

US SHIP: Traceability Systems In Other Pork Export Markets

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Executive Summary

Using the Oxford Language Dictionary, Google defines traceability as ‘the quality of having an origin or course of development that may be found or followed’. Traceability is a ‘blanket’ term as it might involve logistic and/or attribute contexts. The primary goal of the four pork traceability systems evaluated (Australia, Brazil, Canada, and Denmark) were to have logistic traceability of pigs from origin to destination, but some systems had additional aspects that supported attribute-based traceability.

Traceability has three different components: 1) the data that is required to have for tracing; 2) the data entry process and storage or repository of the data; 3) and the governance of the system including the security and access, the enforcement and verification methods. All four traceability systems had a single, central repository that the federal animal health officials could access. Some had precursor repositories for different uses before the data flowed to the central national repository, whether that was local and state repositories as in Brazil, or it was the logistic and attribute-based industry-maintained repository in Australia. Brazil also has an industry-based system, built on top of the municipal systems, to certify attribute traceability, although it has not yet been used for pork.

Balancing the needs and wants of all stakeholders is crucial for the success of any system. The goal of a traceability system is to build trust. A perfect system is not required, but participation in the system is.

A 4-part video series was created to share major findings on traceability across other pork exporting countries. A playlist can be found on YouTube or by using this QR code, with the following title:

1. [What is Traceability?](#)
2. [The Components of a Traceability System](#)
3. [Exploring Traceability Systems](#)
4. [Data Entry, Management, and Governance](#)



Introduction

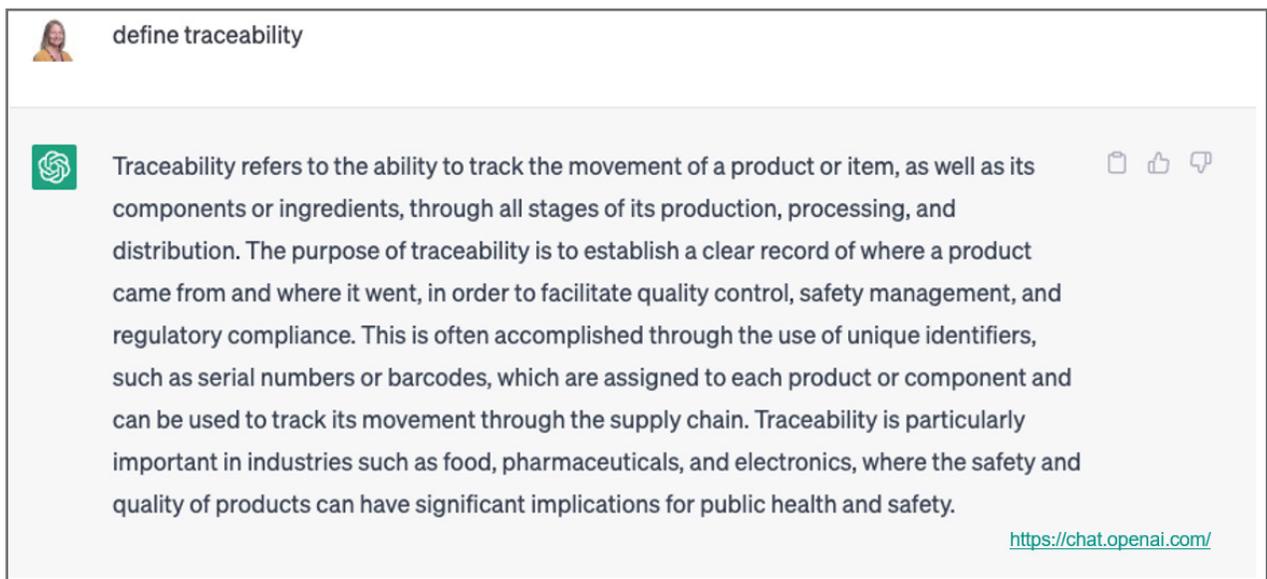
This report builds on the preliminary work of Trevisan, et. al., submitted to the House of Delegates (HOD) in 2022, and is in response to the HOD resolution 2022 – 1 initiative # 2, with the directive to complete a more in-depth study and review of the various approaches and systems being implemented in the various pork exporting countries around the world that are currently meeting this prescribed inter-premises movement of swine reporting.

This report will further define traceability, discuss the general components of a traceability system and compare the components of the traceability systems in four pork exporting markets: Canada, Denmark, Australia, and Brazil.

Traceability: Definition

Google, using the Oxford Language Dictionary, defines traceability as ‘the quality of having an origin or course of development that may be found or followed’. This definition references 2 contexts of traceability. The first, is on the basis of logistic traceability of a product from an origin to its present location or destination. The second context is on the basis of attribute traceability or having the ability to follow a product in its development or through a process. A more detailed definition retrieved from ChatGPT is shown in figure 1.

