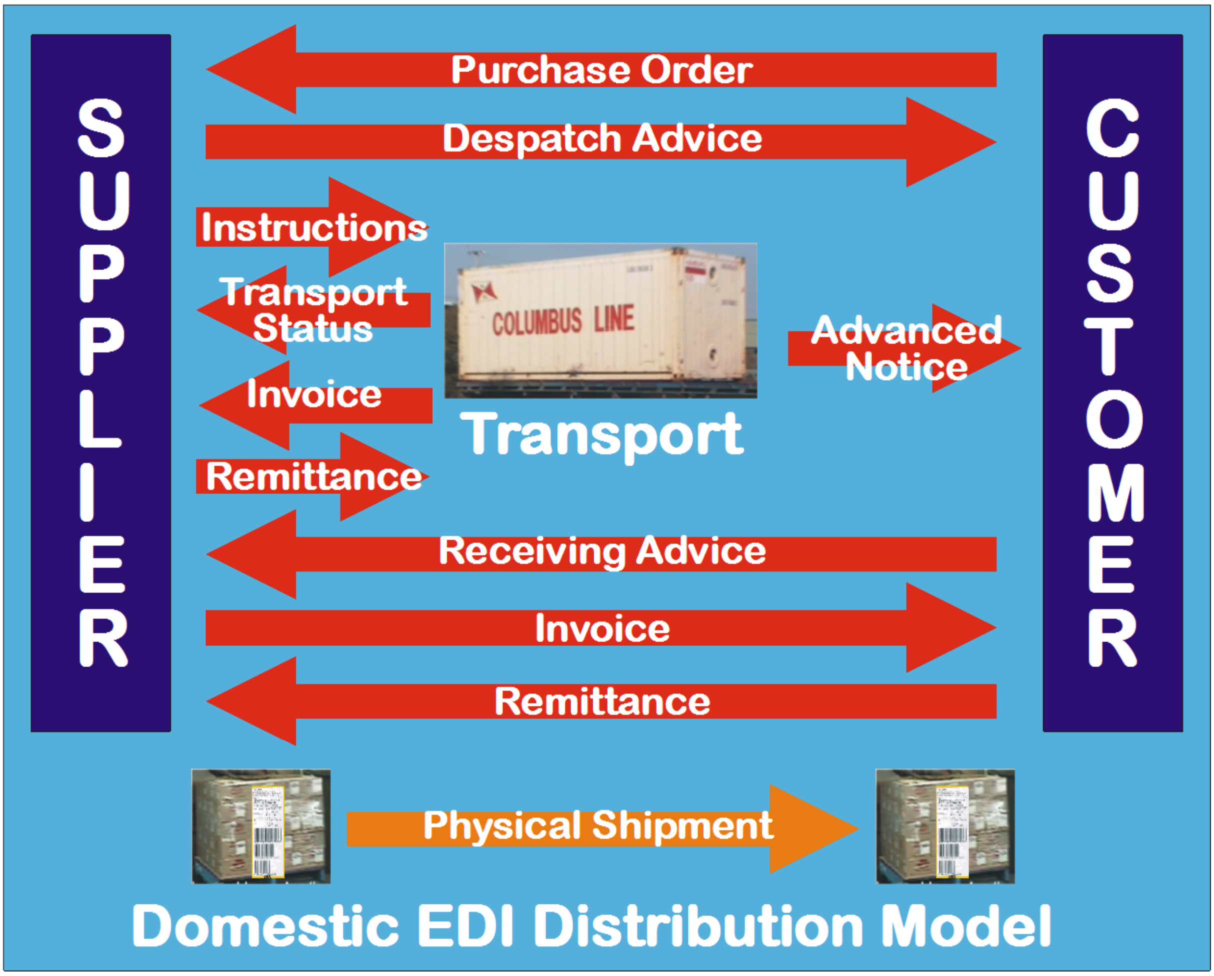


Figure 7– Best Practice Domestic EDI Distribution Model

The above diagram shows the best practice model for the domestic EDI information messages through the distribution system. This model can be a typical representation of the distribution that exists for the domestic meat industry. The meat industry has a high reliance on transport/ cold store facilities. Product must be effectively transported, cold stored and then picked/ delivered to fulfill orders. The requirements for traceability impact greatly through the cold distribution process.

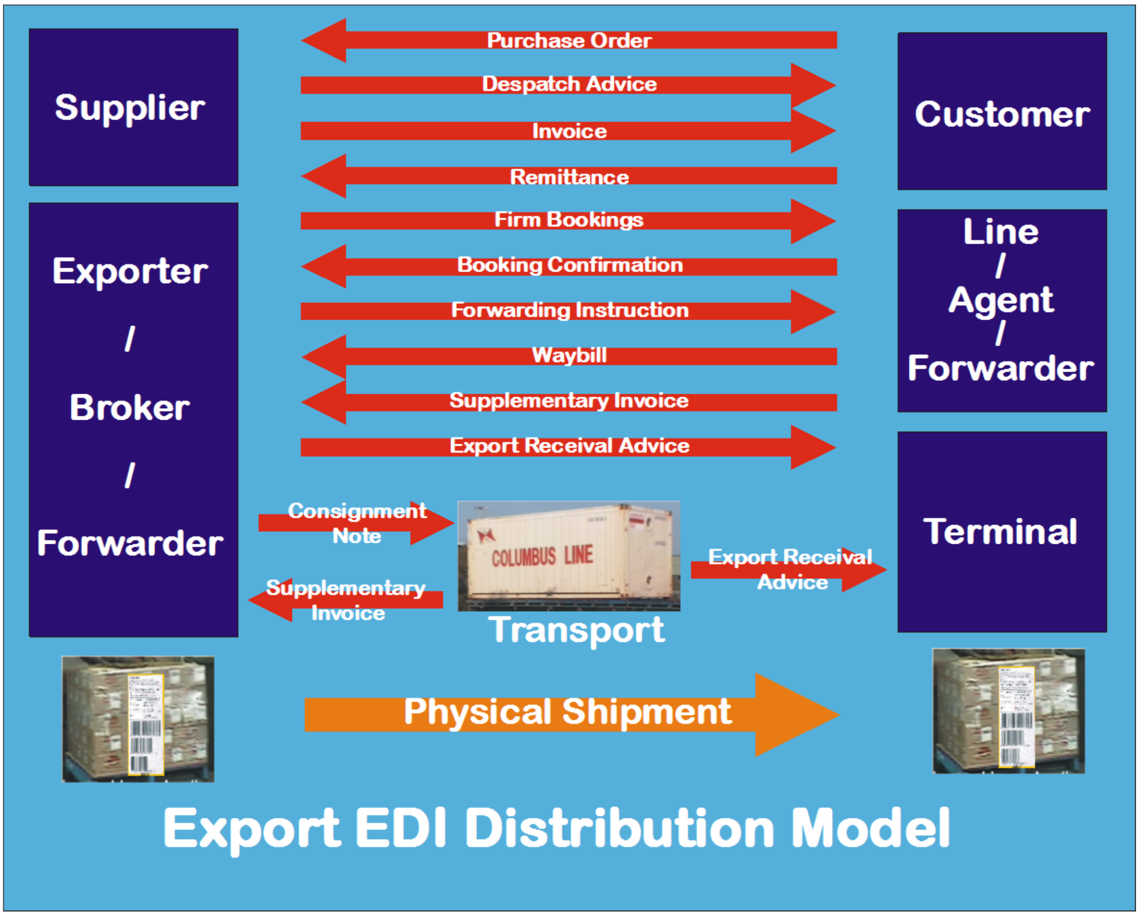


Figure 8– Best Practice Domestic EDI Distribution Applied to Meat Industry

The above diagram shows the best practice model for the export EDI information messages through the distribution system. This model can be a typical representation of the distribution that exists for the export meat industry. This model builds on the basis of the domestic model in the purchase order, despatch advice and invoice activities, but the complexity of export distribution adds additional information and messages to the process flow. The requirements for traceability impact greatly through the cold distribution process.

In reality the EDI through the distribution process is a combination of both the domestic and export models. The process may also be iterative as the product can go into and out of cold store and transport a number of times before reaching a final customer.

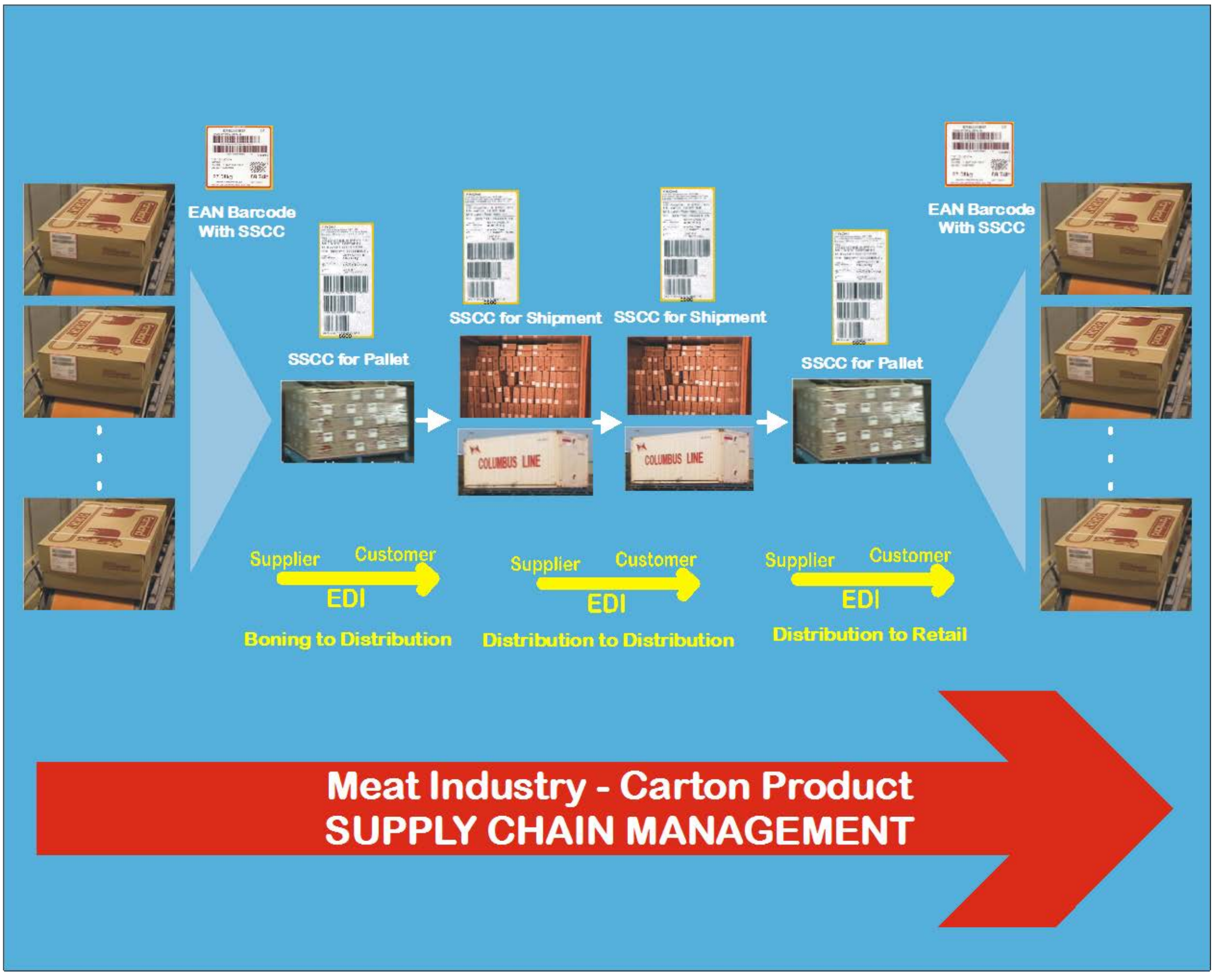


Figure 9– Best Practice Domestic EDI through the Meat Supply Chain

The above diagram shows a three step process for EDI through the meat industry supply chain. The three players involved are a Boning Room, Cold Store and Retailer.

