

Comprehensive Feasibility Study: U.S. Beef Cattle Identification and Traceability Systems

Evaluation of Opportunities, Obstacles and Incentives
Across the U.S. Beef Industry Value Chain



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1. Executive Summary

World Perspectives, Inc. developed this report in response to the following Core Strategic Initiative and corresponding *critical and immediate need* identified in the Beef Industry Long Range Plan (LRP) 2016-2020:

Adopt Animal ID Traceability Systems – Secure the broad adoption of individual animal ID traceability system(s) across the beef community to equip the industry to effectively manage a disease outbreak while enhancing both domestic and global trust in U.S. beef and ensuring greater access to export markets. **Critical and immediate** [need]. Conduct a *feasibility study* to understand the economic opportunity of opening new and expanding markets (e.g., China) and the lost opportunity in the event of an animal disease outbreak.

In producing this *feasibility study*, WPI's team:

1. Collaborated with a Project Steering Committee made up of a broad coalition of industry leaders.
2. Developed key operational definitions for fundamental concepts.
3. Profiled nine foreign beef exporting countries' traceability systems.
4. Conducted a literature review.
5. Modeled export demand of beef exports from countries with traceability systems.
6. Conducted more than 90 qualitative interviews with industry stakeholders.
7. Gathered 600-plus quantitative survey responses.
8. Conducted a cost-benefit analysis on animal ID and traceability systems.
9. Identified opportunities and obstacles for the industry to consider.
10. Offered an objective assessment and conclusion.

This report details the obstacles and opportunities that lay before the U.S. cattle and beef industry regarding animal identification and traceability. While obstacles vary by industry segment from cow-calf producer through to packer, cost and liability are a common thread. Opportunities exist, however, to leverage additional value for the industry by enhancing domestic demand, expanding global markets, and, finally, managing catastrophic events such as animal disease outbreaks. In that regard, this report finds that continued proactive leadership towards a viable and credible animal identification and traceability system(s) will best serve the industry, rather than suffering the consequences of having a prescribed system imposed by government action – as was the case in many other exporting countries that now have animal identification and traceability systems.

Thus, based on the findings generated via WPI's comprehensive methodology, the following conclusions are made with regard to developing an approach to animal identification and traceability. The basic tenets of a system(s) are that it:

- ✓ Is industry driven.
- ✓ Is managed and overseen by an entity that includes both private and government interests.
- ✓ Maintains data privacy.
- ✓ Is equitable to all industry sectors.
- ✓ Is compatible with common industry practices.
- ✓ Operates at the speed of commerce.
- ✓ Is credible in domestic and international markets.

2. Study Background, Structure and Methodologies

Context and Rationale for Feasibility Study

The current Beef Industry Long Range Plan (LRP) 2016-2020, developed by a broad coalition of industry stakeholders, highlights the following Core Strategies and Strategic Initiatives:

Adopt Animal ID Traceability Systems – Secure the broad adoption of individual animal ID traceability system(s) across the beef community to equip the industry to effectively manage a disease outbreak while enhancing both domestic and global trust in U.S. beef and ensuring greater access to export markets. **Critical and immediate** [need]. Conduct a feasibility study to understand the economic opportunity of opening new and expanding markets (e.g., China) and the lost opportunity in the event of an animal disease outbreak.

In 2017, World Perspectives, Inc. (WPI) was contracted to conduct the feasibility study referenced in the industry's LRP and detailed above.¹ WPI, a U.S.-based agricultural industry market and policy consultancy, worked closely throughout the effort with a Project Steering Committee (PSC) made up of a diverse coalition of leaders from across the U.S. beef industry value chain. Note that the industry's strategy of adopting animal identification and traceability system(s) is clearly related to subsequent strategies identified in the LRP: **increase(d) market access and promotion of unique attributes of U.S. beef.**

This study was presented to stakeholder groups at the 2018 Cattle Industry Convention & NCBA Trade Show (January 31-February 2, 2018 in Phoenix, AZ).

Report Structure and Chosen Methodologies

WPI's team endeavored to produce a report that flowed clearly from the critical and immediate need identified in the industry LRP to a data- and information-based analysis on where the industry currently stands vis-à-vis animal identification and traceability. The final section offers an assessment of findings and concluding thoughts from WPI's team. Below is an outline of the report's structure and notes on the methodologies that contributed to the results detailed in each section.

→ **Operational definitions**

- a. Operational definitions are critical to data collection – both quantitative and qualitative – and thus the first step of this study. Via a series of listening sessions and collaborative discussions with the PSC, WPI's team developed operational definitions for the key concepts that are necessary to understand if the underlying critical and immediate need identified in the LRP is to be addressed. Concepts defined included: animal identification and traceability, nationally significant, and mandatory versus voluntary.

→ **Competitor system profiles**

- a. WPI's team conducted research into the animal identification and traceability systems that are currently mandated (and/or significantly complied with by beef industries) in select

¹ The feasibility study was commissioned by the National Cattlemen's Beef Association (NCBA).

foreign countries, both export markets and competitors. A total of nine (9) different systems were profiled and analyzed.

- b. Foreign country profiles were further vetted via direct outreach to industry stakeholders based in the profiled countries who reviewed WPI's research and advised on further issues. These stakeholders included beef industry association leaders.

→ **Literature review and demand modeling**

- a. There is a significant body of peer-reviewed economic analysis on animal identification and traceability in the U.S. beef industry. As such, WPI's team conducted a literature review, emphasizing the work done on traceability as it relates to instances of animal disease outbreak(s) as well as export market access.
- b. WPI's team developed an export demand model to showcase big-picture gains/losses associated with animal identification and traceability systems.

→ **Domestic industry outreach and findings**

- a. WPI's team conducted an extensive industry outreach effort featuring collaborative in-person and phone-based discussions with:
 - i. 23 state-based beef industry organizations.
 - ii. 70-plus stakeholders from across the industry value chain: producers, stockers, feeders, packers, auction market owners/managers, cattle dealers, veterinarians and animal health experts, third-party providers of physical and e-products, government agency personnel, importers, exporters, financial/insurance product providers, etc.
 - iii. Preset questionnaires helped guide discussion and generate measurable quantitative data from the sum of WPI's interviews, supplemented by qualitative feedback and insights.
 - iv. Notably, the 90-plus qualitative discussions that WPI engaged in with industry stakeholders **averaged between 45 minutes and one hour in length**. The time devoted to these calls is reflected in the depth of this report's findings.
- b. With support from Aspen Media, a large-scale quantitative producer survey was conducted (via phone outreach) to generate additional data and insights centered on a series of animal identification and traceability questions. The survey featured over 600 unique responses from U.S. cow-calf producers (majority) as well as dairymen, farmer-feeders, feedlot operators, seedstock-purebred operations, and stockers. Results were checked for statistical significance (see section below for an explanation of methodology).
- c. The purpose of this assessment was to measure the pulse of the industry as it relates to the concept of animal identification and traceability – and related questions thereof. When feasible, materials related to the economic assessment component of the project were gathered as part of this outreach. Ultimately, a series of key perspectives were generated that can influence further discussion by the U.S. beef industry in the traceability space.

→ **Cost-benefit analysis**

- a. This section explores the proper framework in which costs and benefits of animal identification and traceability should be considered. Several concepts are analyzed to help frame how, based on this report's findings, both the costs and benefits of animal identification and traceability systems can be best understood.

→ **Opportunities and obstacles**

- a. This section breaks out the key findings of the study into a series of 1) opportunities inherent in the adoption of nationally-significant animal identification and traceability system(s), and 2) obstacles, delineated by key industry sector (cow-calf, feeder, packer) that complicate adoption of a nationally-significant animal identification and traceability system(s).

→ **WPI assessment and conclusion**

- a. In this section, WPI offers an assessment of this report's findings and a series of conclusions.

Animal identification and traceability is the subject of a significant body of existing analysis. Therefore, an attempt was made to weave the following questions into the body of WPI's narrative: **where does the industry currently stand regarding animal identification and traceability? Where might it go from here, why, and how?** These questions drove the industry to emphasize this subject in their current LRP, and they drive the research presented herein.

3. Strategic Need and Operational Definitions

Strategic Need

This report seeks to illuminate and address a critical and immediate strategic need identified by a broad coalition of industry stakeholders in the Beef Industry Long Range Plan for 2016-2020: adopting an animal identification and traceability system(s). This strategic need is detailed below:

In an increasingly competitive global marketplace, beef industry animal identification and traceability systems are the norm. **However, despite being a globally-recognized leader in all points of the beef value chain, the U.S. currently does not have robust, nationally-significant animal identification and traceability system(s) in place for its domestic beef industry.** This may be hampering the industry's effort, at all points along the value chain, to capture maximum value from:

- ✓ Enhanced domestic consumer confidence and ever-changing demand drivers;
- ✓ Growing global protein demand in new markets, and continued opportunities to differentiate U.S. supply in existing markets;
- ✓ The ability to better manage, and cushion the shock of, animal disease outbreaks.