Figure 1: 2023 ChatGPT definition of traceability



The ChatGPT longer definition supports the logistic context of traceability as ‘the ability to track the movement of a product or item’. It goes on to propose that the purpose of traceability is to ‘establish a clear record’ to ‘facilitate quality control, safety management and regulatory compliance’. An everyday example of logistic traceability is in regard to grocery products where universal product codes (UPCs) and batch numbers are used to trace and identify products. This system allows goods to be traced from manufacture through distribution and potentially even on to the end consumer in the event of a food safety or other product quality issue. A real-world example of logistic traceability is a dog treat recall. Consumers may learn of a product recall in the news and then, if they purchased that product for their pet, they could review the UPC and the batch number on the back of the package to understand if their purchased product is a part of the recall. If it is, they may follow the instructions with the recall, but if it is not, they can now have

confidence in the product and the working traceability system. Alternatively, if the consumer used a store rewards card or credit card for the purchase, the grocer may also be able to contact the consumer and inform them that they may have a product that is a part of the recall. This further improves the traceability of the product from the grocer to the end consumer and builds trust in the traceability system.

The ChatGPT definition does little to address the second context of traceability above, attribute traceability. Pork traceability systems that include attribute traceability, or the ability to trace processes or practices to support product or brand claims, may also have a role alongside logistic traceability. Attribute traceability may involve things beyond logistics such as management practices, quality assurance certifications or sustainability parameters. For US producers, practices like “no antibiotics ever” and adhering to California’s Proposition 12 are just two examples. Outside of pork, the Swedish furniture retailer, Ikea, famous for their flat-pack wood furniture, brings a real-world example of an attribute traceability system with their sourcing of lumber. It was not only important to know where the lumber was sourced from, but consumers also wanted to know that it came from responsibly managed forests. For this aspect of traceability, Ikea requires that all wood sourced for their products either be recycled wood or certified by the Forestry Stewardship Council, an international non-governmental organization that certifies and verifies forestry practices. Ikea has also put in place their own internal team to further spot-check and verify the certification processes of the council.

Whether the goal of a traceability system is to track the movement of an item, or a practice used in the production of an item, the purpose of the system is to improve consumer confidence by building and maintaining the consumer’s trust.

The pork traceability systems in Canada, Denmark, Australia, and Brazil have different goals.

- In Canada, their federal system, PigTrace, states as their goal ‘to ensure and protect the prosperity and peace of mind for the Canadian pork industry and its consumers’.
- In Australia, the Australian PigPass wants to be able to act in the event of a disease outbreak, but it also aims to provide assurance to consumers.
- Denmark has a straightforward goal of veterinary preparedness.
- In Brazil, they have both state and federal government programs for veterinary preparedness, but beyond the government, the industry also has a multi-industry collaborative group that wants to give international traders additional health information beyond what the Brazilian government is giving. Specifically, they are trying to build greater confidence in Brazil’s exported products.

With these stated goals, there is always a desire for logistic traceability, but some systems also desire attribute traceability as well. The four different export markets have different goals for their traceability systems; therefore, the design of their systems varies in order to serve their objectives.

The Components of a Traceability System

Traceability systems have three primary components: 1) the data; 2) the data entry and storage or repository for the information; and 3) the governance of the data and its use. The following sections will break down these three components and compare them in the four markets.

The Data

The data component of a traceability system consists of the fields, and the required format of the fields, to be captured and recorded. Table 1 compares the different fields required by information category including locations, date/time, transport, animals, and reporting person.

All four markets require some information about the origin and the destination of the movement.

In Canada, it is simply the individual site IDs that are required. This equates to premise IDs in the US. In other cases, more location information is needed such as the address or even the owner's taxpayer number.

Three of the four markets require some information about the transportation of the animals for the movement. This may include information as simple as the license plate number, or further details such as the name of the person transporting the animals and whether the truck was clean or not. All markets require information about the animals transported. Again, this information can be as simple as the number of animals moved, or may require further details like the IDs, type, age or gender of the animals or any withholding period information. Finally, Denmark and Brazil also require information identifying the person reporting the movement information.

Table 1: Summary of data fields used as part of a pork traceability system by country and information category.

