



LIVESTOCK TRACEABILITY REPORT

Australia vs United States Comparison

Abstract

This report examines the livestock traceability systems used in the United States (U.S.) compared to Australia. Research suggests that both systems have similar objectives, operations, and technology, but differ in their implementation. In Australia, a single mandatory National Livestock Identification System (NLIS) is used to trace livestock from birth to slaughter for multiple species, while the U.S. relies on various voluntary and mandatory fragmented systems depending on state and species. Research suggests that these differences can be attributed to producer perception, domestic market influence, and industry fragmentation in the U.S. Various opportunities were also identified that could improve livestock traceability in Australia and the U.S. in the future.

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Contents

1.0	Introduction	2
2.0	Background	3
3.0	Traceability in Australia	4
3.1	National Livestock Identification System (NLIS)	5
4.0	Traceability in United States	6
4.1	Animal Disease Traceability Program (ADT)	7
4.2	US Cattle Trace Program	8
4.3	National Scrapie Eradication Program	9
5.0	Limitations.....	11
6.0	Opportunities.....	14
7.0	Summary of Findings.....	16
8.0	Conclusion.....	17
9.0	Bibliography	18

1.0 Introduction

Food and livestock traceability is defined as the ability to track the history and movements of animals and animal-derived products across the supply chain from birth to consumption (Canadian Food Inspection Agency, 2022). A basic diagram of this supply chain can be seen below in Figure 1. Traceability systems exist worldwide for livestock such as cattle as well as corresponding consumer products such as meat and leather (Department of Agriculture, Water, and the Environment, 2022). In Australia, food and livestock traceability is heavily utilised to ensure the safety and quality of these products for consumers. Various systems are used within the red meat industry to achieve this, with one of the major contributors being the National Livestock Identification System (NLIS) (Animal Health Australia, 2021).

The NLIS is a mandatory system that traces primary production animals from birth to slaughter. Rules and regulations within the NLIS must be followed by Australian livestock producers for them to conduct business within the Australian red meat industry. In the United States (U.S.), livestock traceability is accomplished using a mixture of mandatory and voluntary systems, depending on the species and state. The resistance towards a national mandatory system, such as the NLIS, stems from challenges such as producer perception, costs, legislated state independent structure and a reduced need due to the presence of a larger domestic market.

This report will investigate food and livestock traceability in the U.S. compared to Australia, focusing on primary production from birth to slaughter. This will be achieved through both primary and secondary research.

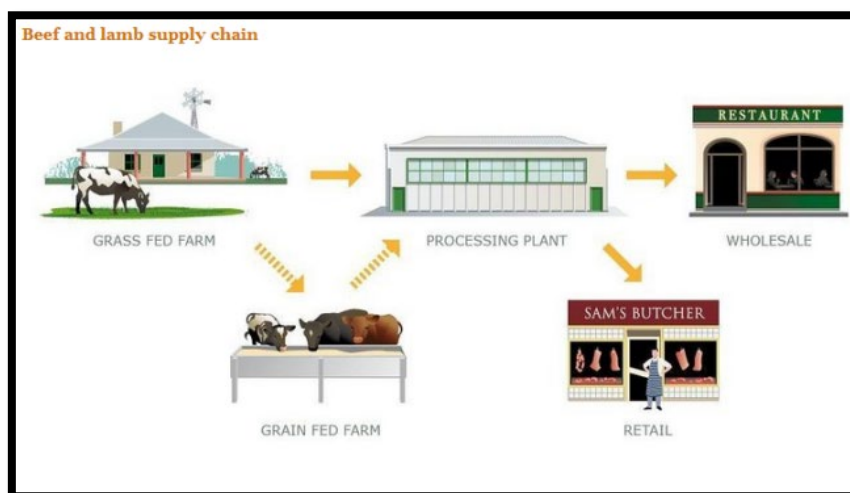


Figure 1: Basic Beef and Lamb Supply Chain

2.0 Background

To trace livestock from birth to slaughter, a unique identifier number is typically assigned to the animal using Radio-Frequency Identification (RFID) ear tags, commonly called Electronic Identification (EID) ear tags, visual ear tags, rumen bolus devices, or tattoos (Meat & Livestock Australia, 2023).

An example of a common RFID ear tag used in the NLIS for cattle, sheep and goats in Australia can be seen below in Figure 2. This identifier is then used to track the animal's movements throughout the supply chain, where its history and movements are recorded in a central database. This database makes it possible to trace back animals to their property of origin to identify the potential source of food safety issues, contamination opportunities or disease outbreaks (Meat & Livestock Australia, 2023).

To trace consumer products further down the supply chain, methods such as product labelling, blockchain technology, and online platforms are used. For example, the online platform Crowd Cow connects consumers directly with farmers and ranchers who sell high-quality meat. They provide detailed information about the source of the meat, including the breed of animal, the farm where it was raised, and the processing facility where it was processed (Crowd Cow, 2023). This has been driven in recent years by consumer preferences and industry regulations linked to the increased demand of biosecurity, food safety, quality assurance and animal welfare (Kumar, Joshi, & Singh, 2017). Producers also see a huge benefit in adopting traceability through increased market access, inventory management, and other associated efficiencies (Kumar, Joshi, & Singh, 2017).