Each of the players codifies the product and layers of product (carton, pallet, shipment) and sends a despatch advice message containing the serial numbers of each carton (or SSCC) or layer. The information contained in messages will differ as cartons are mixed to fill specific requirements.

The power of the EAN•UCC is the ability to track forward and trace back through the whole supply chain by the use of the distributed information management method. Each link of the supply chain codifies and maintains records of the source entities that go into a process (e.g. slaughter, boning, value add, transport and cold store) and the out bound product shipments. As an EDI message is sent between the supplier and customer a link can still be maintained even if one link losses it's records. Ie there is always 2 copies of the EDI message; one with the sender (supplier) and one with the receiver (customer).

3.3 Domestic Supply Chain and EDI

For the domestic meat supply chain the following diagram shows the typical process of the model for the generation of EDI messages and the activities in the supply process. The activities involved in the process can be summarized as follows:

- Scan various cartons to make a pallet (each carton has a unique Serial number or SSCC
- Create an SSCC for the pallet.
- Scan a number of pallets to create an SSCC for the shipment
- Send the Despatch Advice to the customer via EDI
- The customer scans the shipment SSCC to match to the EDI
- The customer inventory can automatically be incremented by the cartons listed in the EDI, thus saving the cost of scanning every carton.
- The supplier can send a receiving advice message via EDI to the customer stating that the goods have been received.

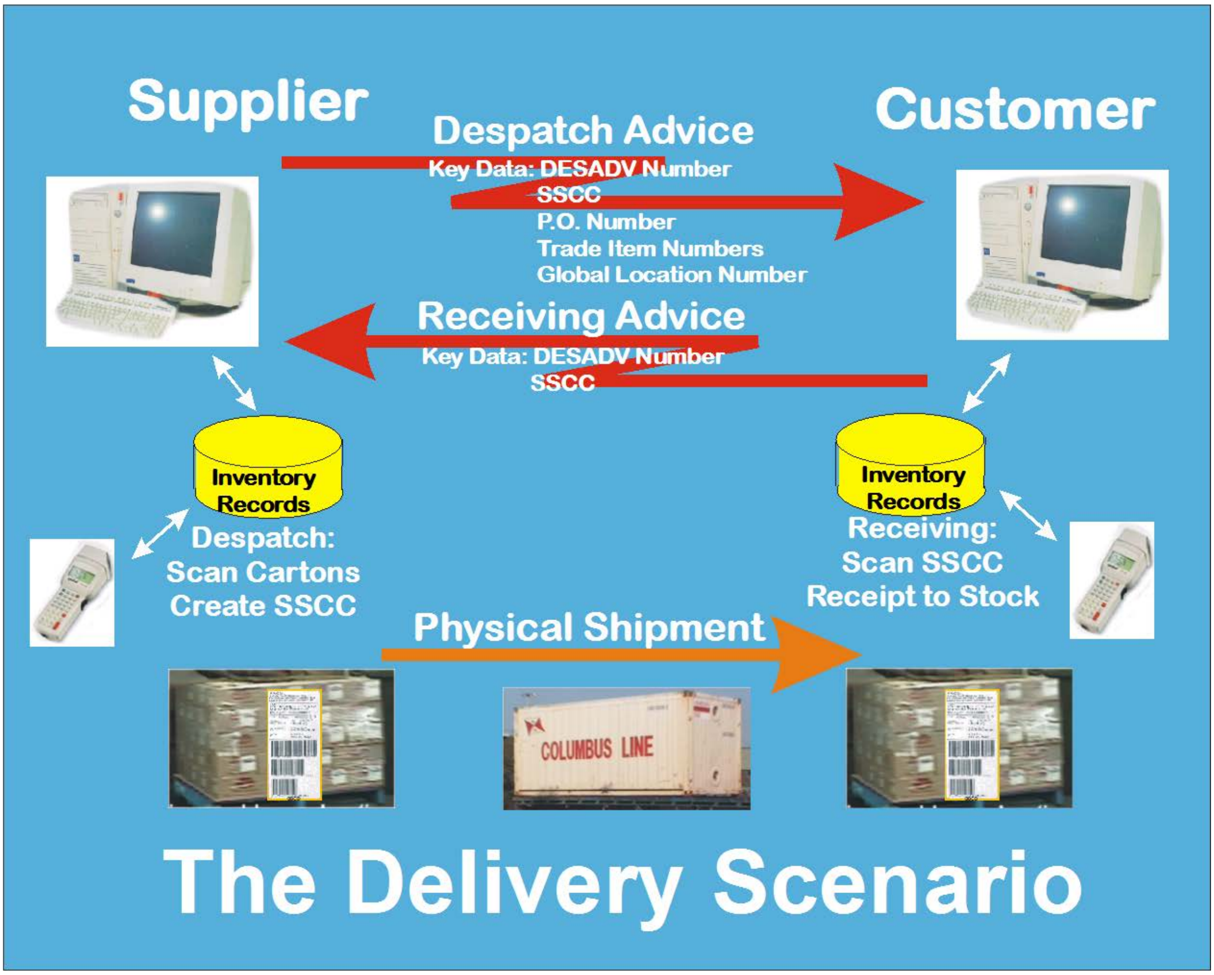


Figure 10– Delivery Scenario for EDI Distribution Model

3.4 Export Supply Chain and EDI

The process for the Export Meat Industry Supply Chain for EDI is more complex than the domestic supply chain. The EXDOC process of the creation of the Health Certificate and the subsequent inspection process in the country of receipt create a much more complex information set and EDI messages. The diagram below shows the process for EDI for an export shipment to the US.

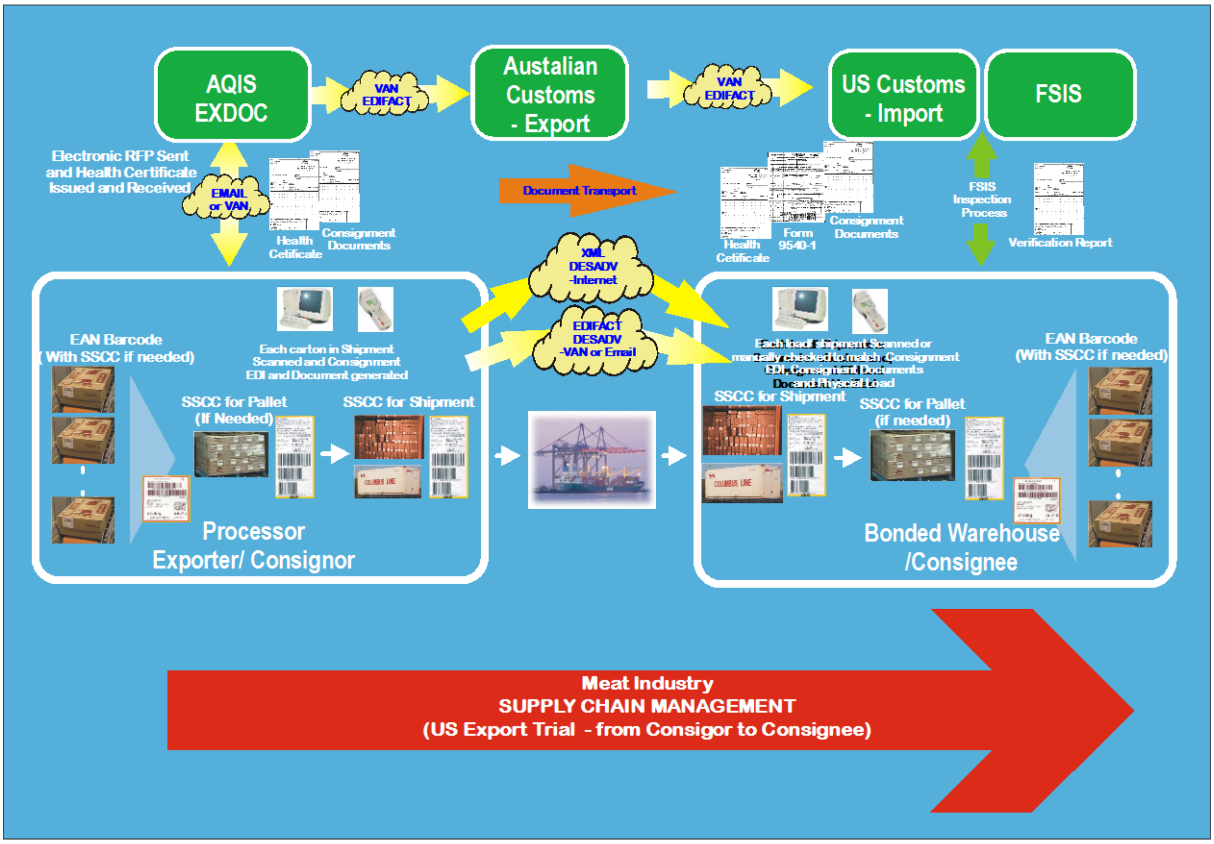


Figure 11– Best Practice Export EDI through the Meat Industry

The process is similar to the process for the domestic EDI messages for Despatch Advice in that cartons are scanned to create a shipment SSCC. For export the Shipment SSCC is linked to the Health Certificate and thus each carton serial number is linked to the Health Certificate.

The EXDOC process and Customer Export processes are linked to the SSCC and Health Certificate.

On receiving the shipment in the destination country the SSCC is checked to match to the health certificate and the EDI despatch advice message containing each carton serial number is able to be checked to verify each and every carton in the shipment. As a copy of the Despatch Advice Message is held by both the exported and the receiving cold store, the message can be audited and fraud easily detected.

The ability that this model delivers in terms of global product track forward and trace back is world best practice. The codification is based on a global standard so the serial numbering process creates a globally unique number. Carton recall can therefore be implemented on a global basis not just on a domestic level.

3.5 New Standards and Applications

The development of global standards for supply chain management is on going. As new technologies provide more cost effective and efficient system then standards evolve to utilise this technology.