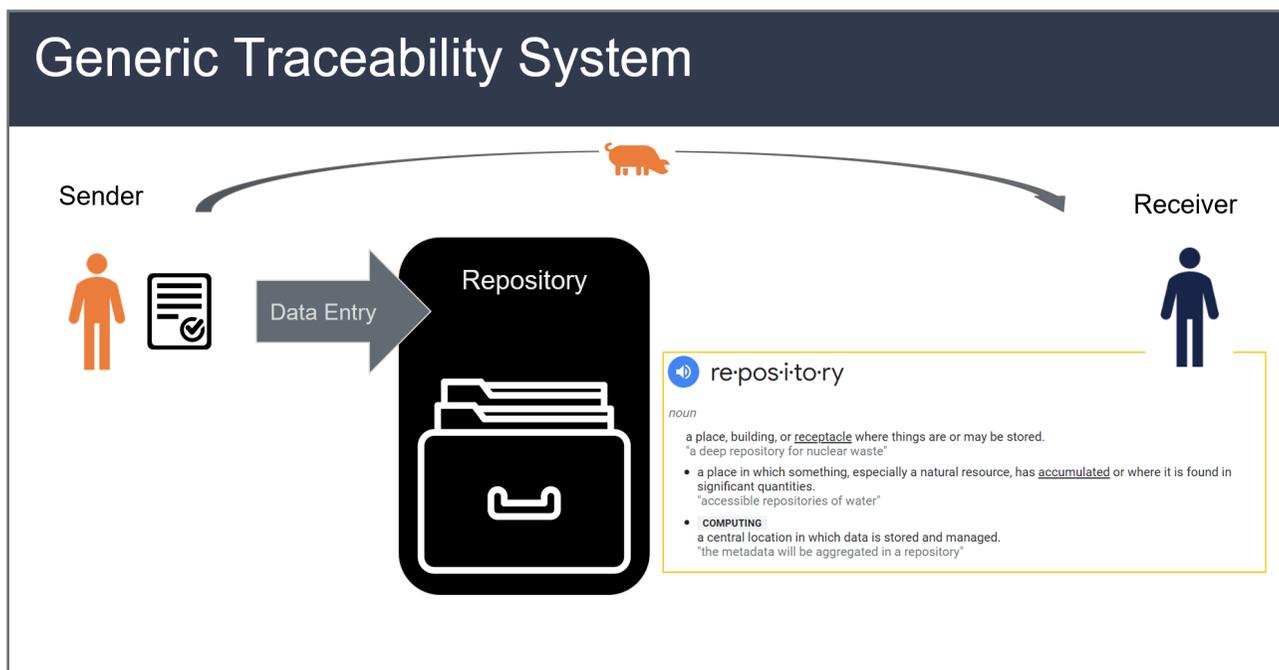
	Canada	Denmark	Australia	Brazil
Locations	Origin & Destination: ID	Origin & Destination: Country Code, CHR#, Address, Crew#	Origin & Destination: Name, Property ID, Address, Phone Origin: Name of person responsible for husbandry Destination: Type of facility, Signature	Origin & Destination: code, name, livestock exploitation code, Owners - CPF/CNPJ (taxpayer#), Owners name, Municipality and federation unit. Origin ONLY: symbol of establishments brand name
Date/Time	Departure OR Arrival date/time	Date of report	Carrier: Load and unload date and time, Ambient Temp at load	Date of issue
Vehicle Info	License plate	Country Code Registration # on carriage & trailer + any trailer used for trans shipment	Carrier: Registration number, Y/N trucks clean, Name, Signature, Phone	License plate
Animal Info	# loaded OR unloaded ID's if applicable	# Animals or Deadstock	#, Gender, Type, Duration on origin property, Withholding period Information	#, Gender, Age or Category, Aptitude and product when applicable, Purpose of transit
Reporter		Logon ID		ID, Place of issue

Although these fields are the listed fields required for each movement, this list may not represent all the information available about each movement. For instance, although Canada doesn't explicitly capture the reporter of the information, the way the data is captured or entered may contain information able to identify the reporter. This will become clearer with the explanation of the second component of a traceability system, the data entry and repository.

The Data Entry and Repository

Once the required information has been established, the next step is to establish a process, or multiple processes, to capture that information and store it. Figure 2 depicts part 1 of a generalized traceability system. The schematic depicts a movement of pigs between the sender of the pigs and the receiver of the pigs. The sender is the first person with information about the movement and would be a logical place to begin data entry. The place where the information is entered and stored is known as a repository and can be thought of like an organized file cabinet. A repository can be as complicated as an accounting software platform or as simple as a .csv file with a column for each field captured where each row is a single individual movement. With this generalized schematic in mind, the next sections provide more detail about the data entry and repositories for each of the four markets

Figure 2: Schematic of a generalized traceability system (Part 1)



Canada

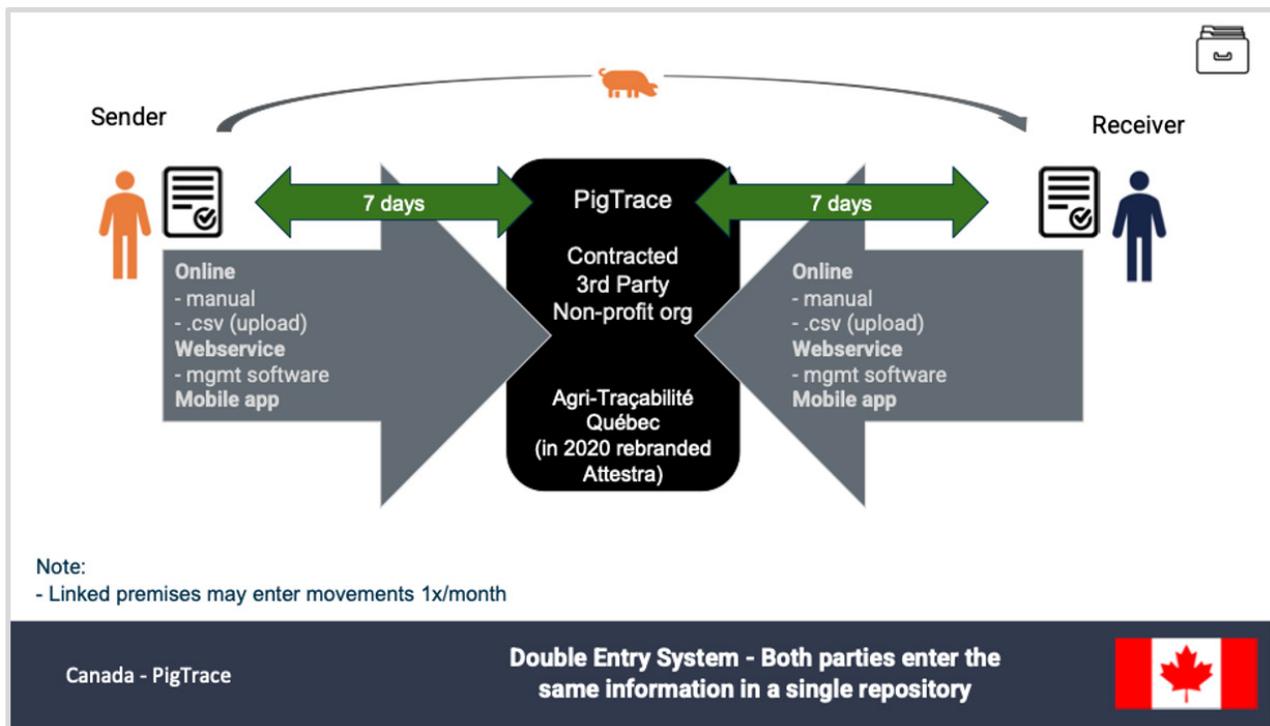
Beginning with the data entry, PigTrace Canada has several different ways for producers to enter the data. Data may be manually entered individually, online or in the mobile app. Alternatively, several movements may be entered at one time with a .csv file of the movement information uploaded to the online platform. Additionally, there is the ability to have web service connections to the repository, which is a direct, one-way connection between the individual producer's management software platform and the repository. This means that once the information was entered into the producer's existing software that the information could be easily transferred into the repository without re-typing the information.