The above list is not exhaustive; however, it outlines some of the generally accepted opportunities inherent in an expanded U.S. approach to animal identification and traceability.

Operational Definitions

Animal identification and traceability has long been discussed and debated, and many industry stakeholders have their own unique or differing understanding of the key concepts involved as discussion has evolved. Data collection and design development in any project or program is unreliable if based on different views of what constitutes the core concepts. The need for operational definitions is fundamental to data collection (both qualitative and quantitative); therefore, to clearly understand the challenge facing the industry, foundational concepts must be detailed and defined.

Animal Identification and Traceability

Animal identification and/or traceability systems – especially those which add value beyond their overhead costs – are custom-designed programs. Consider that there can be many similar components between two manufacturing machines, but each machine is ultimately defined by its output. For example, a machine that makes nails is highly comparable to a machine that makes screws, but the screw-making machine differs in one key aspect: it puts threads in the final product. That differentiates it from the nail manufacturing machine.

Thus, the ultimate purpose animal identification and traceability systems, like a manufacturing machine, must be identified before the system(s) can be defined and subsequently designed to meet objectives. The following discussion touches on some past analysis of the issue of traceability, key industry perspectives, regulations, and models of traceability so that the definition of an animal identification and traceability system(s) can be refined to a level such that than an accurate assessment can be made on the opportunities, challenges, and incentives inherent in wide-spread adoption by the U.S. beef industry.

There have been numerous attempts to define and develop traceability in the U.S. At its most basic, traceability has been explained by Professor Gary Smith, formerly of Colorado State University, as “an information trail that follows the food product’s physical trail.” The International Organization for Standardization (ISO), says that traceability is “a series of recorded identifications” that provides the ability to trace the history, application or location of what is under consideration.

Below is a summary of some of the operational definitions used to date in studies, research, and academic papers on the topic specifically regarding cattle and beef:

1. *Traceability refers to the ability to identify farm animals (livestock and poultry) and their products (especially their meat), according to their origin, as far back in the production sequence as is necessary to (a) ascertain ownership, (b) identify parentage, (c) improve palatability, (d) assure food safety, and/or (e) assure compliance (e.g., for source-verification, process-verification, production practice-verification, branded-beef program constraints, beef export verification, authenticity management, etc.)²*
2. *...the ability to follow and document the origin and history of a food product; from core genetics to the dinner plate, tracing involves identifying all procedures and practices that have impacted the life of a given product and is documented and available for the purchaser or any other supply chain participant to see.³*
3. *Traceability('s) purposes are “(1) protecting our nation’s herds and flocks – preparedness for disease and bioterrorism, to assure containment and to limit damages; (2) promoting consumer confidence – to assure market access in global trade and to deliver on brand promise via added assurances and authenticity management; (3) adding value as a benefit of supply-chain management – preservation of intended value traits created by use of genetics, origin of production, unique inputs or processing method.⁴*
4. *Traceability is the ability to “identify an animal and enable products derived from it to be traced back to a production batch or to a group of animals of the same origin.⁵*

Definitions 1 and 2 emphasize the food level – e.g. the meat of the animal that is ultimately purchased from a retailer and consumed. The fourth definition is similar, as it emphasizes the “products derived from” an animal. The third definition, however, is more focused on goals such as protection against disease outbreak(s) and adding value. For the purposes of this report, WPI presents the following general definition

² Smith, G. C. (1999c). Traceability: Source-verification, production practice-verification and USDA process-verification (pp. 1–11). Presented at the Expo Prado _99, Montevideo, Uruguay; Smith et al, Traceability from a U.S. Perspective, Meat Science 71 (2005) 174-193 (available at www.sciencedirect.com).

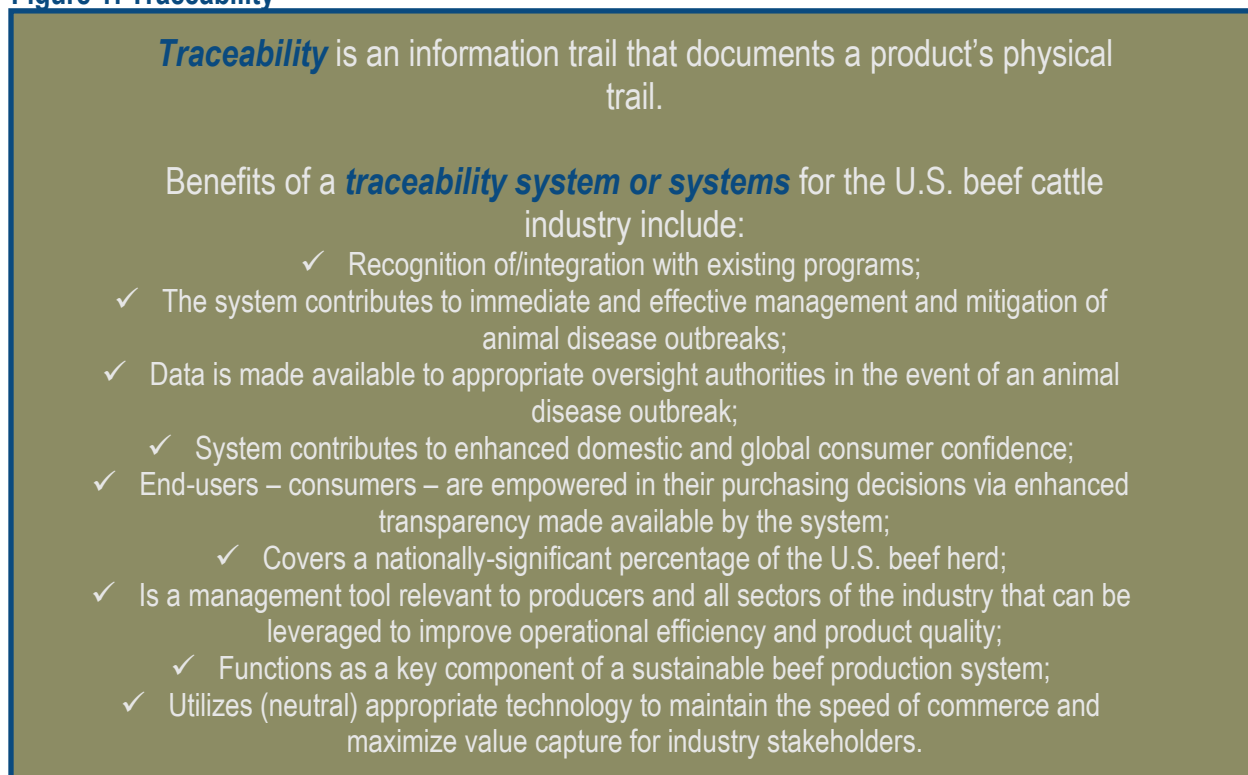
³ Sparks (2002). Food traceability: Standards and systems for tracing and tracking food and agri-products. Memphis, TN: Sparks Companies, Inc.

⁴ Saunders, L. (2004b). Livestock identification and traceability: Software, EID and USAIP (pp. 1–45). Presented at the Gallagher National Sales Conference.

⁵ Meghen, C. (2000). DNA traceability of meat (pp. 1–8). IdentiGEN, Presented at a Meat and Livestock Commission Meeting, London, UK.

for the concept of animal identification and traceability. Note that this definition considers a broad range of inputs and uses the term traceability as a blanket term to cover animal identification and traceability.