The EAN•UCC organization with its 96 member countries and its 1,000,000-member base acts the development coordinator for EDI and EAN standards. The direction for develop of new standards comes from the needs of the various countries and industries.

The different message types that were utilized for the trial, were as follows:

- EANCOM - DESADV via VAN
  - VANs in use by large Meat companies, not by small Meat companies
  - (Used for Export EXDOC and customs process out of Australia
- EANCOM - DESADV via Email
  - EANCOM Message Zipped and Encrypted
  - (Chosen Method in use for trials)
- XML - Despatch Advice
  - Text based data moved through the Internet.

The type of information that an EANCOM Despatch Advice Message and an XML message contains can be broken down into three broad categories, as follows:

- Shipping header level information,
- Product information,
- Process information.

The use of EANCOM Message (EDIFACT Standards) was considered for the following reasons:

- Existing messaging format, well defined standards, including security
- Extensive use throughout many industries
- Language, System and Platform independent messaging
- Many vendors of EDIFACT Messaging software

The use of XML Messages was considered for the following reasons:

- XML is a method for putting structured data in a text file
- Low cost method for moving data across the Internet in a secure manner
- XML is text, but isn't meant to be read
- XML is license-free, platform-independent and well-supported
- XML is new, but not that new - Global Trade Standards are emerging for XML

The future direction of electronic messaging is certainly in the direction of XML. The cost benefit and the easily of implementation make XML based messaging the choice for the future.

3.5.1 Brief Description of the XML Standards

The term XML relates to the method to move data in a internet ready mode. The structure of the messages must still be based on standards. I.e. XML is a method to move data and the DESADV Message standard is the method to understand the data.

One of the strengths of XML is that, unlike traditional Electronic Data Interchange (EDI) languages such as EDIFACT, XML does not need the development of company-specific applications to make the application data in a message understandable. The same data in XML can be presented to either a Web browser or internal application without any additional manipulation or special computer program.

Another strength is its flexibility in using human-readable tags to identify pieces of data. For example, XML will not just specify that a number is a number, it describes that number as an invoice, date, postcode, order or price.

While XML deals with the exchange of data from one application to a browser for human interpretation, its weakness appears in the exchange of data from one application to another. While possible, it must be conducted using the same XML ‘dialect’ for both applications to understand the data.

EAN•UCC is now playing a leading role in the refinement of XML for its global member community, with its primary focus on standardising XML dialects. EAN International does not expect XML to replace traditional EDI languages such as UN/EDIFACT; in fact the implementation of EDIFACT is expected to grow for the next five to 10 years and will be used as a complementing standard to XML during that time.

The EAN•UCC pilot project is one of many development projects on XML being conducted by standards organisations and companies worldwide. It is based on the ebXML (e-business XML) initiative – a global collaboration between the United Nations Centre for Facilitation of Trade and Electronic Business (UN/CEFACT) and the Organisation for Advancement of Structured Information Standards (OASIS).

The initiative aims to serve the objectives of the Global Commerce Initiative (GCI), one of which is the development of a Global Commerce Internet Protocol. Support for the ebXML initiative has been declared by major international electronic business messaging bodies, including EAN Australia, Standards Australia and Tradegate ECA.

Refer to the Appendix for more details on the XML principles and standards.

The diagram below shows an example of one of the method that XML can be used for company to company messaging.

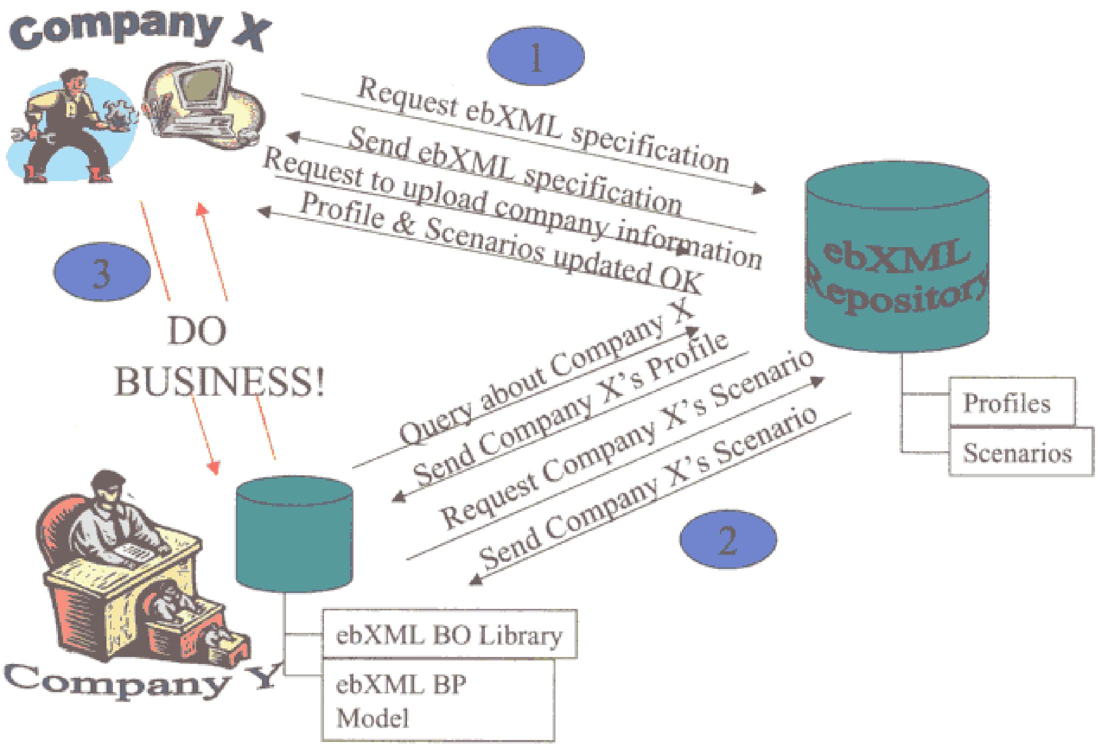


Figure 12– Example XML Model

3.6 How Regulatory Systems Compliment Commercial EDI

Regulatory Systems such as the NLIS and EXDOC that require specific information to be sent to the Regulatory Systems and authorized information returned to the initiator, work in harmony with the EAN•UCC EDI standard for commence and trade.

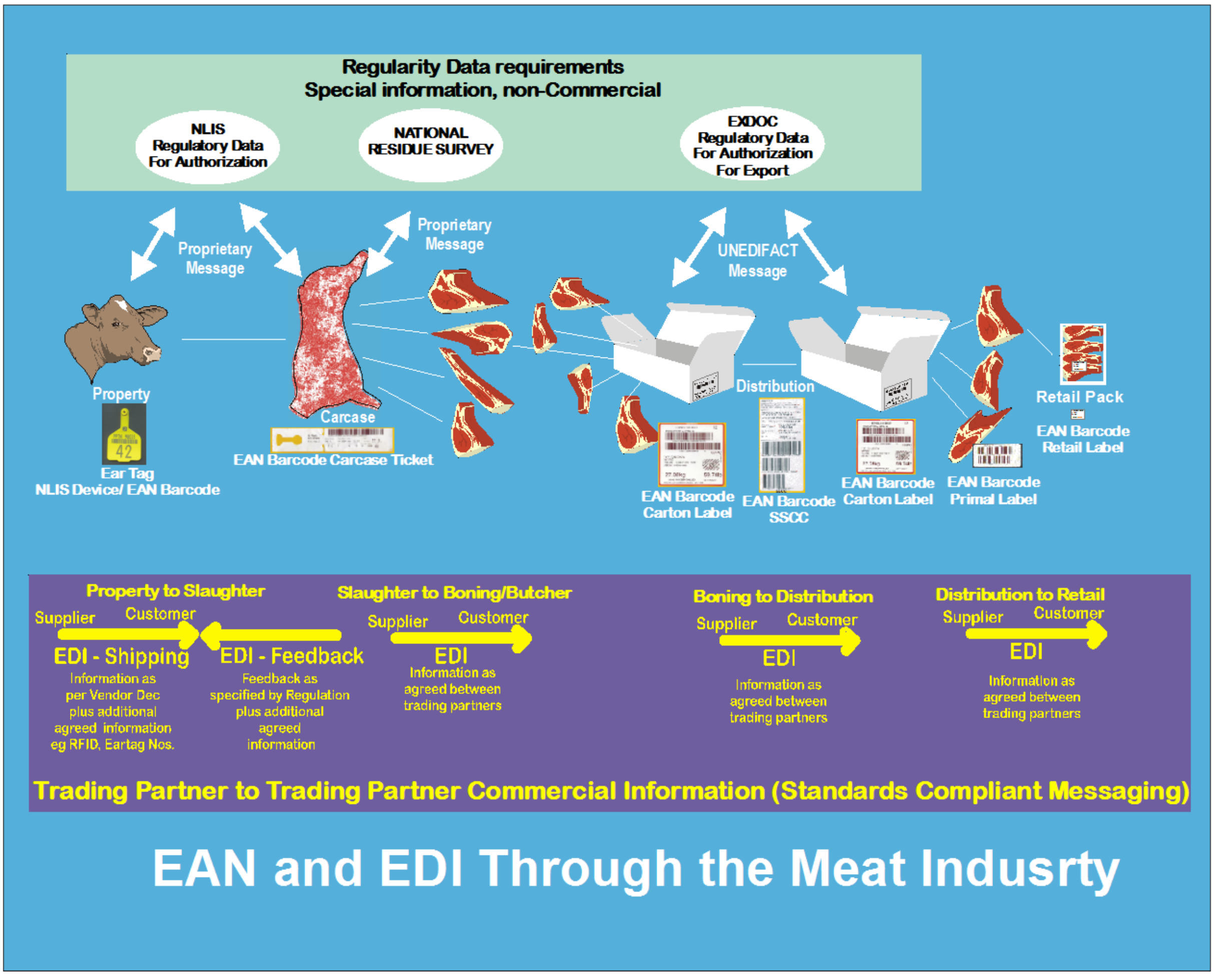


Figure 13– Regulatory Impact on EDI through the Meat Industry

The very specific data required by the Regulatory Systems and the specified means and format for the data to be sent and received by the Regulatory Systems mean that the Regulatory Systems often operate as stand alone and/ or proprietary systems. The commercial data that is sent and received using the EAN•UCC EDI standards for commence and trade may or may not include any of the regulatory system information. Examples of information that would be included in commercial information are such things as PIC (Property ID Code), NLIS device number of each animal, Health Certificate Number for carcase or carton export and Slaughter Establishment Number.

This means that both Regulatory Systems and EAN•UCC EDI standards for commence and trade operates happily together. I.E. A producer will use the NLIS proprietary system as a regulatory requirement, and send and received commercial trading data with trading partners using EAN•UCC EDI standards. The EAN•UCC EDI standards for commence and trade supports industry specific data such as

PICs, RFIDs, Vendor Declaration Numbers, Health Certificates Numbers, Slaughter Establishment Numbers, etc.