As the schematic depicts in Figure 3, the same data entry arrows from the sender are also illustrated coming from the receiver. The Canadian system is a dual entry system where both sides of the movement enter all the information. At 100% compliance, the repository would contain 2 entries for every movement. Both parties in this system have seven days to enter the

information, but there is a condition where a producer may set up ‘linked premises’ that have frequent movements between premises, where movements can be reported just one time per month.

The repository used for the PigTrace system is a single national repository operated by the contracted 3rd-party, Attestra, formerly Agri-Traçabilité Québec.

Figure 3: Schematic - PigTrace Canada double entry, central repository traceability system



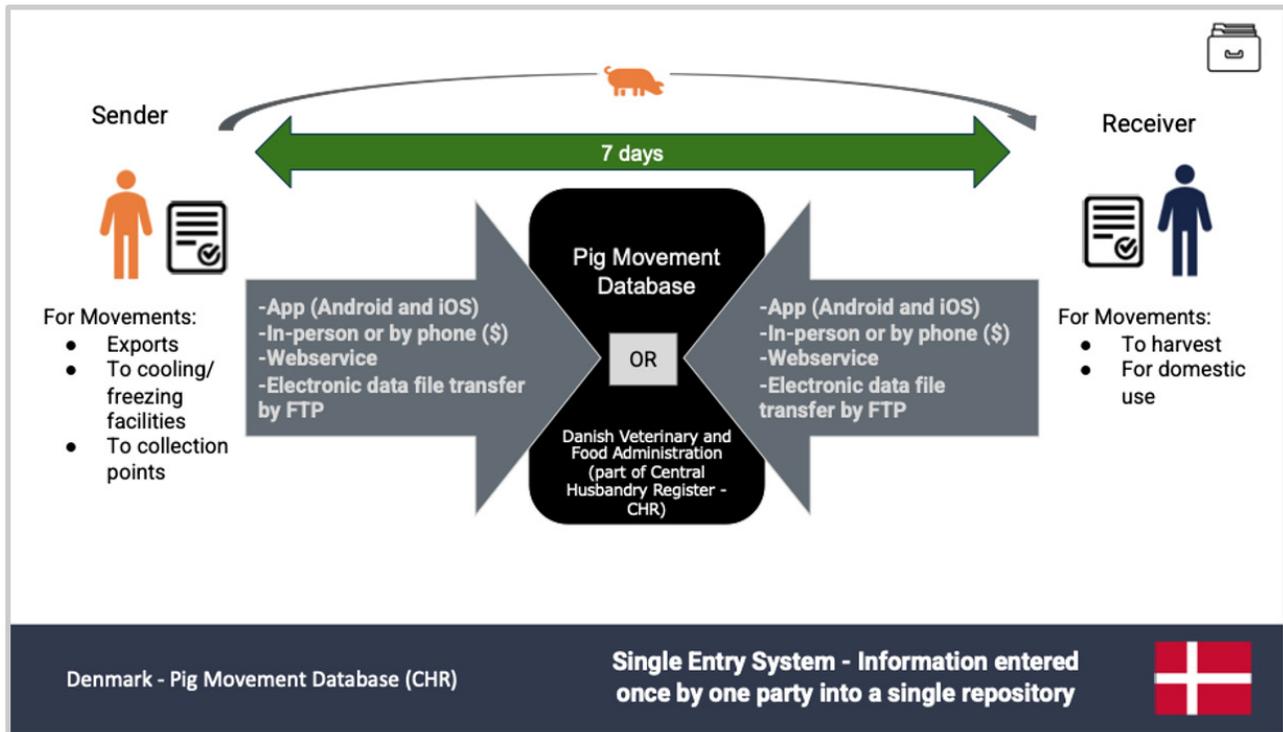
Denmark

In the Danish Pig Movement Database (CHR), the data entry can also occur in many ways. There is an Android and iOS app for movement data entry. There is also the ability to enter a movement in person or by phone, for a nominal fee. There is a web service, as well as the ability to set up electronic data file transfers if a producer wants to set up a direct connection to their system.