Figure 1: Traceability



The above definition aligns with key industry perspectives, including those outlined in the LRP:

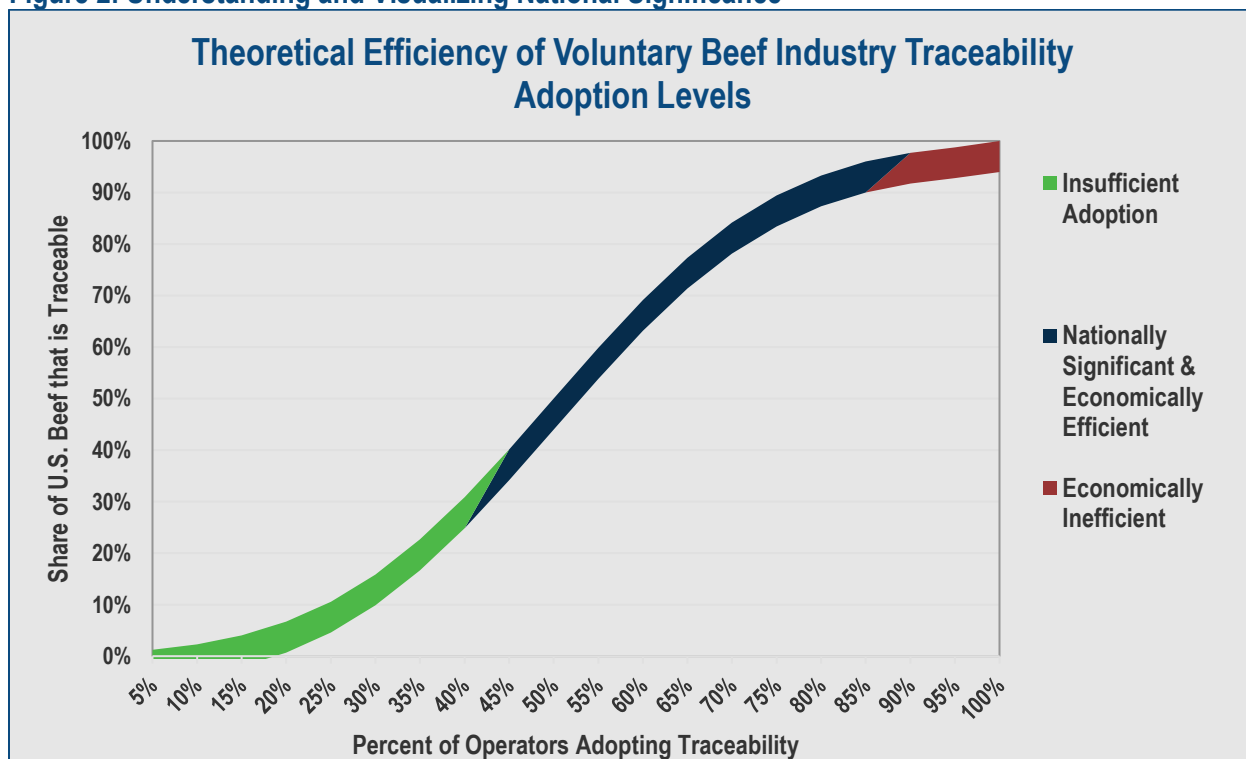
Individual animal I.D. traceability system(s)...equip the industry to effectively manage a disease outbreak while enhancing both domestic and global trust in U.S. beef and ensuring greater access to export markets.⁶

Nationally Significant

The traceability definition outlined above relies on a common understanding of the term “nationally significant,” which refers to the share of annual beef cattle slaughter required to ensure that traceability systems takes full advantage of the opportunities inherent in the key principles outlined above. Figure 2 (below) shows the theoretical trade-offs between increasing the number of ranches, feedlots, packers, etc. who have adopted compatible traceability systems, the share of overall U.S.-industry adoption, and the economic efficiency of achieving various adoption rates under a voluntary approach. Beyond a certain point, adoption of traceability system can yield diminishing marginal returns.

⁶ Industry LRP 2016-2020.

Figure 2. Understanding and Visualizing National Significance



Note: Economically inefficient can also be read as unrealistic or unattainable. Even in a mandatory system, 100 percent compliance or adoption is unlikely.

Figure 2 shows what could be the relationship between individual adaptors and the share of U.S. beef that is traceable – e.g. national significance.

One way to quantify national significance is to think in terms of cattle slaughter. In a given year, approximately 30 to 33 percent of U.S. cattle are harvested for beef; about 10 percent of muscle cut volume goes to the export market (or 13.9 percent per head value, when including variety meats). According to the USDA’s cattle inventory report for 2017, there are approximately 102.6 million cattle in the U.S. That would imply, at the very minimum, that traceability when applied to exported beef should include about 10.26 million head. To encompass total U.S. beef production, about 34 million head would have to be included. However, of more critical importance is where those cattle are in the production cycle and on the value chain. Table 1 shows a breakdown with percentages of the type of cattle slaughtered in the U.S.

Table 1. Rates of Cattle Slaughter by Type⁷

| Type of cattle | Average percent of cattle type slaughtered annually |
|----------------|---|
| Fed steers | 52.5% |
| Fed heifers | 27.5% |
| Beef cows | 8.5% |
| Dairy cows | 10% |
| Bulls | 1.5% |

⁷ Source: USDA and World Perspectives, Inc.

Thus, a nationally significant traceability approach must consider identifying cattle at certain critical control points. One point that is close to harvest would be those cattle placed on feed. For example: for the first 10 months of 2017, cattle on feed averaged about 10.86 million head, a figure that would fall into the low end of the above-discussed range between 10.26 and 34 million head. Again, these cattle would also be closest to the meat supply. Another critical control point is the birth of a calf. According to USDA, the 2017 calf crop is projected to be 36.3 million head, a figure that would be above the top end of the identified range. Moreover, if all calves were identified at birth the whole herd would be identified within a matter of years.

The above information is meant to inform the discussion on national significance as the term is used throughout this report. Keeping in mind Figure 2 – the national significance graph – the following operational definition is used.

Figure 3. National Significance

The concept of **National Significance** relates primarily to the overall number of cattle represented in **traceability system(s)**.

For the purposes of this report, U.S. traceability system(s) with national significance would require:

- ✓ Approximately 68 percent of annual fed cattle slaughter, including beef going to the export market, which is traceable back to the farm/ranch/place of birth.
- ✓ Approximately 68 percent of the national breeding cow herd which is traceable back to the farm/ranch/place of birth.

The above percentage goals for traceability back to the farm/ranch/place of birth – 68 percent of fed cattle slaughter and, concurrently, 68 percent of the national breeding cow herd – are based on WPI's graph. With a low end of 45 percent and a high end of 90 percent, **WPI has taken the midpoint from the graph – 68 percent – and employed that figure as a prospective goal for a nationally significant systems approach.**

It is worth mentioning that, specific to the subject of animal disease control, USDA (2011) estimates that 70 percent of the animals in a specific species and/or sector would need to be identified and traceable to their premises of origin to achieve anticipated disease control benefits. WPI's estimate, derived independently, yields a similar figure.

Mandatory versus Voluntary

Operational definitions must also be developed for the delineation between mandatory and voluntary traceability systems. **To ensure objectivity and comprehensiveness, WPI's team has weaved the differing concepts of mandatory and voluntary system approaches throughout the document.** That is, analysis is conducted with reference to both approaches; industry feedback and insights are considered based on potential adoption of either mandatory or voluntary systems; etc. Keeping in mind the key concepts of animal identification and traceability systems generally, the following foundational definitions are offered.

Figure 4. Mandatory versus Voluntary System(s) Management

Mandatory systems can be administered by multiple stakeholders and have specific requirements, but compliance *is stipulated* via government legislation/regulation.

Voluntary systems can be administered by multiple stakeholders and have specific requirements, but compliance *is not stipulated* via government legislation/regulation.

Key to the above definitions in Figure 4 is the difference between the terms **participate versus comply**. Under mandatory systems government legislation/regulation dictates that industry stakeholders *must comply* with requirements. Contrastingly, under voluntary systems the industry stakeholders can elect to participate.

Both the mandatory and the voluntary approach raise questions of integration with existing systems. Given that a significant number of beef industry stakeholders are already invested in value-added programming – and, it should be noted, voluntary programs can be government-driven and/or managed (e.g. the U.S. Process Verified Program⁸) – neither a mandatory or a voluntary approach should immediately be understood as superseding or replacing existing programs. Rather, emphasis is placed on integration with existing programs to fill a gap in the U.S. approach and address the identified critical and immediate need. Aspects to keep in mind include 1) program size/reach, and 2) the one versus many question (e.g. one nationally significant system versus many smaller programs). Thus, **throughout this report, WPI follows the convention referred to in the industry LRP – that of traceability system(s) versus one single system**. To overcome existing misconceptions and sensitivities inherent in the mandatory versus voluntary discussion, **this report focuses broadly on the feasibility of expanding the U.S. approach to traceability**. Attendant aspects of system management, business, economics, etc. are also considered.

Finally, a note on system architecture: traceability **system architecture** refers to the specific principles, characteristics, and/or requirements of a *given system or systems*. For example: mandatory versus voluntary, penalties for non-compliance, specific animal identification/tagging approach (e.g. ranch of birth, first transaction, etc.), technology, data management and access, and so on are all related to system architecture. These principles, characteristics and requirements vary widely depending on the exact system(s) employed.