The application of the EAN•UCC EDI standards are non-proprietary and non-system dependent. The use of such standards facility trade globally, cross-industry and language independent.

The basis of the EAN•UCC EDI standards are defined message structures and message content. However the message content can be flexible enough to include industry or even trading partner specific data.

This is achieved though the message structure shown below:

Message Structure - **Standards Compliant**
- Message Headers and Footer - **Standards Compliant**
  - Party information (names, address, contact, etc) - **Standards Compliant**
  - Message Content (specific codified details and data such as: number of head, RFID, date/time, value, weights, etc) - **Standards Compliant**
    - Industry Specific (Breed, PIC, NLIS no., etc)- **Non-Standards compliant**

This approach ensures that messages can be sent between different system, platforms, languages, industries, etc yet carry industry specific data while still complying with international standards.

The structure of message means that the industry specific data is contained within standards compliant structures and tagging, yet is flexible enough to support very complex and lengthy industry specific data, without the need for very large and industry specific Data Dictionaries which are expensive to maintain.

The EAN•UCC organisation maintains the EAN•UCC EDI standards for commence and trade. The process of enhancements, maintenance and publication of the EAN•UCC EDI standards is to a large extent funded by the EAN•UCC global membership base. As the standards continue to be enhanced more industry specific components are added on an annual basis to the standards.

4. Demonstration Projects

There were three stages for the demonstration project, these were:

- Domestic EDI trial for a period of 3 months
- Export EDI trial for USDA/ FSIS presentation
- DNA Finger printing system for Value Added products

Each of these stages has been successfully completed. The results have been prepared as part of this report as well as the attached appendices and videos.

4.1 Domestic Demonstration

The domestic trial involved the development of EDI messaging related to carton primal product and value added retail ready product. The reason that retail ready product was chosen was because of its complexity and difficulty for track and trace through the supply chain. The project required technical interaction between Coles Supermarket personnel, Frigmobile personnel, Australian Country Choice personnel, system vendor personnel and EAN Australia personnel. The following diagram shows the completed EDI model that was implemented.

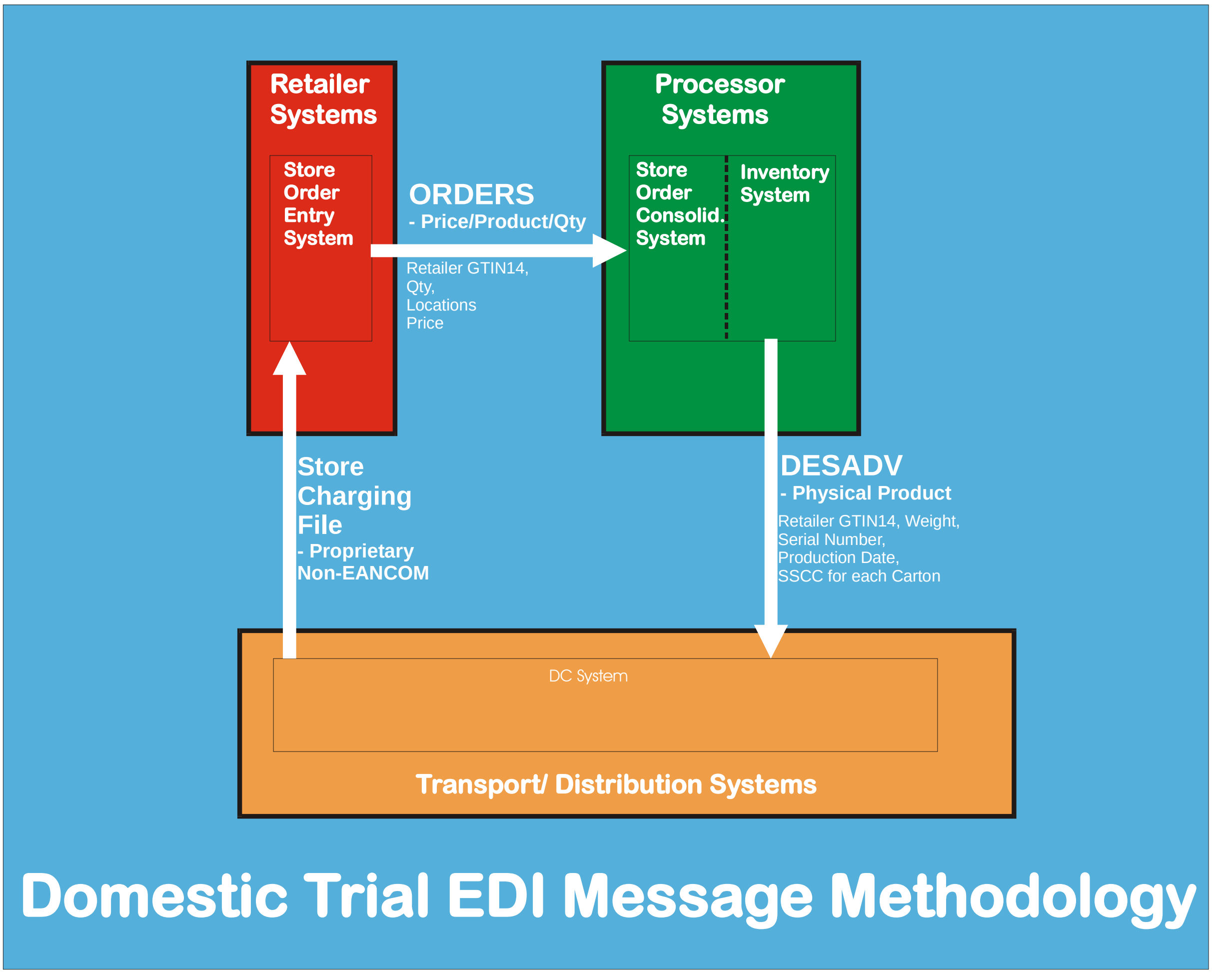


Figure 14– Domestic Trial EDI Methodology

4.1.1 EDI Requirements for the Domestic Trial and Outcomes

The products that were chosen for the domestic trial were Coles specified products. These products could have been manufactured by various suppliers and as such this created a problem in unique carton serial numbers. This comes about as a result of Coles Supermarkets (eg the customer) specifying the GTIN14 barcode on the carton product.

A solution that allowed the same company prefix and product code to be used by different processors needed to be achieved through the use of the standards.

The use of the SSCC on each carton provided the answer.

Retail Ready product that has a Coles specified GTIN (Global Trade Item Number) also has an SSCC on each carton. The detailed explanation of this process is shown in the following sections.

The project outcome was the successful implementation of the 3 month EDI trial between ACC and Frigmobile.

4.1.2 The Current Limitations of Customer Specified GTINs

The requirement for customers to specify their GTIN (Global Trade Item Number) for carton products can create a problem with unique identification, when these are packed by a number of Processing Companies, as there is no guarantee of unique serial numbers.

As the company that packs the product may have an independent serial number system to another company that packs the same product, there is a possibility of non-unique serial numbers.

The Processing Company does not have any control over a customer that specifies a GTIN, therefore there is no information identifying the Processing Company, without adding another attribute to the carton label.

4.1.3 The Solution to the Duplicate Carton Serial Numbers – Using the SSCC

By adding a globally unique 18-digit SSCC number represented in the UCC/EAN-128 barcode to each carton label affixed to each transportable unit not only provides a means to identify the Processing (or packing) Company but also ensures a globally unique serial number, including the other benefits relating to complete product traceability.

Within the Processing Company's Inventory Management system the carton or transportable unit is tracked and traced using the SSCC. The GTIN of the traded unit becomes an attribute of the SSCC, as with other attribute data such as batch number, kill dates, etc.. As the Processing Company generates the Carton SSCC, the EAN/UCC company prefix number of the Processing Company is included in the SSCC number.

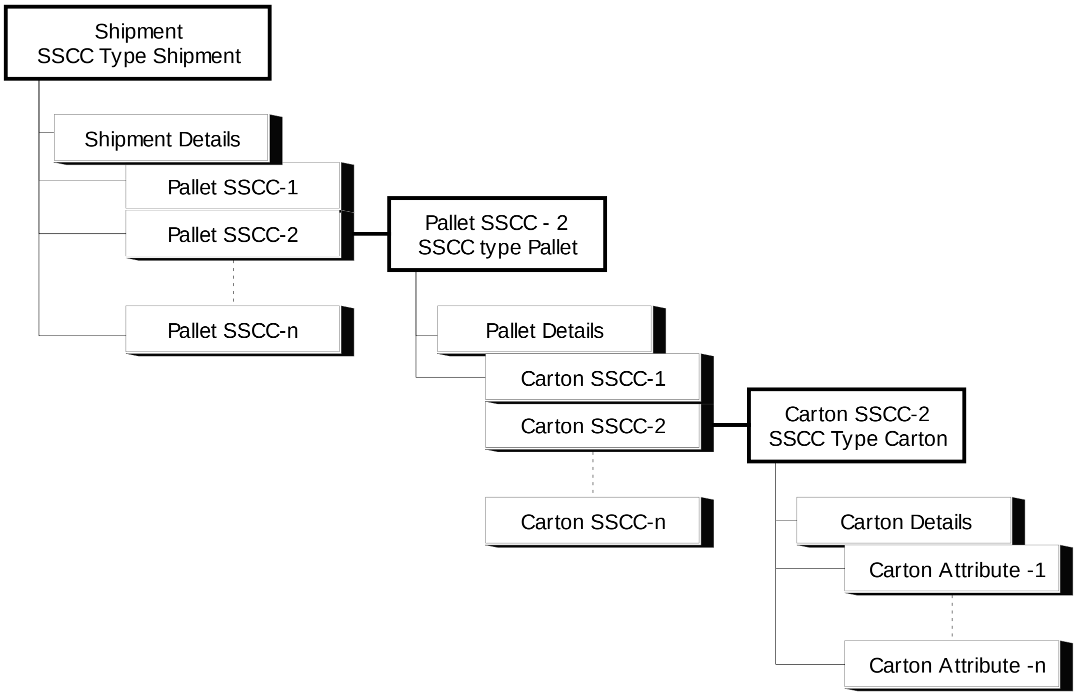
An EANCOM Despatch Advice message for the advance notification of the shipment can be generated that contains each carton SSCC with the GTIN of the product as a data attribute of the individual carton SSCC.

Each individual carton SSCC can be grouped to make another level of transport unit with its own, perhaps pallet SSCC and they in turn may form a larger shipment with its own Shipment SSCC.

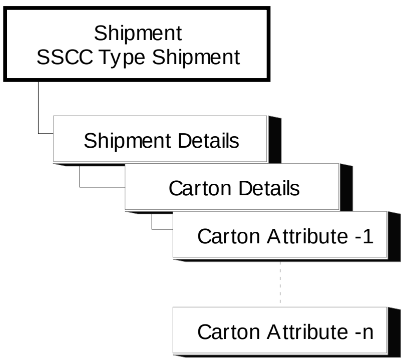
The amount of information included in the EDI message and level of uniqueness or commonality specified in the EDI message will be dependent on the customer/ supply agreement as well as statutory, regulatory and/or industry requirements.