Figure 2: NLIS RFID Ear Tag



Figure 3: Crowd Cow

3.0 Traceability in Australia

Livestock traceability in Australia dates back to the early 20th century with increased focus in latter half of the century, with a focus on preventing the spread of diseases like Bovine Tuberculosis and Tick Fever among cattle (Hird, Paul, & Wong, 1997) (Ni, Wang, Zhang, & Xu, 2015). Traceability programs such as The Cattle Tick and Tick Fever Control program, and the Brucellosis and Tuberculosis Campaign were introduced in the 1970's and 1980's to combat these issues (Hird, Paul, & Wong, 1997) (Ni, Wang, Zhang, & Xu, 2015). Prior to the NLIS, systems were fragmented and often exclusive to specific diseases and industries. For example, the Sheep and Goat Identification scheme was used to prevent the spread of diseases like foot-and-mouth. This created inefficiencies and risks within supply chains.

In the early 1990s, the United States, which was the largest market for Australian beef by volume, prohibited the supply of beef from Australia due to the presence of contaminants in beef containers destined for the US. These contaminants resulted from the use of sprays in cotton production, specifically Helix chemical, which did not break down when cattle consumed cotton seed from crops sprayed with the chemical as part of a drought feeding program. As a result, cattle from only 20 of these farms entered the food supply chain after various transactions and movements.

At that time, the Property Identification Code (PIC) system was inadequate in accurately tracking the movements of individual animals. Consequently, the entire market was shut down, affecting states such as Victoria, Tasmania, South Australia, and Western Australia, as well as the Northern Territory, even though none of these states had any infected animals.

To address this issue, the NLIS was adopted in 1999, firstly in Victoria, as a single mandatory system to be used for an extensive range of livestock across Australia (Integrity Systems Company, 2022). This system has become the primary traceability system used for production livestock, and is used to trace cattle, bison, buffalo, sheep, goats, and pigs (Integrity Systems Company, 2022). In conjunction with the NLIS, Animal Health Australia (AHA) is also currently working with industry stakeholders to develop a national identification and traceability system for camel and all South American camelids, including alpacas, llamas, guanacos, and

vicunas. Further precautions have also been put in place to trace all domestic and production animals that could be susceptible to Foot and Mouth Disease, such as deer (Animal Health Australia, 2021).

Traceability of animal-related products, such as packaged meat, leather and wool have also been in place in Australia for several years. For example, the Woolmark certification program was established in Australia in 1964 by the International Wool Secretariat, which is now known as The Woolmark Company (The Woolmark Company, 2023). Every certified Woolmark product today has a unique batch number that can be trace through to the garment manufacturer, providing a first step in traceability (The Woolmark Company, 2023). The program provides a certification mark to products made of 100% pure new wool, indicating to consumers that they are buying a high-quality wool product (The Woolmark Company, 2023).

3.1 National Livestock Identification System (NLIS)

The NLIS is managed by Integrity Systems, a wholly owned division of Meat and Livestock Australia, via legislation and policies implemented and managed by Animal Health Australia, and the Department of Agriculture, Fisheries, and Forestry to fund and manage its services (NLIS, 2023). As stated previously, the NLIS aims to ensure biosecurity, food safety and provide Australian producers a competitive advantage within the global export market.

The NLIS was introduced in 1999 to enhance cattle traceability and was further expanded in 2009 to include sheep and goats. In 2018, it once again expanded to include the pork industry (Australian Pork Limited, 2022). To ensure lifetime traceability of animals, the NLIS combines three key elements:

1. All livestock are identified by a visual or electronic ear tag/device
2. All physical locations are identified by means of a Property Identification Code (PIC)
3. All livestock location data and movements are recorded in a central database

As animals are bought, sold, and moved along the supply chain, they must be tagged with an NLIS accredited tag or device from their property of birth (PIC). This tag remains on the animal until slaughter, and if it is lost or becomes defective, a new tag must be applied.

If an animal requires a new tag but is no longer at its place of birth and the individual identification number of the animal is not known, a 'post breeder' tag is used, indicating that the animal no longer has 'lifetime' traceability. If the old identification number of the animal is known, the old identifier and new identifier can be linked creating an unbroken chain of identification and thus the animal's full traceability status (lifetime traceability) is maintained.

Producers with NLIS accounts are responsible for recording animal movements between different PICs on the central NLIS database. These accounts are free to open and operate; however, ear tag traceability technology must be purchased by the producer and records of movements undertaken by the producer.

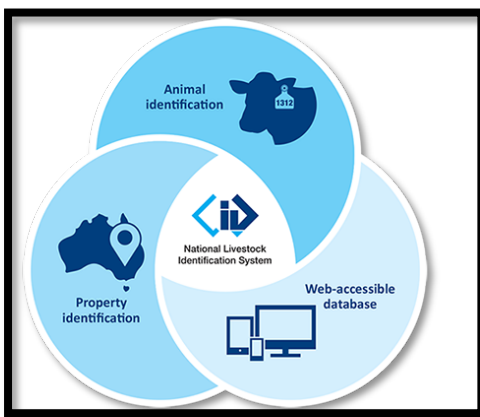


Figure 4: NLIS 3 Key Elements



Figure 5: NLIS Post Breeder RFID Ear Tag

4.0 Traceability in United States

Livestock traceability in the U.S. can also be dated back to the early 20th century, similarly, where federal government developed initial traceability programs to prevent the spread of diseases like Foot-and-Mouth and Brucellosis. The National Brucellosis Eradication Program was established in 1934, marking the beginning of a formalized livestock traceability system (APHIS, 2020).