Because of this potential for variance, WPI's report focuses on animal identification and traceability systems broadly; it also considers existing approaches as well as data drawn from analytical exercises that measure results from the *hypothetical* establishment of a new or expanded system. Hypothetical is a crucial term: while the LRP referenced above calls on the industry to "...secure the broad adoption of individual animal ID traceability system(s) across the beef community..." it does not specify system architecture – and neither does this report. System architecture is referred to throughout, both broadly and narrowly, but analysis was not conducted on a specific, hypothetical system. Instead, the findings in this report can ideally assist the industry, if it so chooses, in developing, defining and implementing an animal identification and traceability system(s) approach that is broadly adopted and thus achieves the goal outlined in the LRP.

⁸ The Process Verified Program is a voluntary program, implemented and coordinated by USDA AMS with directional support from a single participant.

4. Competitor Profiles

Summary: Global Animal ID and Traceability Programs

Starting with a global view, WPI's team profiled animal identification and traceability systems currently operating in select foreign countries. This exercise served to:

1. Provide global context to the current U.S. situation.
2. Identify lessons learned from the development, rollout, implementation and operational stages of global systems.

Most of the global systems currently in use among top beef exporting nations were forced by an event. Typically, national animal health issues such as an outbreak of Foot and Mouth Disease (FMD) or Bovine Spongiform Encephalopathy (BSE), led directly to system adoption – primarily to preserve export markets. (In the case of the European Union, or EU, system implementation was meant to preserve intra-sector trade.) Thus, it can be concluded that most of the animal identification and traceability programs were essentially attempts to recover economic damages on both the supply side (i.e. stemming the spread of animal disease), and on the demand side (i.e. maintaining markets). **None of the programs among the major beef exporting nations were proactively established to enhance demand.**

The global trend is for top beef exporting nations to be reactionary; national traceability systems are adopted in response to a major negative event. Contrastingly, the U.S. is presented with the opportunity to proactively develop a nationally significant system(s) – potentially resulting in an industry-driven, hybrid approach that becomes the global standard.

Brazil is the only major beef exporter to maintain a program that is voluntary, due to opposition from producers to a mandatory system. The program, however, facilitates exports to markets in which identification and traceability are mandatory. Brazil did lose its certification to export to the EU in 2008 over a lack of "...adequate health and traceability systems in place." More recently, the meat inspection scandal in Brazil raised questions about the reliability of the traceability system. A report from the EU on the lack of traceability and the separation of EU and non-EU eligible animals and products stated:

- The segregation of the production of raw material to be used to produce EU-eligible meat products was not ensured.
- The EU eligibility of the meat and mechanically separated meat used was not always verified.
- The exclusion of ineligible types of meat (kidneys and trimmings) was not ensured.
- Mistakes on EU eligibility in the national sanitary certificates were made.

While this scandal goes deeper than the question of whether the traceability program is voluntary or mandatory, it is widely assumed that it will be more difficult to maintain a voluntary system in Brazil because it opens the possibility of misidentifying non-certified and identified animals. Under a mandatory system with all cattle identified and traceable, there would be only one category of animals.

All industry and government officials interviewed for the summaries of national systems (see below) indicated that **the technical aspects of animal identification and traceability systems were much more easily managed than the political aspects** during the project development and implementation phase. Key issues were producer data issues and protecting privacy; Australia has the most innovative system in that it contracts with a private entity to maintain the database and thus exempts the data from their freedom of information laws – laws like those in the U.S. A corollary issue arises with regard to private proprietorship of the data – is the entity an industry organization, private company, a non-profit organization, or a hybrid of private and government?

Other substantive issues arose regarding the implementation of these global programs, including: In Brazil, where the program is voluntary, participants in the system gain a premium while non-participants face a discount. Where there is a mandatory system, there are no premiums for animal identification and traceability, and the costs of the system vary from being borne completely by the producer or to being partially subsidized by the government.

A definitional issue arises with tracing animal movements: what is the criteria for a movement?

Options include a change in premise ID, ownership of premise, ownership of animal, change in herd, etc. There have been reports in the EU that some retailers' express reluctance to purchase meat from animals with too many movements recorded. This is an example of how specific aspects of system(s) architecture can complicate situations.

Post-slaughter traceability of meat remains an issue in a mandatory program. If it is required (as in the EU) it typically has parameters. For example: at the fabrication floor, cutting primals and subprimals into retail cuts involves placing the cuts from multiple animals into boxes or packaging for specific customers. In this case the cutting plant would know which carcasses they have taken cuts from but may not know within the box which cuts came from which primal/animal. Ground beef exacerbates traceability issues further. In the EU, packers use a group identifier to identify where the ground beef came from, typically limiting the batch to a day's kill. This could be less practical in the U.S. given the scale of many packers. Voluntary, private systems based on traceability and identity preservation linked to label claims and other branding and marketing report that these issues can be overcome compared to mandatory systems imposed on the whole beef production value chain.

Considering these global profiles, topline takeaways include:

1. Global systems tend to delineate between premise identification, individual animal identification, and group/lot identification. Depending on the specific system, some or all of these components may be voluntary or mandatory.
2. It is not uncommon for third-party entities to manage program databases, thereby protecting industry/producer data from freedom of information legislation.
3. Initial tagging of calves tends to be mandated by a given period of days after birth or an animal's first movement off their farm of birth.
4. It is not uncommon for industry-led boards to manage programs with oversight from government entities.
5. Foreign countries have adopted traceability systems for several reasons (see Figure 1):

Figure 1. Reasons for Adopting Traceability Systems Among Foreign Countries

Foreign countries have adopted animal identification and traceability systems to:

1. **Maintain** or regain foreign market access.
2. **Manage** animal health issues.
3. **Invest** in long-term industry practices that provide insurance in the case of animal disease outbreaks.

Table 1. Matrix of Global Animal Identification and Traceability System Components

| Country | Government-Mandated System | Components | | | Data Managed by Private Third Party | Oversight Body w/Industry Representation |
|-------------------------|----------------------------|------------|----------------------|--------------|-------------------------------------|--|
| | | Premise ID | Individual Animal ID | Group/lot ID | | |
| Argentina ⁹ | ✓ | ✓ | ✓ | | | |
| Australia ¹⁰ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Brazil ¹¹ | | ✓ | | ✓ | | |
| Canada ¹² | ✓ | | ✓ | | | ✓ |
| European Union | ✓ | ✓ | ✓ | | | |
| Ireland | ✓ | ✓ | ✓ | | | |
| Mexico ¹³ | | | | | | ✓ |
| New Zealand | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Uruguay | ✓ | ✓ | ✓ | ✓ | | |

The top 12 global beef exporters include all the markets listed in Table 1 (with Ireland included in EU data) plus the United States, India, Paraguay and Belarus. These 12 markets account for 95 percent of global beef exports. Of that percentage, approximately 65 percent of beef exports come from countries with nationally significant traceability systems in place or currently under development.¹⁴ **It is estimated that approximately 61 percent of global beef exports come from countries with nationally significant traceability systems in place.** Table 2 (below) details herd inventories, annual calf crop and slaughter numbers for foreign countries, adding perspective to the global situation.

⁹ Group/lot identification in Argentina is voluntary; the system still functions at the group/lot level.

¹⁰ The NLIS website reports that the NLIS is *endorsed* by major industry stakeholders; however, management is coordinated at the federal and state/territory level.

¹¹ Brazil's premise and group/lot identification requirements apply *only* to cattle destined for export markets.

¹² Premise identification (voluntary) is regulated at the Provincial level.

¹³ Mexico's system, while voluntary, is legally authorized to supersede all other animal identification and traceability programs.

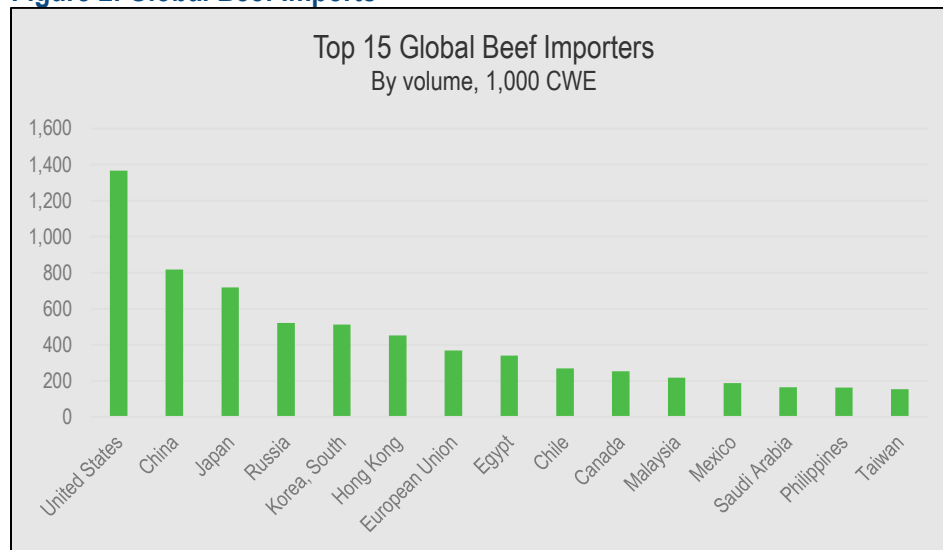
¹⁴ Paraguay has two systems in place (driven by their trading partners' export requirements) while Belarus is currently party to the development of an animal identification system slated for requirement by the Eurasian Economic Union.