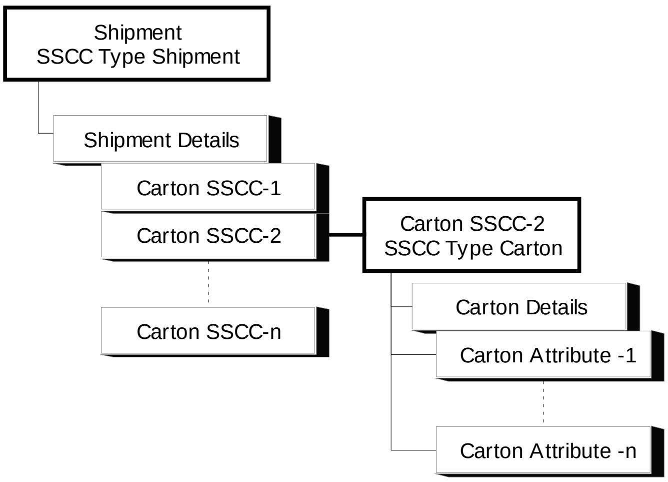
The SSCC is the key used to identify each Shipment, Pallet and carton (or carcase). The plant that processed the carton (or carcase) issues the SSCC. The GTIN (ie. The EAN/UCC-14 product number that is included on the carton label (or carcase ticket) may be that of a customer and not the company that processed the carton (or carcase). To overcome this problem the SSCC is used as a unique identification of the transportable unit, which also identifies the processing company.

The SSCC hierarchy is as follows:



The EDI models below using the SSCC shows on the left a simple shipment made up of like products where all the carton details are held within the one shipment SSCC and on the right a complex shipment made up of many different products. The model on the right has an SSCC for each carton.





4.1.4 Typical Information That Needs to be Sent Through EDI

The information that needs to be sent from supplier to customer through the supply chain is usually just the commercial details about the product. Eg Quantity, SSCC, Product Code, Description, Price per Unit, etc.

This could be defined as follows:

- Shipping Instruction.
- Destination location.
- Customer Name.
- Heath Certificate
- Seal Number
- Mode of Transport.
- Delivery Address.
- Despatch Date.
- No. Of Pallets.
- Each Pallet SSCC
- Total No. Cartons.
- Each Carton SSCC
- Each Carton Description
- Each Carton Weight
- Gross Weight and Cubic Metres.
- (Ref to the EDIFACT reference documents for details of All DESADV fields)

Below is listed the typical types of information in three broad categories that was analysed and certain fields selected for the domestic trail. Some of them may be sent electronically through EDI some may just be held by the supplier and provided on an "as required basis". The information is broken into 3 categories of shipping information, product information and process information.

Shipment Information

Shipment Identification Reference (AI 402)
Dispatch Date
Customer Purchase Order Reference
Routing Code
Consignee (Customer or EAN GLN)
Consignee Address
Consignor (Perorg or EAN GLN)
Consignor Address
Mode of Transport
Shipping Company
Vessel, Voyage
Carrier
Port of Inspection and Release
Final Destination
Final Destination Country
Number of Packages

Total Gross Shipping Weight
Total Net Shipping Weight
Comments

Product Level Information

Logistic Unit ID (SSCC AI 00)
Trade Unit ID (SSCC AI 00)
Product Descriptions
Product Trade Item Number (AI 01, AI 02)
Customer Product Code
Internal Product Code (Aus-Meat, Standpack, etc)
Batch/Lot Number
Kill Date
Kill Location**(s)** (Location GLN and Registration)
Production Date (Kill, Process, Package)
Production Location**(s)** (Location GLN and Registration)
Production Time
Expiry Date
Use by Date
Display Until Date
Production Location (Manufactured By Perorg, GLN)
Item Serial Number
Number of Packages
Gross Weight
Gross Weight UoM
Net Weight
Net Weight UoM
Sale Weight
Sale Weight UoM
Brands and Marks
Species
Stock Type
Grade
Final Grade
Product Characteristics (Fat Depth, Muscling, pH, etc)
Product Attributes (Halal Status, HGP Status, Disease Status (TB), etc)
Container Number
Container Seal Number
Container Temperature
Container Tare Weight (Kgs)
Eligible Countries
Declarations
Source Entity
Export Health Certificate
Meat Transfer Certificate
Source Meat Transfer Certificate(**s**)
Country of Origin
Label Approval Numbers
Datalogger Numbers
Retail Price

Retail Price UoM
Retail PLU Number
Storage ID Number (Container RF ID, Pallet Number, etc)
Comments

Process Level Information

Process
Process Start Date
Process End Date
Process Applied By (Location GLN and Registration)

4.1.5 Information Contained in the Trial EANCOM Despatch Advice Message

The trading information that is contained in a Meat Industry EANCOM Despatch Advice Message is as follows:

An EDIFACT message is made up of a series of segments, within which are contained data elements. The data elements are defined by approved code sets, which describe the nature of the data, provided. Within a message segment the data elements are separated by a (+) and a colon (:) separates the values within a composite data element. Data elements for which there is no value to be output to the file still are represented by a '+'. All segments are terminated with an apostrophe (')

An example of a segment line containing a carton weight would be as follows: -

MEA+PD+AAD:4+KGM:13.68'

Segment	MEA	Measurements
Data Element	PD	Measurement Qualifier (PD = Physical Dimension)
Data Element	AAD	Measurement Dimension, Coded (AAD = Total Gross Weight)
Qualifier	4	Measurement Significance, Coded (4 = Equal To)
Data Element	KGM	Measure Unit Qualifier (KGM = Kilogram)
Value	13.68	Measurement Value

A complete sample message covering the shipment of a single pallet containing 4 carton would be as follows: -

```
UNB+UNOA:3+9327649000001:14+9327649000002:14+000914:1515+ACC0001++++1++1'
UNH+1+DESADV:D:96A:UN:EAN005'
BGM+351+1351+9'
DTM+137:200009141515:203'
DTM+11:200007311200:203'
RFF+ABO:1225/A1'
RFF+IV:93276490000013514'
RFF+CN:SARGNT'
RFF+ZZZ:Y
NAD+SU+9327649000001::9'
NAD+ST+9327649000002::9'
EQD+TE+BIGTRUCK'
SEL+A123456789+SH'
CPS+1'
PAC+1++09'
CPS+2+1'
PAC+4++CT'
MEA+PD+AAB+KGM:40.01'
PCI+33E'
GIN+BJ+193276490000022322'
LIN+1+99300601040103:EN:9'
PIA+1+SRSPRO21300010023:NB+4010:GU+00434929:IN'
IMD+F++:::Coles Side of Lamb'
MEA+PD+AAL:4+KGM:13.68'
MEA+CHW+ADZ:4+KGM:12.48'
QTY+12:1'
DTM+94:20000731:102'
DTM+36:20000805:102'
MEA+SV+ADZ+AMT:1.46'
PCI+33E'
QTY+59+2'
GIN+BJ+193276490000022323'
LIN+2+99300601034515:EN:9'
PIA+1+SRSPRO21300010023:NB+3451:GU+00436108:IN'
IMD+F++:::Coles Side of Lamb'
MEA+PD+AAL:4+KGM:10.80'
MEA+CHW+ADZ+KGM:9.60'
QTY+12:1'
DTM+94:20000731:102'
DTM+36:20000805:102'
MEA+SV+ADZ+AMT:1.46'
PCI+33E'
QTY+59+4'
GIN+BJ+193276490000022324'
LIN+3+99300601034515:EN:9'
PIA+1+SRSPRO21300010023:NB+3451:GU+00436108:IN'
IMD+F++:::Coles Side of Lamb'
MEA+PD+AAL:4+KGM:10.68'
MEA+CHW+ADZ+KGM:9.48'
QTY+12:1'
DTM+94:20000731:102'
DTM+36:20000805:102'
MEA+SV+ADZ+AMT:1.46'
PCI+33E'
QTY+59+4'
GIN+BJ+193276490000022325'
LIN+4+99300601010335:EN:9'
PIA+1+SRSPRO21300010023:NB+1033:GU+00434383:IN'
```

```
IMD+F++:::Coles Side of Lamb'
MEA+PD+AAL:4+KGM:4.85'
MEA+CHW+ADZ+KGM:3.65'
QTY+12:1'
DTM+94:20000731:102'
DTM+36:20000805:102'
MEA+SV+ADZ+AMT:1.46'
PCI+33E'
QTY+59+8'
GIN+BJ+193276490000022326'
CNT+2:4'
UNT+70+1'
UNZ+1+SRS0001'
```

4.1.6 Implementation of the 3 Month Domestic EDI

The domestic EDI trial was implemented between Coles Supermarkets, Australian Country Choice and Frigmobile on the 1st of November 2000.

All retail ready and value added product had an EAN compliant carton label that includes an SSCC to overcome the problem of the unique carton serial number for Coles issued product codes.

Refer to the appendix for samples of barcodes.

As the product is produced to meet the consolidated customer order, the product is palletized. The product on the pallet is scanned to create a pallet SSCC. When a truck is to be loaded the various pallets with SSCCs are scanned and an SSCC for the shipment is created. Once the Shipment is confirmed an EANCOM Despatch Advice message is created listing all cartons and their respective details. The cartons within the shipment automatically decrease the Australian Country Choice inventory.

The EANCOM Despatch Advice message is placed at an IP address where it is taken electronic by the Frigmobile system.

Once the truck arrives at Frigmobile that SSCC for the shipment is scanned. The process of scanning the SSCC links the EANCOM Despatch Advice message to the shipment and the Frigmobile inventory is incremented by the cartons within the shipment. This includes a record of every carton SSCC for the purpose of traceability and recall.

This process has now been in operation from over 3 months and has functioned correctly.

Refer to the appendix for details of the messages and example of the Domestic EANCOM Despatch Advice message.

4.2 Export Demonstration

The trial involved the shipping of a container of Beef from Australian Meat Holdings Dinmore to a stated point of receiving in the USA.