In the late 20th century, concerns about food safety and disease outbreaks led to the development of more comprehensive traceability programs. In 2004, the United States Department of Agriculture (USDA) established the National Animal Identification System (NAIS) to cover a wide range of species, including cattle, sheep, goats, pigs, horses, and poultry (APHIS, 2020) (Kaur & Gupta, 2011). Like the NLIS, the NAIS aimed to enhance animal

health and disease surveillance by tracing animal movements from birth to slaughter. However, the program was discontinued in 2013 due to a lack of funding and concerns about privacy and government overreach. It has now been replaced by a new system known as the Animal Disease Traceability Program (ADTP) (Noble Research Institute, 2013).

Despite having programs that cover a variety of livestock and diseases like the ADTP, livestock traceability in the U.S. is primarily driven by industry organisations and individual states' rules and regulations. In addition to the ADTP, two other heavily utilised programs for livestock traceability that were identified are the US Cattle Trace Program and the National Scrapie Eradication Program.



Figure 6: USCattleTrace



Figure 7: United States Department of Agriculture

4.1 Animal Disease Traceability Program (ADT)

ADT program was established by the USDA in 2013 as a replacement for the NAIS. This program is administered by the USDA's Animal and Plant Health Inspection Service (APHIS), in partnership with state animal health officials, industry stakeholders and other federal agencies. The program requires livestock moving interstate to be accompanied by an Interstate Certificate of Veterinary Inspection (ICVI), owner-shipped statement or a brand certificate, all of which must be approved by officials in both the state of origin and the receiving state. For intrastate movements, the program follows the regulations set by each state (Noble Research Institute, 2013).

Additionally, the program requires animals to be identified with official identification tags, with the use of EID tags being encouraged for faster and more accurate traceability, though not enforced. State animal health officials are responsible for maintaining records of all

animals' movements within their respective states, and this information is shared with federal authorities as needed for disease surveillance and response efforts (APHIS, 2022).

4.2 US Cattle Trace Program

The US Cattle Trace Program is a widely recognized and praised traceability initiative and was frequently mentioned by producers in the US cattle industry as a promising solution for improving cattle traceability. One of the largest Angus breeding ranches in the U.S., Gardiner Angus Ranch, has yet to adopt an official traceability system but is actively looking into the US Cattle Trace program to combat this issue. Similarly, Ken Ridenour, President of from Global Animal Products in Amarillo, Texas, also identified US Cattle Trace as becoming a popular choice for cattle traceability.

Established in 2018, the US Cattle Trace program is a comprehensive national disease traceability system that was developed as a private industry initiative in collaboration with state animal health officials and the USDA. The program aims to address gaps in existing traceability systems and improve the cattle industry's ability to quickly respond to disease outbreaks.

The program relies on the use of EID tags, which contain unique identification numbers, and a central database that can track animal movements from birth to slaughter. The program is managed and funded by a collaborative effort between industry stakeholders, state animal health officials, and the USDA, with the board of directors representing various segments of the cattle industry, including cow-calf producers, auction markets, feedlots, and packers. In particular, the program has received significant funding from industry organizations such as the Beef Checkoff Program and the National Cattlemen's Beef Association (United States CattleTrace, 2021).

The USCattleTrace program operates in a similar way to the NLIS in Australia. When cattle are sold or moved, the owner or transporter must report the movement to the US Cattle Trace central database, allowing for real-time tracking of the animal location and movement history. This information is then stored in the database and can be accessed by authorized personnel for disease surveillance and response efforts. In the event of a disease outbreak, the database quickly identifies potentially affected animals and traces their movements to determine the source of the outbreak, allowing for a more efficient response and

containment of the disease (United States CattleTrace, 2021). An example of the USCattleTrace EID ear tag and data collection process can be seen below in Figures 8 and 10.

4.3 National Scrapie Eradication Program

Sheep and goat traceability in the U.S. is primarily managed through the National Scrapie Eradication Program. An interview with former executive board member for the American Sheep Industry Association (ASI) Bob Buchholz, mentioned that little traceability exists for small ruminants, as producers don't tag their animals due to the rapid turnover to slaughter. The National Scrapie Eradication Program, introduced in 1952, is designed to control and eventually eradicate scrapie from the US sheep and goat populations (Wisconsin Department of Agriculture, Trade and Consumer Protection, 2012). This was the main traceability system for small ruminants identified by Bob, which was later supported by Benny Cox, the sheep and goat manager for Producers Livestock Auction, San Angelo, Texas.

The program is managed by the USDA's Animal and Plant Health Inspection Service (APHIS) in collaboration with state animal health agencies and industry stakeholders. It applies to all states in the US and has been successful in reducing the prevalence of scrapie in adult sheep sampled at slaughter by over 99 percent (APHIS, 2019). The program requires identification of sheep and goats using EID tags, metal/plastic visual ear tags, or injectable transponders approved by APHIS.