Table 2. Global Cattle Numbers.

| Global cattle herd, calf crop and slaughter | | | |
|---|-------|-----------|------------------|
| | Herd | Calf crop | Annual slaughter |
| Argentina | 67.9 | 14.1 | 12.4 |
| Australia | 35.5 | 9.0 | 7.6 |
| Brazil | 280.8 | 49.0 | 38.8 |
| Canada | 16.0 | 4.3 | 3.2 |
| EU | 119.1 | 30.0 | 27.3 |
| Mexico | 23.9 | 7.4 | 6.0 |
| New Zealand | 14.9 | 4.8 | 4.2 |
| Uruguay | 14.6 | 2.8 | 2.3 |

Source: USDA FAS.

The U.S. and India account for the majority of the share of global beef exports that come from countries without nationally significant traceability systems in place. India's place on the list is questionable given the actual makeup of the exported product (so-called carabeef versus pure bovine meat). However, **the fact remains that, among top exporting countries, nationally significant traceability systems are the norm.** This is not to say that U.S. product quality suffers compared to other top exporters; nor is it fair to state that the U.S. is at a competitive disadvantage on the export market *without* a system(s). Again, the point here is that traceability systems are becoming a global norm. Going forward, it remains to be seen how the development of this norm impacts the U.S.' position as a leading global beef exporter.

Figure 2. Global Beef Imports

Source: USDA PS&D

The markets detailed in Figure 2 include three with nationally significant traceability systems in place for their domestic cattle industries (profiled below): The European Union, Canada, and Mexico. Import requirements among the top 15 markets vary. For example:

- The only major import market that requires traceability today is China. Key U.S. export markets have domestic traceability requirements, and it is important for the U.S. to be aware that these countries

or major customers in these countries could decide to extend this requirement to imports. One scenario for this happening would be an animal disease outbreak, though less drastic developments could also trigger a shift, e.g. a reaction to a food safety scare in the U.S. or pressure from domestic cattlemen or consumer groups who demand that imports meet the same standard as domestically-produced beef.

The following sections provide profiles of select global markets, including Argentina, Brazil, Uruguay, Mexico, Canada, Australia, New Zealand, the EU, and Ireland.

Argentina

Argentina began a limited mandatory animal identification and traceability system in 2003, known as the Animal Health Information System (SIGSA). The purpose of the SIGSA was to support exports to the EU given Argentina's status with FMD.

The original program was a group/lot identification system; in 2007 the program was updated to require individual animal identification. However, for traceability purposes the system still works at the group or lot level. The program is currently administered by the country's National Health Service and Food Quality (SENASA) agency. Key components of the Argentine system include:

- ✓ Premise identification for the farm of origin is mandatory.
- ✓ Individual animal identification is mandatory for all calves born after September 2007.
- ✓ Group and/or lot identification is voluntary.
- ✓ Two ear tags have been required:
 - A flag-type tag in the left ear, and a button-style tag in the right ear. The flag-style ear tags are color-coded depending on the animal disease zone from which the calf originates. From a zone free of FMD with vaccinations, the color was yellow. From a zone free of FMD without vaccination, the color is green. This was updated in July 2017: those cattle from a zone free of FMD with vaccination now only use a button identifier of yellow color, with the numbers legible. Those from a zone free of FMD without vaccination still use two tags, but the flag-style tag is green.
- ✓ Supplemental identifiers are allowed, e.g. herd identifiers, but the supplemental devices or tags may not replace the mandatory official tags.
- ✓ **A calf must be tagged when weaned, receiving veterinary treatment, or when first moved from the farm – whichever event is earlier.** This is a requirement for export to the EU as well. Calves must be tagged to be eligible to be moved.

Brazil

Brazil created the Brazilian Bovine and Buffalo Identification and Certification System (SISBOV, now renamed ERAS) as a farm-level identification system for cattle in 2001. In September 2006, the program was extended to include the entire beef value chain rather than just producers, and the program was proposed to be mandatory within two years. **However, producers opposed the mandatory requirement and the program remains a voluntary system.** The program was developed to maintain market access to the EU.

Brazil's program is mandatory for cattle harvested for meat that is destined to the export market for countries that require traceability. Cattle not enrolled in the program may be marketed domestically and to countries that do not have traceability requirements.

After a review by the its Food and Veterinary Office (FVO), in 2008 the EU imposed a near-total ban on beef imports from Brazil because of shortcomings in the latter country's system. Recent audits by the EU/FVO have identified still existing shortcomings but continued systematic shipments of beef from Brazil to the EU have been approved.

Under ERAS, Brazil's Agriculture Ministry (MAPA) is responsible for the accreditation of third-party private certifiers, known as *certificadoras*, who administer the program. Key components of the Brazilian system include:

- ✓ Premise identification is voluntary overall, but mandatory for cattle harvested for beef destined for export to markets which require identification.
- ✓ The original intent of the program was individual animal identification. However, instead of identifying individual animals, classification has been by group lot of animals destined for export (individual tags of animals in such lots are applied).
- ✓ Bar code ear tags are required to comply with the program (even if other forms of identification are used).
- ✓ Movement recording is voluntary.
- ✓ (The cost of tagging is estimated to be about 10 *reais* per head; the premium paid is about 5-8 *reais* per arroba – which is a unit of weight measurement per carcass of 15 kg, or 33 pounds).

Uruguay

Uruguay implemented a mandatory animal identification system in 2006, known as the National Livestock Information System (SNIG). The deadline for complete mandatory compliance was extended a couple of times until ultimately, in 2013, all cattle were required to be registered. This program builds on the much older national premise identification system (DICOSE) in Uruguay started in 1973. DICOSE is a premise and lot identification system; SNIG is an individual animal identification system. **Uruguay is generally considered to be the only country with 100 percent animal identification of its cattle herd.**

Uruguay's program was established to enhance exports, especially in response to an FMD outbreak in 2000/2001 which cost the country its export markets. The industry in Uruguay also enhances its EU Hilton HQB quota supply (grain fed beef versus grass fed beef) by tracing it with the national system. Grain fed beef is about 10 percent of the slaughter in the country. Generally, Uruguay leans on the program to differentiate its small supply from larger global competitors.

The program is administered by the Ministry of Livestock, Agriculture, and Fisheries (MAGP). The program costs are subsidized by the federal government; MGAP pays for the ear tags and everything related to the infrastructure of SNIG. Producers pay private operators for reading the tags before each transaction and for veterinary certifications. Separately, Uruguay also has the USDA's Agricultural Marketing Service Process Verified certification for its claim of natural (grass fed) beef.

Key components of the Uruguayan system include:

- ✓ Premise identification was pre-existing under the DICOSE program as a pilot program in the 1970's; premise identification is mandatory in the new system.
- ✓ Individual and group animal identification is mandatory (but only for bovines).

- ✓ The system requires two tags:
 - One tag must be highly visible and display a number; one must be RFID technology-enabled. Cattle must be tagged before they reach 6 months of age or are first moved from their farm of birth. The RFID tag includes individual animal identification, which can be used to access the SNIG database for information about the farm from which the animal originated, and its ownership and movement history.
- ✓ **The SNIG database holds all the data collected: premises and animal identification, movements, and termination data.**
- ✓ Post-termination product movement can be integrated into the database for carcasses and muscle cuts.

Mexico

Mexico initiated a federal animal identification system (SINIIGA) in 2003. **The program is voluntary, and serves a key function in operating PROGAN, a domestic federal livestock subsidy in Mexico.**

The program is overseen by Mexico's Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA) and administered by a Board of Directors including appointees from private industry groups, cattle producers, genetics companies, etc. Tags for the program are supplied to producers as part of the PROGAN federal program. Producers are expected to register information on the premise and herd when they receive their tags. **Despite the voluntary nature of the program, its legal authorization states that it should supersede all other identification and traceability programs.**

Key components of the Mexican system include:

- ✓ Premise identification is voluntary.
- ✓ Individual animal identification is voluntary.
- ✓ Group and/or lot identification is voluntary.
- ✓ Tagging is done with two tags, one in each ear; both tags have the same alpha numeric code and one of the tags may have an RFID chip.
- ✓ Movement recording is voluntary. Under a joint strategy with USDA APHIS, Mexico has focused the system on exporting. In 2013, an effort was undertaken to strengthen the database with software for movement control and export documents.