The objective was to demonstrate the use of EAN Labeling (with unique numbering per carton) and the use of EDI (EANCOM DESADV message) to absolutely identify and track the shipment and/or each individual carton. The reference information that relates to the shipment (as used in the EDI Message and hard documents) include the following:

- Health Certificate,
- SSCC for the shipment,
- DPI Seal Number,
- Container Number
- Shipment Reference (eg Invoice, etc)
- Establishment Number(s)
- Dates (loading, shipping, etc)
- Product Description
- Shipment Weights
- Number of Cartons
- Shipping Mark
- Exporter/ Consignor
- Consignee
- Carton EAN Numbers (unique for each carton)

The Points of Processing that occurred were as follows:

1. Collection of Shipment Details

2. Generation of Consignment Documents

3. EDI File Generation

4. Load Verification at Point of Receipt

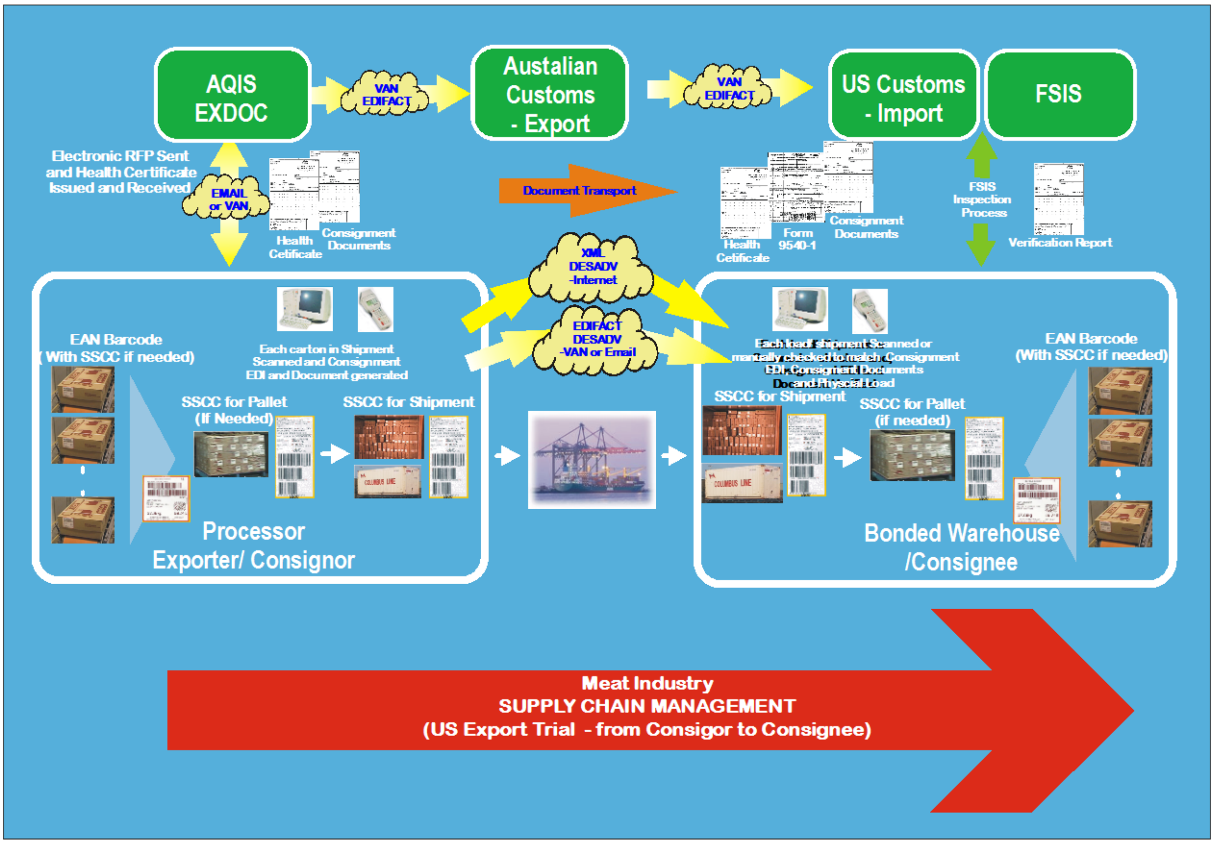


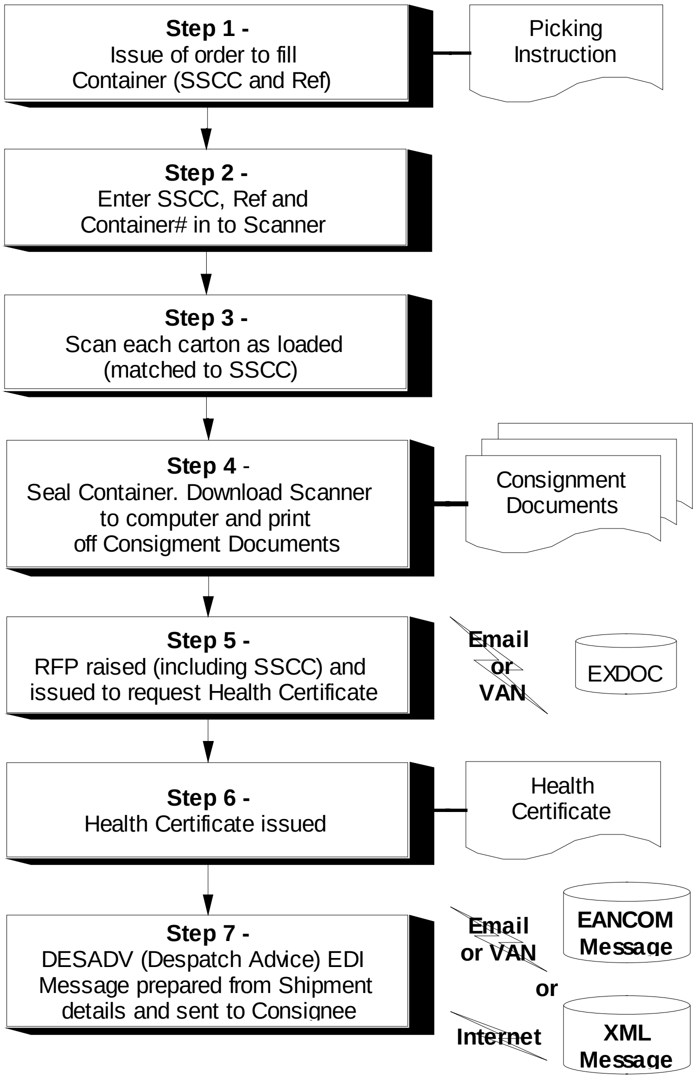
Figure 15 - US Export Trial EDI and Information Flows

The above diagram shows the complexity of the process for the EDI trial for export product. The number of organisations involved with the project was very large and the coordination of the various organisations was critical.

The project occurred in the manner defined in the above diagram and individual carton serial numbers could be demonstrated at each of the points identified in the diagram.

4.2.1 Exporter / Consignor Dispatching Process

The process that was followed for the generation of the consignment documentation and the electronic file that represents the consignment is shown by the following flow chart:



The critical points on this process are the following:

- The use of an SSCC (Serial Shipping Container Code) that identifies the consignment and links it to a Health Certificate and the individual carton serial numbers.
- The inclusion of the SSCC on the Health Certificate.
- The transfer to the Consignee of an Electronic File (EANCOM DESADV Message or XML Message) of the entire set of individual carton serial numbers, weights, production dates and EAN 14 numbers.

This information can then be used by the Consignee to prepare evidence that a specific group of cartons match the details about a specific consignment/ health certificate.

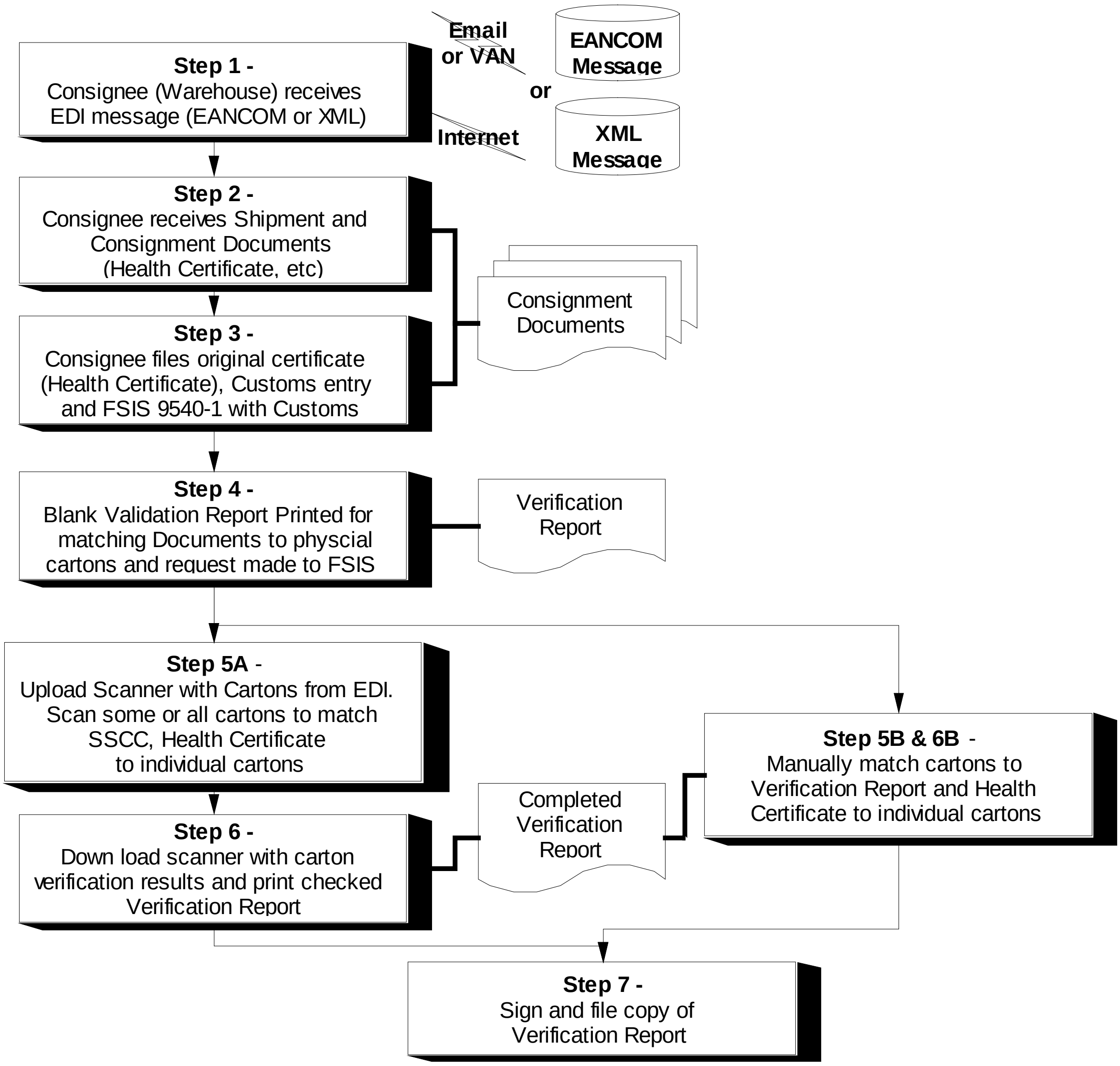
4.2.2 Bonded Warehouse / Consignee Receiving Process

Once the shipment was consigned to the Bonded Warehouse / Consignee the various export, import and clearance Receiving Processes were able to commence.

Once the physical shipment and the EDI message had been received by the bonded warehouse the original certificate (health certificate) and the FSIS Form 9540-1 were submitted.