All sheep and goats moving off their premises of origin must have identification unless they are moving with a group ID and owner/hauler statement, they are castrated sheep or goats under the age of 18 months of age, or they are moving within a state and have only resided on premises and in flocks in the same state. In such cases, the owner of these flocks or premises must not engage in interstate commerce of sheep and goats (APHIS, 2019). This lack of traceability for small younger ruminants and interstate movement present significant challenges in identifying the source of disease outbreaks and effectively controlling their spread.

Producers must keep records of movements and transaction details must be kept for years after the animal is sold or otherwise disposed. Records must be taken when official identification is applied to the animal and when an animal is bought or sold (APHIS, 2019).

Various other livestock traceability systems are also operational in the U.S., such as the Brucellosis Eradication Program, Cattle Fever Tick Eradication Program, state-level livestock traceability programs, and the premises identification number system, among others.



Figure 8: USCattleTrace EID Ear Tag



Figure 9: National Scrapie Eradication Program Metal Visual Ear Tags

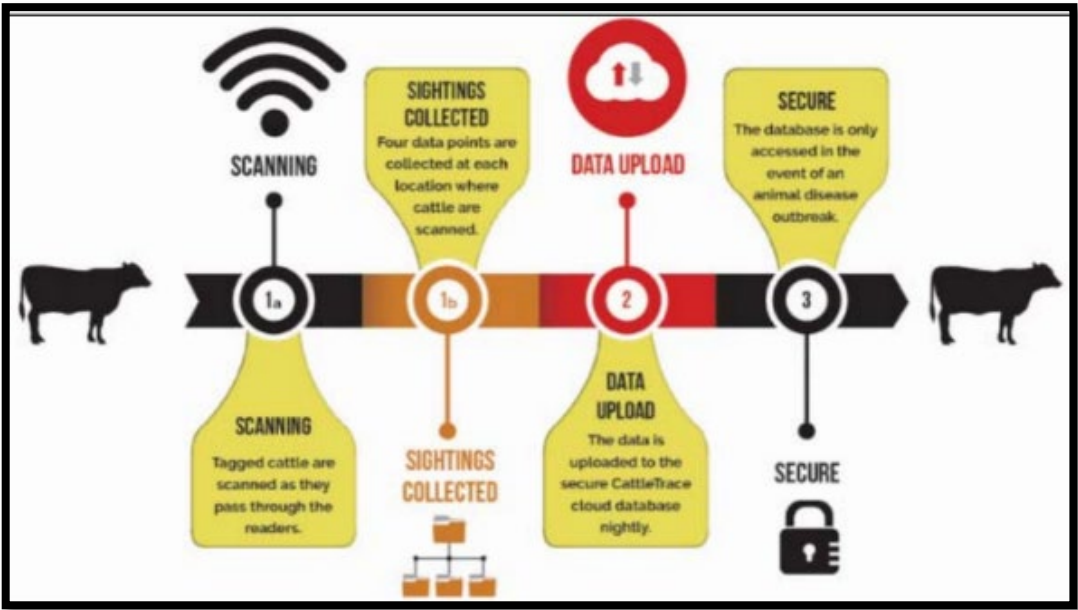
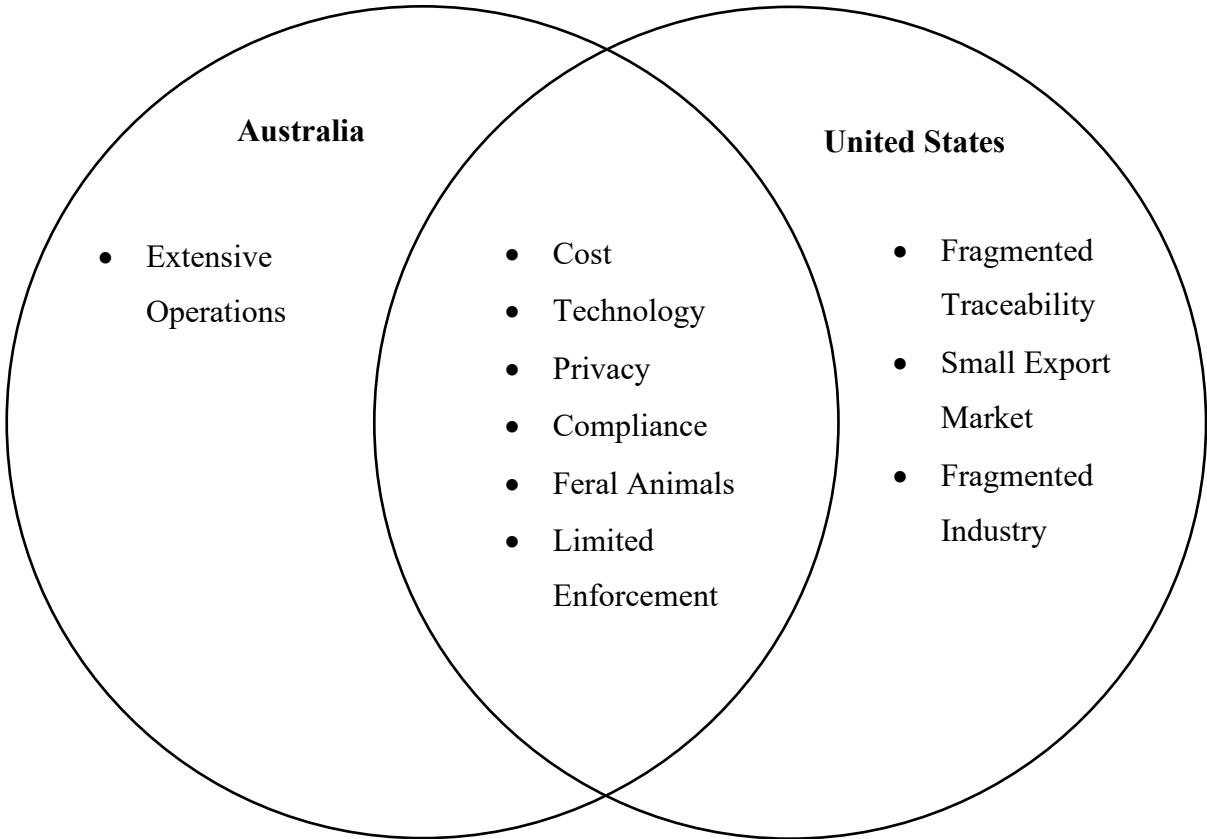