Canada

Canada started its animal identification and traceability program in 2001 "...designed for the containment and eradication of animal disease." That year, six months after the requirement that call cattle be tagged upon leaving their farm of origin, all packing plants were required to start processing the identification information (i.e. retiring tags). **The program was first implemented as a voluntary system but was made mandatory during the next year; the program is reportedly at 97 percent compliance.**¹⁵

The program is enforced by the Canadian Food Inspection Agency (CFIA) which can levy fines for non-compliance. The program is administered by the Canadian Cattle Identification Agency (CCIA) which is governed by a board of directors made up of the various private cattle trade associations. The CFIA and

¹⁵ Available here: http://www.canadaid.com/about_us/about_us.html.

Agriculture and Agri-Food Canada (AAFC) are ex-officio members of the board. Key components of the Canadian system include:

- ✓ Premise identification is voluntary, though the CCIA “strongly encourages” every producer to enroll in premise identification. Premise identification is regulated at the Provincial level.
- ✓ **Individual animal identification is mandatory.**
- ✓ Group and/or lot identification is not accepted under the program. However, sequential series of tag numbers can be reported on (i.e. birth dates, movement, etc.).
- ✓ Tagging is required with CCIA approved tags. Since 2010, CCIA has required RFID tags, which also include visible identifiers. **Tagging must be done before an animal leaves the farm of origin; upon tag issuance all animals are reported to the database.**
- ✓ Movement recording is voluntary. However, movement identification is planned to be phased-in to the program going forward.

Note: Canada has recently updated its identification requirements for breeding cattle entering the country from the U.S. Effective February 1, 2018, U.S. breeding cattle exported to Canada will need an 840 RFID tag and a USA tattoo in the right ear. The change is intended to reduce inspection time at the border and eliminate the need for U.S. animals to be re-tagged with Canadian system identifiers.

Australia

The National Livestock Identification System (NLIS) is Australia’s system for animal identification and traceability of livestock. **The system for cattle has been mandatory since 2005.** The pre-cursor to the current system was established in the 1960’s to eradicate bovine tuberculosis (TB) and brucellosis. Mandatory premise identification dates to this era. A contributing factor to Australia’s system development was the motivation to protect export markets, as the country typically exports more than 65 percent of its total beef production.

Australia’s federal government coordinates the NLIS. State governments have legal jurisdiction over the movement and health of livestock and have enforcement action as part of their jurisdiction. **The states also maintain the registry of premise identification data and are responsible for the supply of the tags and RFID tags.**

The NLIS database is administered on contract with Meat and Livestock Australia (MLA), which is a private organization. Thus, producer data is protected and exempt from the Australian Freedom of Information (FOI) statute. Key components of the Australian system include:

- ✓ **Premise identification, animal identification, and group and/or lot identification are all mandatory.**
- ✓ Tagging is required with NLIS-approved tags, which may be a visible or electronic RFID tag.
- ✓ A calf must be tagged when first moved from a registered premise, unless a permit is obtained from the territory. Each movement an animal makes to a location with a registered premise (including auction markets and packing plants) is recorded into the NLIS database.
- ✓ Post-harvest movement traceability is enabled by the system: at slaughter a unique identification is assigned so that carcasses, hides, and offal products may be traced to an individual animal if transacting parties agree to do so. Generally, however, post-harvest products are grouped by lots.

New Zealand

New Zealand's animal identification system is known as National Animal Identification and Tracing (NAIT) system. System development began in 2006. Legislation was passed in 2009, and individual animal identification became mandatory in 2012.

New Zealand had a mandatory premise identification system under the National Bovine Tuberculosis Identification Program (NBTIP), a herd-based system that required the identification of cattle (and deer) before movement from their property of origin. NAIT builds on that program.

The program is coordinated by the Ministry of Primary Industries, and administered by NAIT, Limited, as designated by the Ministry. NAIT, Ltd., is governed by a board of directors made up of producer organizations. The program's launch was funded by the federal government, and ongoing operations are funded by the government and industry assessments. Required tags must be purchased by producers. Key components of the New Zealand system include:

- ✓ **Premise identification and animal identification are mandatory.**
- ✓ Group and/or lot identification is voluntary.
- ✓ Tagging is required with NAIT-approved RFID Birth ID tags. Calves must be tagged within 180 days of birth or first off-farm movement, whichever comes first.
- ✓ All animals must be identified with a NAIT-approved tag for direct-to-slaughter movements and NAIT-approved RFID primary tags.
- ✓ Post-harvest movement traceability is enabled by the system: at slaughter a unique identification is assigned so that carcasses, hides, and offal products may be traced to an individual animal if transacting parties agree to do so. Generally, however, post-harvest products are grouped by lots.

The European Union

In 1997, in response to the BSE crisis, the EU implemented a mandatory system of permanent identification for cattle to enable traceability from birth to death. All bovine animals were required to be enrolled by January 1, 2000 per regulation (EC) 1760/2000.

The EU classifies animal identification as part of its “food safety” policy. As the various animal identification systems evolved within the EU, they have each incorporated traceback and general traceability as a system goal along with animal identification.

The program is administered by the European Food Safety Authority (EFSA). Bovine, ovine, and swine all have similar but separate traceability systems. Key components of the EU system include:

- ✓ Premise identification is mandatory; three (3) percent of the registered premises in each Member State are subject to surprise inspection per year. Sites are selected by risk analysis which includes factors such as herd size and history. Failure to comply with all regulations (e.g. keeping an on-farm register), can result in loss of EU farm payments.
- ✓ Animal identification is mandatory.
- ✓ Group and/or lot identification is voluntary.
- ✓ Tagging is required with double ear tags. After July 2019, cattle can be identified using two means of identification: conventional ear tag and an electronic identifier. Member States and operators may

choose the electronic identifier from, for example, an electronic ear tag, a ruminal bolus or an injectable transponder.

- ✓ Movement tracing is mandatory domestically and for export within the EU via an animal “passport” which reports details of the animal, details of where it has been throughout its life, and details of the animal’s termination (death or harvest). This is technology neutral but overwhelmingly done by electronic transmission.
- ✓ In addition to tracking animals, post-harvest movement must be traceable to comply with the EU labeling regulations. These require a reference number that links the meat product to the animal or animals of origin: country of origin, place of fattening, slaughter date as well as the packing plant or fabrication plant’s EU approval number.

Ireland

Ireland implemented its animal identification and traceability system, the Animal Identification and Movement (AIM) System, in 1997 in accordance with the EU Directive. Since 2005 it has been mandatory for EU countries to adopt animal traceability through animal identification and movement tracking programs.

AIM is one of several animal-tracking databases that have been established by individual EU countries for use at the domestic level. Ireland exports a large percentage of its production and developed its own system in part to differentiate its herd from the U.K., where BSE was found. Moreover, Ireland has the highest level of cattle movement in the EU.

The AIM database provides a daily feed to the Irish Cattle Breeding Federation (ICBF) database of all births, movements and deaths in the herds (some 90 percent of all) that are involved in the ICBF database. The ICBF database provides a wide range of cattle breeding services provided in the country, including the Herd Books for dairy, beef and dual purposes breeds (20 percent of all dairy cattle are bred to beef breeds in Ireland); and the milk recording, beef recording and artificial insemination services. Key components of the Irish system include:

- ✓ **Premise identification and animal identification are mandatory.**
- ✓ Producers are required to maintain a herd register of all bovine animals on their holdings. The herd register must be kept up-to-date and record information in relation to all calves born on the holding; additionally, details of all animals entering or leaving the herd and of animal deaths on the holding must be recorded.
- ✓ The system captures all animal movements. This information is used to check compliance of cattle with eligibility criteria of the Single Payment Scheme to verify the origin, identity and life history of cattle entering the food chain.