The process for verification was by electronically uploading into a Portable Data Capture device (Scanner) and scanning some of the cartons against the SSCC (or Health Certificate), there was also a manual check for a number of carton serial numbers against the SSCC (or Health Certificate).

The following flowchart describes the demonstrated process for verification of the shipment:



4.2.3 Method of Information Capture

The typical method for information capture on the Points of Processing were as follows:

1. Collection of Shipment Details

   This involves scanning each carton as it was loaded into the container to capture the unique carton barcode (this could have been by either an EAN128 with AIs including serial number or an SSCC on each carton). If the same carton is scanned for the same container/ shipment an error message was displayed. Before, during or after scanning the cartons for a shipment, a set of information about the shipment was entered. This included Shipment Reference (Job number), Container Number, Seal Number (if available), SSCC for Shipment (if available), Comment Field. Each carton had the Carton Number (EAN128 with up to 48 digits), Date, Time, User (Default value entered for the operator of the DCU [Data Capture Unit/ scanner]). A function to remove cartons that are scanned in error was available. A running total of carton was displayed on the screen for the DCU)

2. Generation of Consignment Documents

   Once one or more Containers worth of cartons had been scanned the data was downloaded to a PC from the DCU. The data was then used to print off a Shipment Consignment Information - Form 1 (See Appendix) showing the shipment details and a Shipment Consignment Summary - Form 2 showing the shipment details and each carton barcode serial number for the Container. The report is 1 page for 1 shipment ie up to 700 cartons. A detailed report, Shipment Consignment Details - Form 3, showing every carton barcode was printed. This report can be many pages in length. Additional SSCC labels (compliant to the EAN Guidelines) for the shipment were generated as labels or document for inclusion in the group of document that comprise a shipment.

3. EDI File Generation

   Once the Scanned carton data had been uploaded in the PC, any additional information entered (information needed for the EDI Preparation) and the various reports printed, then an EDI DESADV message was generated. The complete EDI message was only issued once the Health Certificate has been received and entered. (See Sample Files for EDI examples). The EDI file was then sent to the point of receipt for the container (Cold store in US).

4. Carton Checking at Point of Receipt

   The EDI file (EANCOM DESADV) once received by the Cold Store was used to generate the same reports as previously. The EDI file was then converted and uploaded into the DCU. The DCU was then used to scan the SSCC for a Shipment (or Health Certificate Number) and some of the Cartons from the shipment scanned. If correct the DCU beeped and showed "Correct". If the carton did not match an error message stating "Carton not part of Shipment" was displayed. If more than one shipment has been upload to the DCU, a select function for, "shipment to be checked", can be used. Once a number of cartons had been scanned, the DCU was down loaded and a Shipment Verification Report - Form 4 was generated that shows all cartons for the shipment and underlined the checked carton.

4.2.4 Information Sent Electronically (EDI)

The information about the shipment that was sent from the Exporter/ Consignor to the Bonded Warehouse/ Consignee included the following:

Message Information [Header], [Footer]	Shipment/ Consignment Information (for each container/ shipment)	Shipment/ Consignment Details For each carton)
Message Date, Message Number, Etc (as required for EDI [EANCOM] or Internet XML)	SSCC Number, Consignor, Consignee, Vessel/ Aircraft Sea/ air port of loading, Date of departure Sea/ air port of discharge Shipping Mark(s) Container Number Health Certificate No. Species Establishment No.(s) Country of Origin (Container) DPI Seal Shipment Reference Description Total Net Weight Kill date(s) Number of Cartons	Product Code EAN/UCC 14 Carton net Weight (AI3xxx) Production Date (AI11) Serial Number (AI21) (if applicable individual carton SSCC)

The information was sent by electronic means in two of the following ways.

The proposed methods are as follows:

- EANCOM DESADV Message (EDIFACT based message) through a VAN (No used for Trial)
- EANCOM DESADV Message (EDIFACT based message) through Email (low cost)
- XML message through the Internet

The simplest of these 3 to test is the EANCOM DESADV message through Email. The structure of the data is a text file, which complies with the EDIFACT based EANCOM DESADV messages. For the purpose of security the text file can be compressed and encoded. The unzip key was sent separately for the purpose of the trial.

4.3 DNA Finger Printing Validation for Value Added Product

The use of DNA finger printing services for source product identification provides the basic audit and validation tool for food safety traceability. This is a crucial part of a broader MLA project addressing best practice strategies for supply chain management, food safety traceability and EDI systems.

The DNA finger printing trial was used to match value add products (composite samples – mince, sausages, etc) to source carcases and live animal samples.

Over a 12 month period an estimated 1500 DNA analysis were conducted on emulsified beef sausage, beef trim and dried meat smears to identify successful pooling methods and sample collection techniques. These pooling and sample collection techniques were specifically demonstrated for the purpose of food safety traceability for value added product.

The value-added products such as beef sausages, beef patties and trim are a composite mix of many animals. These products are also heterogeneous i.e. non-uniform in nature. Thus the DNA extraction and analysis methods used had to be sufficient to provide repeatable results across a range of products and dried meat samples.

There was sufficient markers used to be able to state known confidence levels for the exclusion and inclusion of sausages, patties and boxes of trim as being composed of designated groups of animals.

The two issues in value add DNA testing are the sampling methods for source product and at retail product levels.

Sampling methods relate to both Product entering the value add process (trim, carcases, etc) and the retail samples tested (sausages, stir-fry etc).

STAGE 1:

The determined production date/ batch is the 4th and 5th of July to obtain DNA samples from the source product entering the value add lines. This is to include Sausage, Stir-Fry and diced beef.

The source product is defined as each and every carton of trim going in to production for a specific batch. The carton label details (plant, production date, carton number, etc) is to be recorded in the sequence that they enter the product process. A DNA sample is to be taken from as many of the individual pieces of trim that is practical for the nominated batch. This is estimated as being several hundred.

During the production process samples of in process product (sausage meat, diced, stir-fry) were collected at the beginning, ¼, half, ¾ and end of the batch. This was up to 10 samples.

At the point of final processing before packaging, additional samples in sequence were collected.

Once all the DNA samples for the entire source product, in process product and final product co-ordination occurred with distribution and Coles retail to collect samples at stores that represented the nominated batch. Non nominated batch product was also collected and used as non-reference samples. I.e. some retail samples must match and some must not match.

During the store visits mince product samples were obtained. This included the source meat into the mince machine and retail product.

These control and reference retail products and the DNA source samples were all appropriately serial numbered, referenced and then given to Genetic Solutions. Genetic Solutions processed and determined the exclusion/ inclusion probabilities.

STAGE 2/3:

After completion of the first stage a second and third stage set of testing was conducted. This was based on only the reference samples at the end of the product process for sausage and a nominated sampling method for Stir-Fry and Diced Beef.

The diagram shows the graphical flow of the sampling process and subsequent analysis.

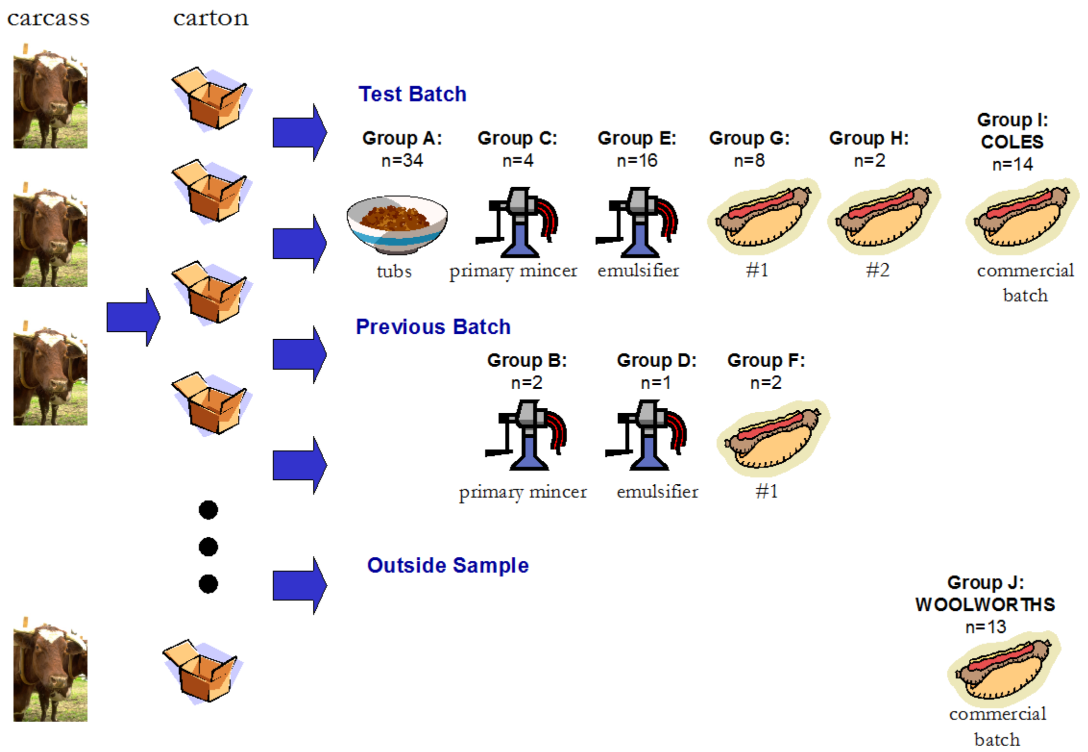


Figure 16: Flowchart showing the sampling regime adopted throughout the manufacture of sausages.

4.3.1 DNA Finger Printing Objectives

The objectives of the DNA Finger Printing trial were as follows:

- To provide the necessary DNA Finger Printing testing results to prove the viability of Value Added DNA Trace Back.

- To demonstrate the ability to identify source meat samples to value added samples with a measurable confidence level of DNA finger printing matching results.

4.3.2 DNA Finger Printing Demonstration Trial details

A number of sampling programs were undertaken during the trial. These related to an initial sausage sampling trial and initial beef stir fry sampling trial and a commercial sausage trail.

Each of the sampling trial were conducted to demonstrate some aspect of the DNA finger printing process.

4.3.3 Initial Sausage Sampling Trial

An initial sampling process was conducted on the 5th of July 2000 at the sausage manufacturing plant of *Australian Country Choice*. The test batch consisted of a 400kg batch of beef made from 14 cartons of beef trim (packed on the 4th of July 2000). Samples were taken from each stage of the production line in two batches: A test batch and a previous batch. It was expected to see on average, two alleles identified for each sample in this batch since each should represent one piece of unprocessed meat. Finally, two commercial packs of sausages were tested, one of which originated from the observed manufacturing process.

Samples from a previous batch were also taken. Samples were taken from 3 tubs of trim of the test batch. Additional samples were taken from the primary mincer. Emulsified sausage samples were also collected. Finally, two commercial packs of sausages were tested, only one of which originated from the test batch.

The sausage dataset consisted DNA marker profiles from 12 markers on a collection of 96 samples taken throughout the manufacturing process. In addition, a previously collected population dataset of meat samples, containing marker information from 29 markers on 893 animals was used for reference.