Figure 10: USCattleTrace RFID Data Collection Process

5.0 Limitations

Various limitations prevent the expansion and adoption of traceability systems both in Australia and the U.S. The main sources of limitations identified through primary and secondary research were:



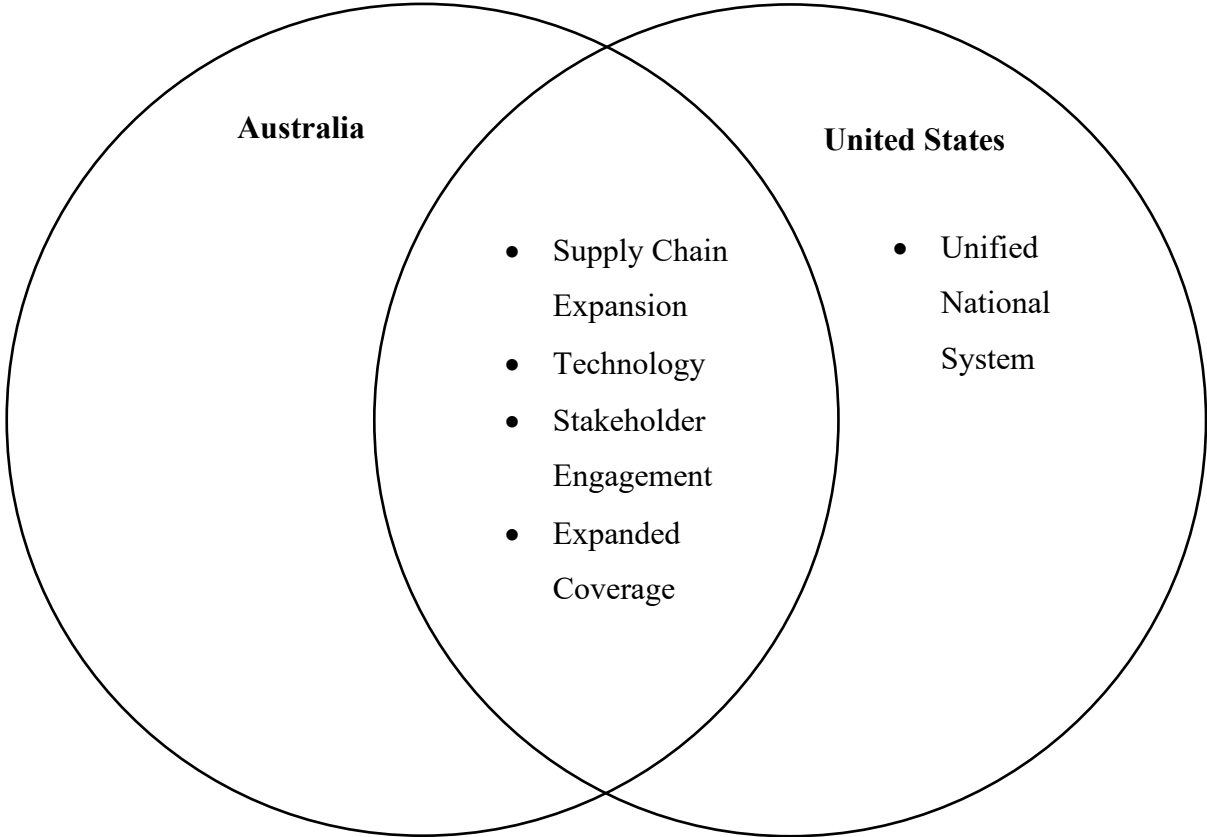
Limitations	Australia	United States
Cost	<ul style="list-style-type: none"> • Often it is a requirement to purchase technology such as ear tag identification, and reader technology if applicable 	
Technology	<ul style="list-style-type: none"> • RFID, EID tags and readers can be unreliable and difficult to use, causing delays and inaccuracies in the tracking process 	
Privacy	<ul style="list-style-type: none"> • Many producers are hesitant to provide the government with information about their business • Government overreach is a particular concern in the U.S. 	