5. Literature Review and Demand Modeling

Questions of economics, costs/benefits, incentives, business impacts, and so on are very important when considering the issue of animal identification and traceability systems for the U.S. beef industry. Broadly, one goal of this feasibility study was to identify and analyze credible economic considerations that come with the prospect of a nationally-significant system(s). To achieve this goal, the following section offers big-picture economic analysis to provide context to analysis conducted in subsequent sections. This macro-level approach is comprised of two parts:

1. **Literature review:** The portfolio of peer-reviewed economic analysis on animal identification and traceability in the U.S. beef industry is expansive. Thus, WPI's team conducted a literature review of past work, emphasizing efforts that focused on traceability as it relates to instances of **animal disease outbreaks** and **export market access**.
2. **Export demand modeling:** Following the literature review, a unique export demand model developed by WPI's team showcases big-picture gains/losses associated with the presence of a nationally significant animal identification and traceability system(s) approach.

This section is meant to be high level; additional analysis will pivot off the literature review and export demand modeling.

Literature Review

Note: this literature review is meant to provide background to this report's research on animal identification and traceability. While important to consider the body of work detailed herein, WPI's team has noted where there is disagreement with certain conclusions, or if, in WPI's view, an issue is better understood by viewing it within a different framework.

Theory of Traceability

As human populations and economic growth has increased, so has the need for international trade. With increased trading, however, comes increased risk of animal and human disease transmission, whether by unintentional means or by intentional terrorism (the latter became an especially poignant concern after the September 11, 2001 U.S. terrorist attacks). As the risk of an animal disease outbreak crossing international borders and infecting another country's herd have increased, so too have requirements to ensure traded products are safe.

Consequently, animal traceability systems are becoming ubiquitous around the world, with many major beef exporting countries adopting national systems (Souza-Monterio and Caswell, 2004; Schroeder and Tonsor, 2012). **Such systems are predominantly mandatory, with the U.S. and Mexico being notable exceptions.** Moreover, the requirements for compliance with government-mandated traceability programs are rigorous, with most countries either using or investigating implementation of movement tracking systems (Schroeder and Tonsor, 2012).

Souza-Monteiro and Caswell (2004) noted that most countries adopt traceability in response to importing country requirements. **That is, programs are adopted to avoid the threat of losing export markets.** This is corroborated by the findings detailed in the foreign country profiles (see above). Souza-Monteiro and

Caswell note the exporting country's motivation for adopting traceability is often to maintain or increase market share, not necessarily to enhance its own food safety. The authors further state that:

“Four patterns of adoption are evident in the major producing and trading countries: adoption of mandatory systems in response to consumer concerns (EU and Japan), imposition of mandatory traceability to maintain or enhance export shares (Australia, Brazil, and Argentina), industry managed mandatory programs for animal identification (Canada), and voluntary systems (United States)” (p. 7).

Murphy et al. 2008 note that animal traceability systems are becoming prerequisites to international trade. Souza-Monterio and Caswell state that the export market for beef is becoming bifurcated, with separate markets (and different prices) for beef that is traceable and that which is not.

Contrastingly, WPI's analysis of this subject does not lead to the blanket conclusion that the export market for beef is becoming bifurcated – there is not enough additional evidence to support this claim based on WPI's primary and secondary research. Going forward, in a scenario whereby the U.S. continues its current kaleidoscope of voluntary traceability systems without a nationally significant approach, global trade may shift to the point that the U.S. finds itself marketing high-quality beef to second-tier markets, simply because the importing country cannot be assured of full traceability. *However, that is currently not the case.* There is significant evidence that traceability systems can cushion the impact of animal disease outbreaks and mitigate financial losses for the industry, but that is a separate discussion.

Note that, going forward, if the U.S. finds itself at a disadvantage in the world market it may have little recourse to fight importing country's traceability requirements. The World Trade Organization (1994) notes that:

Members may introduce or maintain sanitary or phytosanitary measures which result in a higher level of sanitary or phytosanitary protection than would be achieved by measures based on the relevant international standards, guidelines or recommendations, if there is a scientific justification.

As Pendell, et al. 2010 note “...the general adoption of animal tracing systems raises international standards. The United States is likely to lose international export market competitiveness and/or market access if it lags the rest of the world in adopting animal identification and [tracing] systems.” If the world's trade arbitrator (the WTO) permits import restrictions that would include traceability requirements, the U.S. would have few options left other than to implement a national traceability system or watch its exports erode. These points relate to the conclusion that animal identification and traceability systems are becoming a global beef supply chain expectation.

Golan, et al. (2004) noted that voluntary traceability systems must increase net revenues for the firm or else they will not be adopted. The authors further argue privately-borne costs are often unequal to the social benefits of traceability adoption, such that incentives do not exist for private firms to bear the costs. This is claimed as a market failure and, while several options exist to correct this, the authors note **government programs are often ill-fitted to deal with these failures. Private options intended to increase firms' incentives (i.e. revenues) to build traceability systems are touted as the best course of action.** Moreover, Resende-Filho and Hurley (2012) find government regulation based on mandatory traceability may not necessarily lead to safer food and increases food processors' costs. This information should be considered if/when the U.S. beef industry develops an expanded traceability system(s) approach.

Brester, et al. (2011) noted the U.S. needs to take a “candid look” at its approach to traceability systems and “philosophical changes” will be required for the U.S. to align itself with changing global standards. The rest of this section explores the costs and benefits of implementing a nationally significant traceability system(s) approach in the U.S., with the goal of motivating beef industry stakeholders to be proactive in their discussion on the issue.

Economic Impacts

The economic impacts of animal traceability systems are two-fold. The first set of impacts are those negative in nature – e.g. financial losses related to animal disease outbreaks or reduced export market access – that occur from the absence of traceability systems or their implementation. The second set are those positive in nature, whereby national traceability systems either add value to stakeholders along the value chain, increase consumption, demand, or both, and/or offer other tangible benefit to its participants. The following briefly reviews the literature associated with both the negative (costs) and positive (benefits) sides of traceability systems.

Costs: The negative impacts associated with traceability include the direct costs of implementing systems and the costs of not implementing systems, or the opportunity costs. Others may exist, but this study focuses on the direct and opportunity costs.

- *Direct costs:* Murphy, Pendell, and Smith (2009) noted the mandatory Canadian traceability system was created at a government-borne cost of \$4 million (the Canadian government covers the cost of purchasing a \$0.20 CCIA ID tag for cattle). Stanford, et al. (2001) reported that Canada, at the time, paid approximately \$1.5 million (Canadian dollars) for the research and development of their system. Such information from a nation with similar beef production systems as the U.S. may be helpful in U.S. industry discussions that reach the level of specific system(s) architecture.

Brester, et al. (2011) estimated the direct costs of source and age verification (SAV) programs in the U.S. varied substantially for firms at the cow-calf, stocker, feedlot, and packer levels. Moreover, costs varied by size of operation (economies of scale were present) and by whether cow-calf firms were currently tagging cattle. Their results found costs ranged from \$2.40-4.21/head for cow/calf operations tagging cattle and from \$5.04-5.54/head for firms not currently tagging cattle. Costs for stocker operations ranged from \$0.14-0.75/head, feedlot costs from \$0.12-0.50/head, and packer plants had a volume-weighted average cost of \$0.18 cents/head.

Brester, et al. (2011) further found the total cost of implementation across the U.S. beef industry would reach \$350 million, with almost 60 percent of the costs borne by the cow-calf sector. The authors note that low levels of adoption can be achieved with little cost (early adopters are likely to be large, efficient operations already tagging calves who, therefore, have lower costs) while higher levels of implementation are achieved with a higher marginal cost. The authors estimate the cost of moving from 90 percent to 100 percent adoption would reach \$115 million. This supports the notion that a nationally significant approach need not include 100 percent of industry stakeholders. However, WPI notes that this report’s cost-benefit analysis (see Section 7) provides a more appropriate and accurate framework for understanding the costs and benefits of traceability.

Despite the direct costs of implementing national traceability systems, analysis by Pendell et al. (2010) finds that comparatively small changes in export and/or domestic beef demand can easily pay for implementation. **The authors predicted a 34 percent increase in U.S. beef exports (based on 2007 levels) would pay for a 90 percent adoption rate of [an] animal identification and traceability system in the U.S.** The USDA APHIS (2009) estimated that a 23 percent increase in demand for U.S. beef exports would pay for 70 percent national adoption while a 34.1 percent increase would pay for 90 percent traceability adoption in 10 years. USDA APHIS further found that "...small increases in domestic beef demand, with all else constant, would also completely pay for full animal ID and tracing in the beef industry." The domestic demand increases necessary to pay for animal traceability and ID in the U.S. were less than 1 percent for all adoption levels (30 percent, 50 percent, 70 percent, and 90 percent). Again, WPI's team notes that 1) a system's costs cannot be truly measured unless its architecture is clearly defined, and 2) there are too many unknown factors to predict export gains *because of* a system, especially to a level whereby the system's (unknown) costs would be paid for.