Although the schematic in figure 4 depicts data entry arrows originating from both the sender and the receiver, the CHR is a single-entry system where either the sender or the receiver enters the information depending upon the type of movement. For export movements, the sender enters the information. For movements to cooling or freezing facilities or to collection points, again, the sender enters that information. For movements that go to harvest or are from farm to farm within the country for domestic use, the receiver is responsible for the entry of the information. This results in the information for each movement being entered once by one party into the repository. Both parties have seven days from the date of the movement to enter the information.

The repository for the Pig Movement Database is a single national repository operated by the Danish Veterinary and Food Administration. The repository is a part of the Central Husbandry Register or CHR.

Figure 4: Schematic – Danish Pig Movement Database single entry, central repository traceability system



Australia

In the past, Australia had and continues to still use a three-part form to collect movement information. These triplicate forms utilized a carbon copy system where the pressure of writing on the top page transferred writing, although more faintly, to the remaining pages in the document. In this case the top page was pink for the sender, the middle green for the carrier and the bottom white for the receiver. Each party, the sender, the carrier and the receiver, has their own section of information to fill out to complete the record and a copy to retain for their own records. Australia's PigPass system allows the use of the paper forms, but also mimics the forms in a digital capacity with data entry by mobile app.

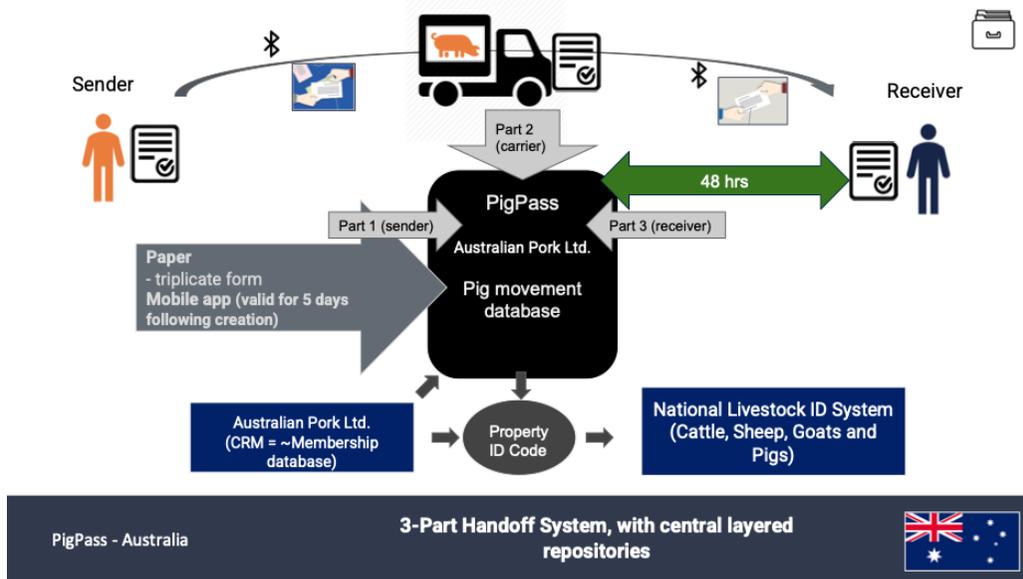
If using the form, the process begins with the sender completing the top part of the form and tearing off their pink copy to retain for their records, while passing the rest of the document to the carrier. If instead the sender uses the app to enter their information about the movement, they can use their mobile device to Bluetooth sync that information to the carrier's device when both have the app open and are in proximity. The carrier continues with their section on the form or in the app entering information at the sending site and entering more information at the receiving site. Once they've completed their section, then they can do the Bluetooth final pass off to the receiver. The receiver completes their section and signs off that all the information is correct by form or app.

The sender may start recording a movement up to 5 days before the movement begins. The carrier continues the record of the movement at the time of the movement. The receiver then has 48 hours to complete and submit the movement record.

All movement information enters the single national PigPass repository. The repository is

operated by Australian Pork Ltd, the national pork industry group. They manage the movement database alongside a membership database that has more information about the ownership and relationship of property ID codes. They then pass the movement information on to the National Livestock ID system, where there is national level traceability for all livestock logistics used for veterinary preparedness of foreign animal diseases and for other governmental programs.