<p>Compliance</p>	<ul style="list-style-type: none"> • Producers may resist implementation and progression of traceability systems due to concerns about the additional regulatory burden it places on their business • Compliance to traceability record-keeping and reporting can be time consuming and costly to producers 	
<p>Feral Animals</p>	<ul style="list-style-type: none"> • Feral animal movement and interactions with livestock across properties is not traced • This increases the risk of disease, causing inaccuracies and challenges in identifying and controlling outbreaks • Cause damage to property and infrastructure like fences, further disrupting traceability systems 	
<p>Limited Enforcement</p>	<ul style="list-style-type: none"> • Limited resources available for enforcement can make it challenging to monitor all transactions and livestock movements • Private cash transactions and unregulated slaughter can further complicate the process of achieving a comprehensive traceability record of all livestock 	
<p>Extensive Operations</p>	<ul style="list-style-type: none"> • Extensive cattle stations in northern Australia typically undertake less intensive management strategies • Animals may not be tagged until they are mustered which means they can spend years on a property without clear traceability • Undefined boundaries and broken fences can result in livestock wandering between properties, further reducing traceability accuracy 	<ul style="list-style-type: none"> • Smaller herd sizes and properties reduce the risk of this in the U.S., however, still a slight limitation

<p>Fragmented Traceability</p>	<ul style="list-style-type: none"> • NLIS reduces this limitation • Still potential for supply chain and species expansion for NLIS 	<ul style="list-style-type: none"> • Lack of a unified national system makes it difficult to track animals across state and industry boundaries
<p>Small Export Market</p>	<ul style="list-style-type: none"> • Australia exported approximately 72% of red meat in 2022 (Meat & Livestock Australia, 2022) • Traceability must be used to meet export regulations 	<ul style="list-style-type: none"> • U.S. beef market is primarily domestically consumed with only approximately 15.2% of U.S. and variety meat production being exported in 2022 (U.S. Meat Export Federation, 2022) • Reduces the need for traceability to meet export regulations
<p>Fragmented Industry</p>	<ul style="list-style-type: none"> • Average cattle herd size in northern Australia is 1576 head (Australian Competition and Consumer Commission, 2019) • Larger operations with more capital at risk in the event of a disease outbreak, food safety issue etc. 	<ul style="list-style-type: none"> • Highly fragmented, with many small producers • Average beef herd size in U.S. is approximately 44 head (USDA Economic Research Service, 2022) • Less incentive to adopt traceability • Makes it difficult to establish and enforce uniform traceability requirements due to range of production methods and practises

6.0 Opportunities

Various opportunities exist that can improve livestock traceability in both Australia and the U.S. Some of the main opportunities identified through primary and secondary research were:

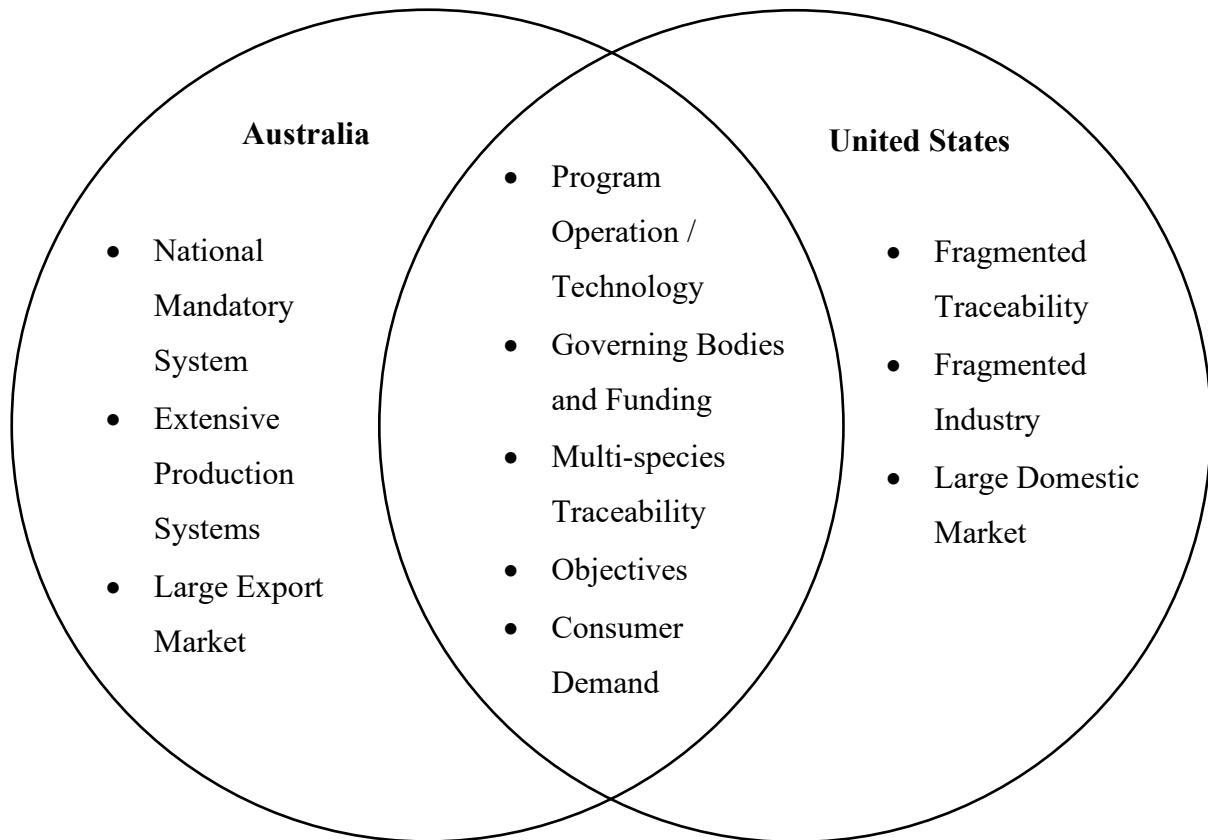


Opportunities	Australia	United States
Supply Chain Expansion	<ul style="list-style-type: none"> Systems like the NLIS or ADT could be expanded to include animal-related products such as packaged meats, wool, and leather 	
Technology	<ul style="list-style-type: none"> Technological advancements will lead to a more reliable system increasing the accuracy of data collected Increased automation could be used to reduce the burden on farmers and other industry stakeholders 	

<p>Stakeholder Engagement</p>	<ul style="list-style-type: none"> • Collaboration and frequent communication with industry stakeholders will ensure the system remains relevant and effective to the producer’s needs 	
<p>Expanded Coverage</p>	<ul style="list-style-type: none"> • Animal Health Australia is looking to create traceability systems to cover a wider range of animals such as camels, camelids, and deer • Could be expanded to cover these animals as well as other production and domestic livestock such as horses • Traceability can also be used to track other factors such as sustainability throughout the supply chain 	
<p>Unified National System</p>	<ul style="list-style-type: none"> • NLIS has captured the associated advantages of a unified national system • Could be expanded further across supply chain and animal classes (horses, deer etc.) 	<ul style="list-style-type: none"> • Develop one mandatory traceability system that covers all production animals across all states • Improve consistency, efficiency of traceability across supply chain

7.0 Summary of Findings

Upon comparing the livestock traceability systems used in Australia and the U.S., several key similarities and differences were identified as seen below:



Australia and U.S. share similar livestock traceability systems from birth to slaughter. Both countries utilise common technologies, such as EID, RFID, and visual identification tags, alongside a central database to track animals’ movements throughout the supply chain. The management and funding of traceability programs in both countries are predominantly led by industry stakeholders and government agencies, with systems covering multiple species.

Traceability objectives in both countries are also aligned, with a shared aim to enhance biosecurity, food safety, quality assurance, animal welfare and market access, while meeting increasing consumer demand for product transparency. Despite shared limitations, such as privacy concerns and costs to producers, both countries have opportunities for traceability improvement through stakeholder engagement to remain relevant and technology advancements to improve operating efficiencies.

The main difference identified between the two countries is the absence of a national mandatory traceability system, like Australia's NLIS, in the U.S. This difference can be attributed to factors such as a fragmented industry with small production herds that are often considered hobby farms or operations in the U.S. As a result, the financial risk for the average producer in the U.S. is not as significant as in Australia, which leads to a lower incentive to adopt appropriate traceability measures to mitigate biosecurity threats. Additionally, the U.S. has a large domestic market, which reduces the need for producers to meet additional export rules and regulations associated with livestock traceability. Concerns about government overreach and information security was also a large contributing factor to poor producer perception towards traceability systems in the U.S.

8.0 Conclusion

After conducting primary and secondary research, it is clear that livestock traceability in Australia and the U.S. are quite similar in terms of both their operations and objectives. One key advantage that Australia has over the U.S. is the implementation of a single mandatory national system (NLIS) that spans across all states and multiple species. The NLIS provides consistency in identifying and managing disease outbreaks, as well as accessibility to crucial information. However, it is important to note that while livestock traceability from birth to slaughter is important, it only represents one aspect of the supply chain. The U.S. may have a more comprehensive and accurate system of food and animal product traceability from slaughter to the consumer. To fully understand the differences and advantages of each country's traceability system, further research is needed in these areas.

9.0 Bibliography

Animal Health Australia. (2021). Traceability. Retrieved from [https://animalhealthaustralia.com.au/traceability/#:~:text=NLIS%20is%20Australia's%20system%20for,property%20identification%20code'%20\(PIC\)](https://animalhealthaustralia.com.au/traceability/#:~:text=NLIS%20is%20Australia's%20system%20for,property%20identification%20code'%20(PIC))

Animal Health Australia. (2021). NLIS for various species. Retrieved from <https://animalhealthaustralia.com.au/nlis-for-various-species/>

Australian Competition and Consumer Commission. (2017). Cattle and beef market study: Final report. <https://www.accc.gov.au/system/files/ACCC%20Cattle%20and%20beef%20market%20studyFinal%20report.pdf>