Composite DNA profiles were constructed at various stages along the manufacturing process by pooling DNA marker data from the subsamples. When plotted as a barplot, a clear DNA profile was obtained for each group.

The Kappa statistic was used to assess the measure of agreement between composite DNA profiles.

There were very clear differences in the DNA profiles of the two commercial packs of sausages. There was a high degree of similarity between composite DNA profiles of samples from the test batch. The Kappa statistic was an effective discriminating tool.

Sample size analyses suggested that show that as few as 11 samples may be sufficient to detect a clear difference between sausage batches. However further data is needed in the area of sample size estimation.

4.3.4 Initial Stir Fry Sampling Trial

Sampling was conducted on the 19th of July 2000 at the stir-fry production line at *Australian Country Choice*. The test batch consisted of a batch of beef stirfry made from twenty-three cartons of boneless beef packed on the 18th of July 2000. Samples were divided into the different groups from which they were sourced and Figure 17 describes the sampling process. Samples from Group A consisted of 398 samples of meat from the carcasses that were processed on the 17th of July 2000 and were the source for the boneless beef. Each observation represents one DNA sample per animal. Groups B, C and D represent DNA samples taken from 10 strips at three separate stages of production of the stirfry batch, one sample being analysed from each strip. Since each sample is not heavily mixed, we expect to see approximately 3-4 animals represented in each of Groups B, C and D. Finally, Groups E and F represent samples taken from commercial packs of stir-fry strips. Group E represents a commercial pack produced by the plant (Coles) and Group F represents an outside commercial pack (Woolworths).

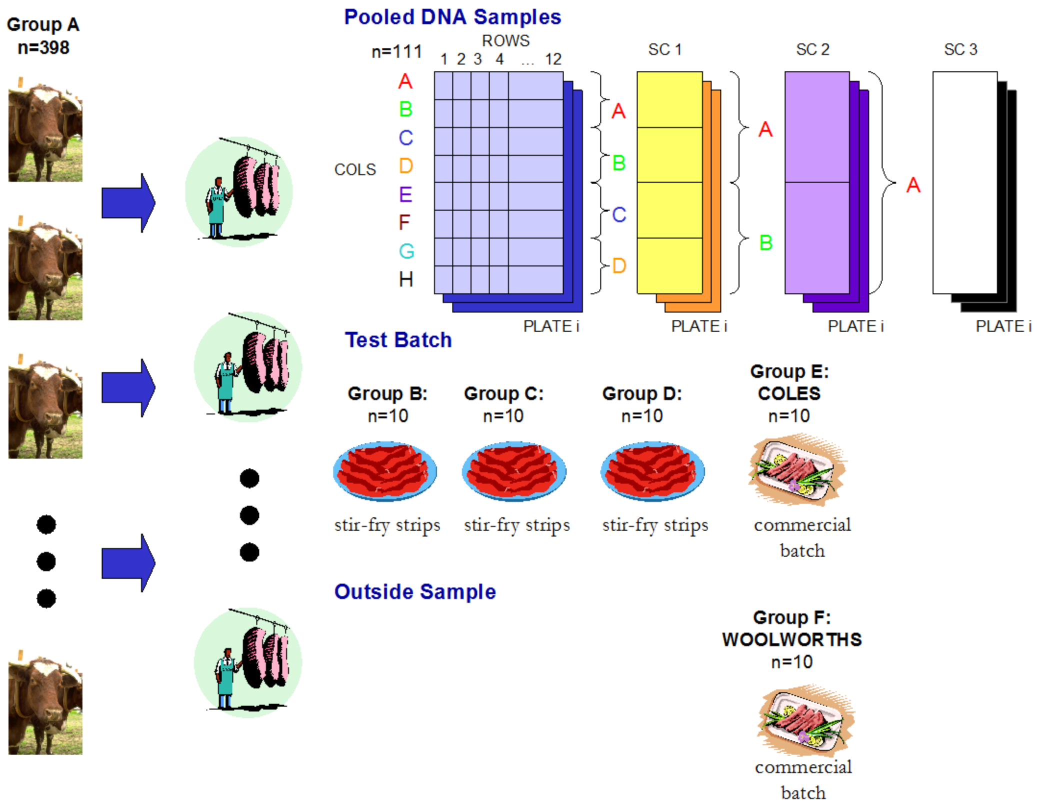


Figure 17: Flowchart showing the sampling regime used in the manufacture of stir fry.

In addition to samples taken throughout the manufacturing process, we also tested pooled DNA samples made up of samples from the carcasses. There were 111 pooled DNA samples. The pooling process performed over 5 x 96 well plates. Pooling can be performed in a number of ways depending on the extent of pooling required. Consideration was given to pooling the DNA samples across the blue plate

(SC1), by grouping A and B, C and D, E and F, and G and H together to form the yellow plate shown in the Fig 17. Consideration of pooling the yellow plate (SC2) by grouping A and B, and C and D to form the purple plate and furthermore we can continue pooling in this manner to produce one pooled sample (SC3) represented by the white plate shown in Figure 17. Consideration was also given to pooling down columns of the blue plate (COLS) and across rows (ROWS). The pooling process provides significant advantages for both the genetic and statistical analyses especially when pooling of DNA samples right down to the white plate because the process then works with a smaller number of DNA samples: ROWS (n=48); COLS (n=34); SC1 (n=17); SC2 (n=8); SC3 (n=4).

4.3.5 Commercial Sausage Sampling Trial

The commercial demonstration project was conducted over a 2-week period during March 2001. The commercial demonstration involved collection of samples over 10 production days and collection of 10 none related sausage samples. Eg Woolworths, Franklins, local butchers, etc.

The sample collection process was as follows:

Step 1. - From each batch of Sausage production take the first sausage and take 23 sausages from evenly across the batch and then take the last sausage. (Total 25 Sausages)

Step 2. - Place each sausage in the pre-labeled plastic bags and write on the bag the sausage number. Eg Sausage 1, 2, 3 etc to sausage 25.

Step 3. - After each Batch is collected, take all 25 plastic bags containing the Sausages and ship to Genetic Solutions for Analysis.

Preliminary results have identified that the sampling process is able to identify the individual sausages for the related sausage batch and can be excluded from all other batches.

The purpose of this phase of the study was to evaluate whether the DNA profiling system used for a specific sausage batch could be applied across a wide variety of batches and sources of sausages.

The test material consisted of 25 sausages from each of 10 batches of sausages between the dates of 19th and 30th of March. Samples were also taken from ten independent commercial sources of sausages (Special samples). DNA analysis was performed on each sample using 12 DNA microsatellite markers: BM720, CSSM016, HUJ625, ILSTS006, MGTG4B, MGTG7, RM026, TGLA057, TGLA122, TGLA126, TGLA227, URB042.

DNA profiles were constructed for samples from each sausage. A composite profile was constructed for each batch using profiles from all sausages except one chosen at random. The excepted sausage became the test sample for each batch whilst the profile from the remainder was used as the reference sample for each batch. The Kappa statistic was used to assess the measure of agreement between composite DNA profiles from each of the test samples against each of the reference samples. The comparison was also made between test samples and composite profiles from the independent sausage samples.

Genetic Analysis revealed a different number of alleles in the initial five batches compared to the second five. No structured sampling issue could be identified as being responsible.

Comparisons between batch profiles and profiles of the Special samples revealed that no special sample showed ‘Good’ agreement with any of the ten reference batches. Randomly selected samples from each of the batches showed either substantial or ‘Good’ agreement with their reference batch. This suggests the technique can successfully distinguish sausages from one source from another in most cases.

Comparisons of randomly selected samples across batches revealed that ‘Good agreement’ was generally only found with the batch from which an individual sample came.

Analysis of a randomly selected set of 98 sausages from amongst the 250 analyses revealed that assignment at a level of ‘Good’ agreement was only possible in 63% of cases. In 13% of cases there were false positives. This level of specificity is too low to utilise as a diagnostic between batches from the same source. Further genetic analysis would be required. Ideally using samples taken from individual carcasses that had contributed to the batch.

Refer to the Appendix for the individual report of the analysis.

4.3.6 Outcome for DNA Finger Printing Trial for Value Added Product

The trial demonstrated that it is commercially possible to implement sampling processes for value added product such as mince and sausages for the purpose of Food Safety traceability.

The ability for retail stir fry or diced beef samples to be easily included or excluded from a product batch was not able to be positively determined. These was always the possibility that an individual sample of stir or diced beef did not get sampled at time of processing. To overcome this difficulty all carcases that went into the stir fry or diced beef product were analysed and matched to the stir fry or diced beef retail samples with a positive result.

The sausage commercial trial demonstrated that it was commercially viable to collect a number of samples at the time of product of sausage or mince and be able to include or exclude a retail sausage or mince sample from a specified product batch. Thus food safety traceability for sausage, mince, stir fry and diced beef product were successfully demonstrated at a commercial level.

4.4 Dissemination to Industry

As part of the project demonstration that was a requirement to participant in industry dissemination program.

To achieve this, three 1/2-day workshops were held in March. Refer to the appendix for information of the specific content the power point presentation of the presenters.

The workshops were held in Brisbane, Sydney and Melbourne.

The presenters were as follows:

Ian King	AUS-MEAT
Steven Periera	EAN Australia
Ashley Manners	AMC representative
Des Bowler	Project representative.

The workshops were focused on providing a briefing to the participants on the project work completed to date, the support for the regulatory authorities and the step to implement EAN number, barcoding and EDI.

5. Recommendations

The supply chain management / food safety traceability demonstration project had a number of specific objectives to be met. Each of these were achieved with a positive outcome.

It has now been demonstrated that the use of EAN numbering, barcoding and EDI through the supply chain is achievable in the meat industry and can provide significant efficiency gains and cost saving. The use of EAN numbering, barcoding and EDI also provides a very high level of food safety traceability through the whole supply chain at a global level.

The use of DNA finger printing systems for food safety traceability can provide validation tools for the inclusion or exclusion of value added products at a cost effective commercial level.

The following recommendation are made to assist in the implementation in the meat industry of these system:

- On going dissemination and workshops programs both at a management and technical levels be undertaken.
- Undertake a larger commercial demonstration trial of the use of EAN numbering, barcoding and EDI for export product to the US. This would include involvement from USDA, AQIS, etc to show the use of EAN labels to replace Shipping Marks.
- MLA provide a single point of contact (Web site, news letters, etc) for the meat industry in reference to questions and guidance in the implementation of EAN numbering, barcoding and EDI, and DNA finger printing systems for food safety traceability
- Stage 3 for Live Animal EDI demonstration project be funded to provide a total chain platform link for on-farm sectors with suitable linkage to the regulatory systems such as NLIS.
- E-Commerce initiatives for the meat industry be investigated to continue on the work completed on use of EAN numbering, barcoding and EDI.
- On going work be conducted in the development of XML message standards in conjunction with EAN Australian and EAN International to suit the needs of the Australian Meat Industry.