Figure 5: Schematic – Australia’s PigPass 3 part handoff single entry, central layered repository traceability system



Brazil

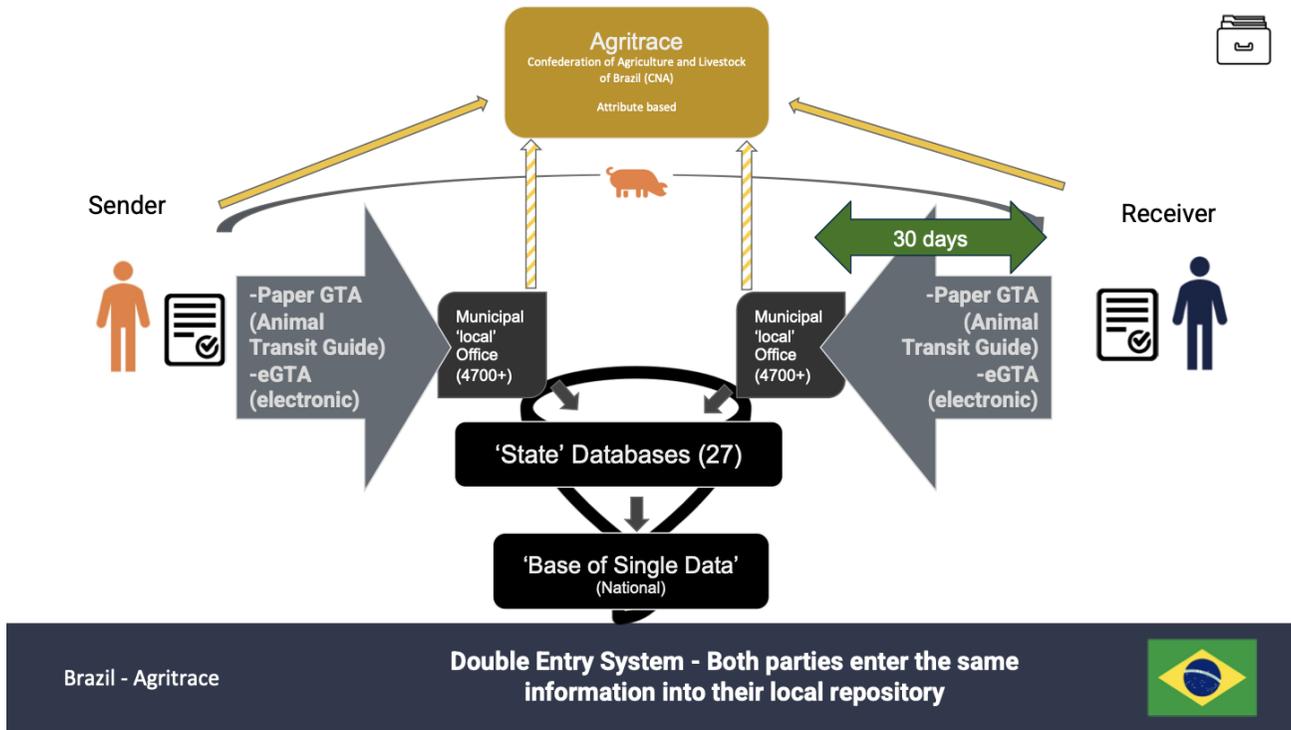
Brazil has a double entry system where both the sender and the receiver complete an Animal Transit Guide (ATG). There is both a paper copy or an alternative electronic version. Both are entered into a repository at the local municipal office. There are more than 4700 municipal offices throughout Brazil.

Brazil has a layered repository structure where the information from the municipal offices is then transferred to one of the 27 state databases. Those state databases then pass the information to the national database, loosely translated as the ‘base of single data’. This database is used at the federal level for governmental programs. As Brazil is a double entry system, both sender and receiver may enter the information into a single local office or different local offices depending on their locations. The sender enters prior to the movement, while the receiver has up to 30 days from the date of the movement for entry. This is similarly true at the state level. Only at the National level, if the system was 100% compliant, would every movement have both the sender’s and receiver’s entries.

The state and federal system meet the desire for logistic traceability, but Brazil also has an additional traceability system at the ready for attribute based information. In this system, the information that is required governmentally at the municipal level may also be moved into a parallel system called Agritrace. Agritrace is managed and maintained by the Confederation of Agriculture and Livestock of Brazil as an export market traceability system. The system not only

has the movement data that the municipal government requires, but it can also capture additional attribute based information that goes beyond the information that the government collects but that export markets may require. The system currently only has programs that support attribute based certification for beef exports, but if an attribute verification process was desired to increase the value of Brazilian pork exports, the system template is already in place.

Figure 6: Schematic – Brazil’s double entry, multi-layered repository traceability system



Comparison: Data entry and repository systems

Each export market has multiple routes for the data to be entered in the system with all of them having an electronic option. Several markets have entry methods that may cater to specific producer types. For Large producers with many movements or the same movement repeated frequently, there's often ways to batch movements into the repository or to have a direct connection to the repository. Smaller producers or show pig producers may prefer options to enter information by phone or form. In Australia and Brazil digital data entry systems have mimicked the legacy paper-based systems while still maintaining the paper forms, thus easing the adoption process over time. Improving the ease of data entry into a repository for the different producer types should garner both faster and more broad participation throughout the industry.