Australian Pork Limited. (2022). Pig Identification. Retrieved March 19, 2023, from <https://australianpork.com.au/sites/default/files/2022-04/FACT-SHEET-Pig-Identification-web-2022.pdf>

Canadian Food Inspection Agency. (2022). Animal traceability. Retrieved from <https://inspection.canada.ca/animal-health/terrestrial-animals/traceability/eng/1300461751002/1300461804752>

Crowd Cow. (2023). The marketplace for craft meat. <https://www.crowdcow.com/>

Department of Agriculture, Water and the Environment. (2022). National traceability. Retrieved from <https://www.agriculture.gov.au/biosecurity-trade/market-access-trade/national-traceability>

Hird, D. W., Paul, D. M., & Wong, T. S. (1997). Review of the literature on animal health information systems and traceability. *Preventive Veterinary Medicine*, 30(1), 1-13. doi: 10.1016/S0167-5877(96)01107-1

Integrity Systems Company. (2022). NLIS standards. Retrieved from <https://www.integritysystems.com.au/identification--traceability/nlis-standards/>

Kaur, H., & Gupta, A. K. (2011). Livestock Identification and Traceability. In P. L. P. Wong (Ed.), *Livestock Production* (pp. 497-514). IntechOpen. <https://doi.org/10.5772/17220>

Kumar, R., Joshi, A., & Singh, R. (2017). Livestock traceability: An overview. *International Journal of Livestock Research*, 7(2), 1-6. doi: 10.5455/ijlr.20170201095456

Meat & Livestock Australia Limited. (2023). Ear tagging and ear marking. Retrieved from <https://www.mla.com.au/research-and-development/animal-health-welfare-and-biosecurity/husbandry/ear-tagging-and-ear-marking/#:~:text=National%20Livestock%20Identification%20System,-The%20NLIS%20is&text=NLIS%20devices%20for%20cattle%20can,or%20an%20RFID%20ear%20tag>.

Meat & Livestock Australia. (2022, March 7). Global markets export wrap. <https://www.mla.com.au/news-and-events/industry-news/global-markets-export-wrap/#:~:text=As%20a%20result%2C%20exports%20represented,meat%20production%20over%20the%20year>.

National Livestock Identification System. (2023). Our partners. Retrieved March 19, 2023, from <https://www.nlis.com.au/#/partner-list>

National Pork Board. (2023). Secure Pork Plan. <https://www.securepork.org/>

Ni, B., Wang, Y., Zhang, H., & Xu, L. (2015). Design and implementation of a beef cattle traceability system based on RFID and internet of things. *Journal of Animal Science and Biotechnology*, 6(1), 1-10. doi: 10.1186/s40104-015-0019-6

Noble Research Institute. (2013, May 23). New animal identification rules aid disease traceability. *Ag News and Views*. <https://www.noble.org/news/publications/ag-news-and-views/2013/may/new-animal-identification-rules-aid-disease-traceability/>

The Woolmark Company. (2023). About. <https://www.woolmark.com/about/#:~:text=We%20are%20the%20world's%20most,representing%20pioneering%20excellence%20and%20innovation>.

The Woolmark Company. (2023). Certification. <https://www.woolmark.com/industry/certification/>

United States CattleTrace. (2021). Resources. Retrieved March 19, 2023, from <https://www.uscattletrace.org/resources>

United States Department of Agriculture Animal and Plant Health Inspection Service. (2022). Animal Disease Traceability Performance Standards Report: 2013-2022. Retrieved March 19, 2023, from <https://www.aphis.usda.gov/traceability/downloads/adt-trace-perf-report-2013-2022.pdf>

United States Department of Agriculture Animal and Plant Health Inspection Service. (2020). Brucellosis Eradication Program. Retrieved March 19, 2023, from <https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/cattle-disease-information/national-brucellosis-eradication/brucellosis-eradication-program#:~:text=The%20goal%20of%20the%20National,testing%20in%20the%20United%20States.>

U.S. Department of Agriculture, Economic Research Service. (2022). Cattle/beef sector at a glance. <https://www.ers.usda.gov/topics/animal-products/cattle-beef/sector-at-a-glance/#:~:text=Beef%20cows%20graze%20on%20forage,herd%20is%20about%2044%20head.>

United States Department of Agriculture Animal and Plant Health Inspection Service. (2020). NAIS User Guide. Retrieved March 19, 2023, from <https://www.aphis.usda.gov/traceability/downloads/NAIS-UserGuide.pdf>

United States Department of Agriculture Animal and Plant Health Inspection Service. (2019). Scrapie: A Guide for Sheep and Goat Owners. Retrieved March 19, 2023, from https://www.aphis.usda.gov/animal_health/animal_diseases/scrapie/downloads/fs_ahscrapie.pdf

U.S. Meat Export Federation. (2023). FAQ. <https://www.usmef.org/about-usmef/faq/#:~:text=U.S.%20beef%20export%20value%20equated,production%20was%20exported%20in%202022.>

Wisconsin Department of Agriculture, Trade and Consumer Protection. (2012.). Scrapie: An overview of the disease and the NSEP. <https://datcp.wi.gov/Documents/ScrapieAnOverviewoftheDiseaseandtheNSEP.pdf>