Both single entry and double entry systems were utilized. Canada and Brazil both used a double entry system where, with 100% participation, each movement would be entered twice. The disadvantage of a double entry system is the double burden of the entry process on both sender and receiver. But double entry systems have an advantage in the ability to more thoroughly audit and verify the process as it is unlikely that both parties would not enter information. Although an audit process is possible with a double entry system, no documentation mentioning a process in either Canada or Brazil was found. Denmark's and Australia's single entry system eases the burden of the data entry process, but might make it more difficult to verify and audit. Later

sections of the paper will discuss this point further.

There is a wide range of time allowed between the time of the movement to data entry particularly from the receivers of pigs, from 48 hours in Australia to 30 days in Brazil. The time allowed would most definitely impact the readiness to respond in the case of a foreign animal disease or other food safety concern. Systems should weigh a short time frame to speed any necessary response with the ability and ease of participants to fully participate.

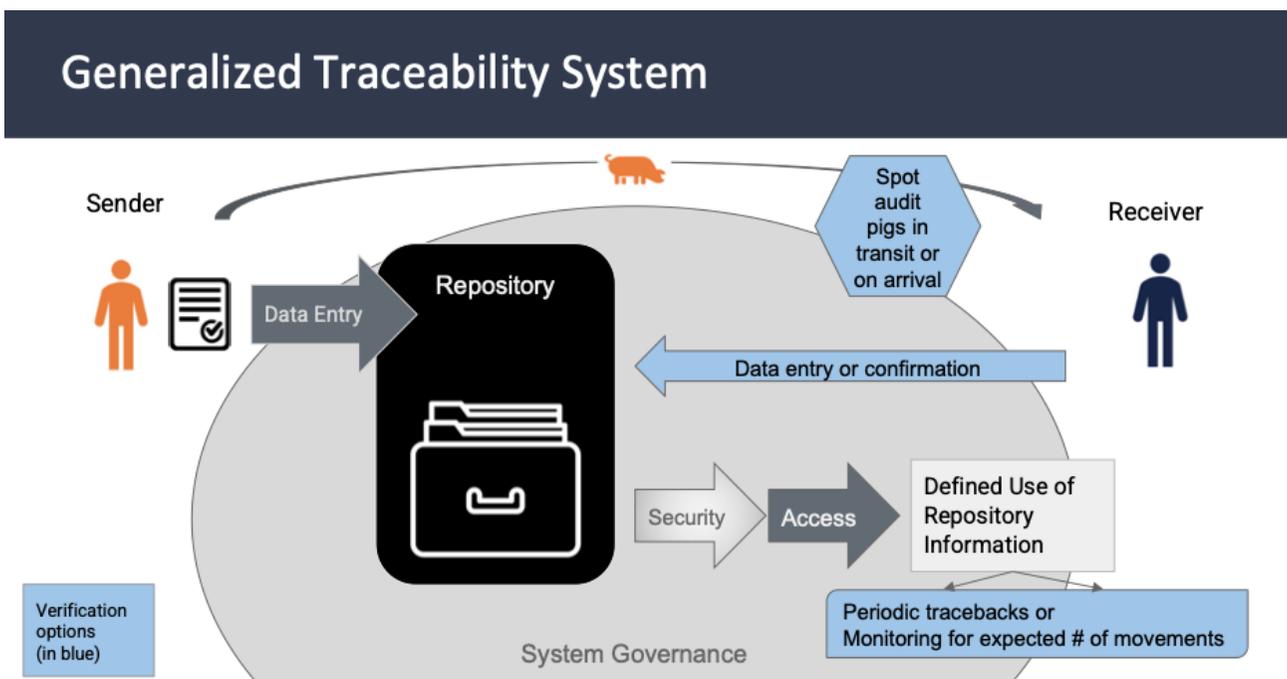
Each of these traceability systems result in all movement data added to a single repository that the National Animal Health officials can access. There may be a single central repository that the data is directly entered into, as in Canada and Denmark. Although an efficient means to capture, store and access the information, these systems may be considered a data security risk with all of a nation's movement records in a single place. Alternatively, the data may pass through one or more repositories, either for local or state logistic traceability use, as in Brazil, or for industry or trade attribute traceability use as in Australia and Brazil. Movement data may also be duplicated and/or augmented to support attribute traceability depending on export market requirements. Although these layered systems allow repositories to serve additional purposes on top of national logistic traceability, the passing of the information from layer to layer may also lengthen the time it takes for the information to enter into the national repository.

Governance

The final major component of a traceability system is the governance of the system.

Governance includes the security, access and use of the data, the enforcement of the process and management of proposed changes to the system and verification methods used to know that the system is performing as expected. Figure 7 illustrates these components in a generalized traceability system.

Figure 7: Schematic of a generalized traceability system (Part 2)



Data Security and Access

Data security is a large and increasingly complex field. The details of specific cyber security practices used within these systems are not published and are beyond the scope of this report. In two of the four export markets, Denmark and Brazil, a governmental organization maintained the data repository and it is presumed that those repositories would be held at the same data security standards as other governmental databases. Canada chose to outsource the maintenance, management and security of its repository to a 3rd party that specializes and has a track record of managing traceability data in industries throughout Canada. Australian Pork Ltd, the industry organization, manages and maintains the repository of pig movement data. Prior to the pig movement repository, the organization also maintained a separate membership database that includes information like premise ID, location and ownership information. It would seem that the industry group had the track record and confidence of the producers to house their information securely.

Often the security of data is improved by limiting access to it and by defining and limiting its intended use. Table 2 summarizes the accessing entities and the rationale for use by country.

The governmental repositories are often only accessible to governmental officials for the purpose of contact tracing, administration or enforcement of the program. In Canada's central repository federal inspectors have access to the information, while provincial inspectors may gain access with a signed data sharing agreement. They may also grant limited access to law enforcement if pertinent to a legal matter. The Brazilian governmental repositories are similarly accessible to governmental officials at the level of the layered repository: municipal, state or federal. Denmark's central repository is also accessible to authorities but the Danish repository allows other parties limited access. Registered producers have access where they may enter, edit or delete their own movements. Registered users may research movement to and from a known premise or CHR number but their research does not return sensitive information such as phone, email or physical address. The public may also access the repository to obtain aggregate information such as the animal density in locations across Denmark or to understand the countries where pork is imported or exported.

Table 2: Data access entities and rationales in four pork export markets

Governance - Security Who can access and why? 			
Canada 	Australia 	Denmark 	Brazil 
<u>Who?</u> Federal inspectors Provincial inspectors, with agreement Law enforcement, with cause.	<u>Who?</u> Australian Pork Ltd. (which grants access to others)	<u>Who?</u> Authorities Public Registered producers Registered users	<u>Who?</u> Local officials State officials Federal officials CNA
<u>Why?</u> - To administer the program. - To verify compliance to the program. - To enforce requirements.	<u>Why?</u> - To manage emergency disease outbreaks or food safety events - To track industry production volume trends - To verifying levy payment accuracy as a service to Govt stakeholders. - To operate and maintain the database	<u>Why?</u> - For contact tracing - For enforcement - To obtain animal density - To make understand import and export countries - To enter, edit or delete own movements - To research movements with a known CHR number (does not return phone, email or physical address)	<u>Why?</u> - For contact tracing - For program administration - To make available reports and information of public interest related to Brazilian agribusiness - To certify product meets customers desired quality attributes

The industry repositories in Australia and Brazil are similarly accessed by those organizations in order to operate and maintain their respective repositories. Brazil’s Agritrace, not yet used for pork, is accessed by organization personnel as a means to establish certification of desired attributes for a particular market. Australia’s repository may be accessed by Australian Pork Ltd personnel to manage disease outbreaks or food safety events that are not of a multi-species nature, like foot and mouth disease, and/or are not designated as federal concerns. PRRSV (Porcine Reproductive and Respiratory Syndrome Virus) or PEDV (Porcine Epidemic Diarrhea Virus) detection in Australia are examples of single species impact that may not warrant a larger federal response. The organization also accesses the data as a means to verify levy payments, known as indemnity payments in the USs, as a service to the Australian government. Further, the organization accesses the information to establish production volume trends nationally and they may use the information in the repository for research, marketing, industry development or policy development to further the Australian pork industry. Lastly, the organization accesses the repository to enhance and pass the data to the national livestock movement repository.

The System Enforcement and Changes

Generally, the enforcement of a movement traceability system is undertaken by a governmental body, a national entity in all except Brazil, where the individual states regulate and enforce the program. Most frequently, escalated non-compliance may result in fines or other legal action. In Canada, non-compliance is first managed with education on the program, where additional incidents may result in a letter from the Canadian Food Inspection Agency and then escalate to fines, where the dollar amount of the fine depends on the gravity of the offense. In Denmark, restrictions may be imposed on the farmer for non-compliance implying that no movements would be allowed and movement documents could not be issued until resolved. If further escalated, the producer may face legal action. One of the main enforcement measures used in

Australia is through enforcement at the abattoir where incomplete documentation could result in a penalty notice to the abattoir.

In all four countries, there is a national requirement to comply with the traceability program where the rules and regulations of the program are clearly stated. Changes to the program would require following governmental processes for the country in order to change policy. As Australia has an industry repository as a precursor to what is required by the national repository, it is theoretically possible that the industry organization could make changes or adjustments to the program, as long as the changes still met the requirements set out by the Australian government. The organization states that it ‘will from time to time make PigPass system improvements and changes to facilitate industry compliance with government regulations, and to improve traceability outcomes for the industry.’ It is presumed that any major changes to the system or system requirements for producers would follow their corporate governance process as defined in the Australian Pork Ltd constitution.

Verification Methods

Each traceability system requires a series of checks and balances to ensure that the system is working as intended. The Canadian system uses the repository information to estimate the number of pork producers participating against expected numbers. Additionally, the data may be used in provincial outbreak simulations. The Danish system has a series of automatic control systems to validate the information and follow-up on anomalies. They also have an annual confirmation or update of premise information. In Brazil, the more than 4,700 local agricultural health offices are responsible for maintaining updated farm information and compliance to the traceability program is regularly checked by independent inspectors. Australia’s 3-part hand-off system has checks and balances in place within the system including a unique serial number for each movement and the acceptance of information from the sender and the carrier by the recipient of the pigs. The system is also used to verify any government levy payments which acts as a financial incentive for participation and maintaining accurate information. Finally as mentioned previously, abattoirs are required to have complete documentation or face fines meaning movements without complete documentation would not be accepted for harvest.

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