- **Opportunity Costs: The opportunity costs of not having robust traceability systems are best exemplified by the 2003 BSE outbreak that occurred in the U.S.** Coffey et al (2005) estimated the U.S. beef industry suffered losses of between \$3.2 billion and \$4.7 billion in 2004. Prior to discovery of BSE in a Washington cow, U.S. beef exports were roughly \$3.14 billion but collapsed to only \$550 million in 2004 after the discovery.

The 2003 BSE event in the U.S. has been the foundation for other research examining probable impacts of export market losses that would occur if the U.S. fails to implement national traceability system(s) before the next disease event. Pendell, et al. (2010) estimated that a 25 percent loss of U.S. export market share (e.g. the size of South Korea's share of beef exports before the 2003 U.S. BSE outbreak) would lower slaughter cattle prices by 1.03 percent and feeder calf prices by 0.89 percent. Other impacts combine to create a \$6.6 billion loss to the entire U.S. livestock/meat complex, with the cattle feeder and slaughter sectors losing \$2.95 billion and \$4.35 billion, respectively.

USDA APHIS (2009) found that the industry-related costs of not implementing the NAIS could reach \$1.32 billion over 10 years, mostly due to reduced export market access. In terms of per-head revenues, their study found beef producers could lose between \$7.31-\$36.47/head in revenues due to export market losses, depending on the exact decrease of export market share.

Keeping in mind these studies, WPI notes that the true value of having had a traceability system in place prior to a disease outbreak is that it would have reduced the time that markets remained closed and thus mitigated the financial impacts of the outbreak.

See below for additional analysis of animal disease control impacts.

Benefits: The benefits of traceability systems are multi-faceted and often interconnected. As Golan, et al (2004) note, U.S. traceability systems tend to be motivated by economic incentives, not government mandates. The USDA ERS noted that, because of this dynamic, the benefits of traceability must "translate into larger net revenues for the firm."

To date, U.S. firms have adopted traceability measures to improve supply-side management, increase safety, and market foods with certain attributes (for example, GMO-free or no-antibiotic use) (Golan, et al. 2004). Each of these activities is aimed at increasing net revenues for the private firm. Golan, et al. (2004) further note that traceability is not the only way to achieve these objectives, nor does it necessarily achieve them either. However, when properly implemented and used, traceability systems can have pronounced benefits, economic and otherwise.

WPI's primary research identified that the majority of U.S. industry stakeholders currently participating in some sort of animal identification and traceability system do so (among other reasons) to improve the quality of the animals they raise and market – a supply side management benefit. Management includes understanding animal genetics to maximize the potential of the breeding herd, as well as individual animal feed, growth, and – importantly – *health* attributes. Ultimately, beef quality can be most positively impacted if individual animal *data* is available to act on.

An example: herd management benefits were noted in a pilot program conducted by the Dickinson (North Dakota) Research Extension Center (2004-2006). The program's synopsis identified that participants found the technology employed (electronic ID tags) to be efficient – that is, it had little impact on the speed of commerce at the ranch or further along the value chain. Further, the benefits of additional information – on animal date of birth, gender, parentage, birth weight, weaning weight, yearling weight, harvest data, etc. – were acknowledged by trial participants as a beneficial tool that they could use to maximize their business options and maintain flexibility in marketing.

Meanwhile, foreign consumers have reported a positive willingness-to-pay for traceability and/or product attributes (see Brester, et al. 2011, page 240). Dickinson and Bailey (2005) found consumers in Japan, the U.S., United Kingdom, and Canada were willing to pay a 7-25 percent premium for beef and pork sandwiches made with traceable meat. Brester, et al. (2010) note that traceability systems may increase consumer confidence in U.S. beef, leading to additional demand for American-origin beef. The authors note U.S. traceability adoption rates and export demand are likely to be positively correlated. These findings align with Souza-Monterio and Caswell's argument that traceable beef commands a different price than non-traceable beef.

The existing body of literature is thin regarding estimates of export market gains from traceability. Several papers (as noted above) have estimated consumer preferences for traceable meat, but these have not attempted to analyze change to global trade as a whole. This report (see Export Demand Modeling below) attempts to shed some light on this issue, but further analysis is warranted. **Given the proven, positive willingness-to-pay exhibited by consumers in certain markets, one may assume implementation of traceability systems may increase a country's beef exports. However, WPI notes that this has not been definitively proven yet.**

Animal Disease Control Impacts: One chief goal of traceability systems is to reduce the severity and duration of a disease outbreak. Saatkamp et al. (1995) found animal identification systems can indeed reduce the duration, severity, and economic consequences of such disease outbreaks. Beyond animal disease control, Disney et al. (2001) noted cattle identification systems may provide economic benefits in addition to reduced economic consequences of an FMD outbreak. Moreover, animal traceability systems benefit both producers and consumers by lowering producer/consumer surplus losses under simulated FMD outbreaks (Zhao, Wahl, and Marsh, 2006).

Pendell (2006) found that high-level animal identification/traceability systems could reduce a simulated FMD outbreak in southwest Kansas by 12 days versus a scenario without systems in place. The analysis further showed the number of cattle depopulated in an FMD outbreak decreased 65 percent between a low- and high-ID scenario, while the cost associated with disease outbreak control also fell 65 percent from \$559 million to \$196 million.

Pendell, et al. (2007) conducted an economic impact assessment of a simulated FMD outbreak in Kansas. Their results showed if the disease were introduced in a single cow herd, the southwest Kansas economy would incur economic losses of \$35 million. If the disease were introduced simultaneously at five large feedlots, the economic damages climb to \$1 billion.

Conclusions

Based on the existing literature, the costs of implementing nationally significant traceability system(s) in the U.S. are neither insignificant nor overwhelming. In many cases, they are simply difficult to accurately measure because of uncertainties regarding specific system architecture. Concurrently, gains from implementation can be estimated, but one must be cautious in using specific results from a handful of studies to make blanket conclusions. In a best-case scenario, relatively small gains in domestic and/or export market beef demand would pay for adoption of a national traceability system(s) in +/-10 years. If international consumers' documented willingness-to-pay for traceable meat holds true, a nationally significant traceability systems approach adopted by the U.S. beef industry could potentially offer the economic benefits needed to encourage participation. **Again, as stated before, WPI has attempted to provide a more accurate framework for considering costs, benefits, gains, losses, etc. inherent in the discussion on animal identification and traceability in this report** (see Section 7).

Importantly, the literature review helps us understand that implementing traceability programs can decrease the duration and severity of animal disease outbreaks. While the economics of traceability systems in such events (the 65 percent reduction in containment costs estimated by Pendell, 2006, for example) may alone be sufficient to encourage adoption, the intangible benefits of improved "optics" for the industry are another potential motivator. Indeed, the ability of traceability systems to reduce disease impact, including animal depopulations, should be an important motivator in this age when an ill-timed (or simply untruthful) cellphone video can go viral on the Internet. More germane, however, is the idea that beef industry stakeholders should take every opportunity to care for their animals and reduce the risk of harm. Such actions are both economically wise and virtuous.

Virtue aside, it is clear the U.S. beef industry stands at a crossroads – thus, the industry's emphasis on the traceability issue in the recent LRP. The easy path avoids immediate costs but leaves the industry without a robust traceability systems approach and risks larger damages from disease outbreaks and potentially pronounced financial losses. The other path requires changing fundamental philosophies in the industry. Consider U.S. President Teddy Roosevelt's¹⁶ thoughts that "...nothing in the world is worth having or worth doing unless it means effort."

¹⁶ Given in a speech titled "American Ideals in Education", delivered November 4, 1910 to the Iowa State Teachers' Association.

Export Demand Modeling

Part of this study's objective is to illuminate and quantify benefits that could accrue to the U.S. beef industry from adopting nationally significant traceability system(s). **As was pointed out in previous sections, traceability is becoming a norm in the global marketplace.**

Historical research (for example, Pendell, 2006; USDA APHIS, 2009; Brester, et al. 2011) has looked at the probable costs to the beef industry should the U.S. fail to adopt nationally significant traceability system(s). While these studies provide an excellent assessment of what the U.S. stands to lose, it is important to quantify potential benefits as well as costs. To that end, WPI developed econometric models that examine the export market activity experienced by select countries after implementing systems. The countries examined in this section include:

- Argentina,
- Brazil,
- Canada,
- Mexico,
- New Zealand, and
- Uruguay.

Each of these countries has a national traceability system (NTS) that is explained in more detail in Section 4 of this report. As such, they create prime opportunities for economic case studies to help illustrate trade impacts should the U.S. adopt a similar approach.

Of course, a myriad of economic factors, both global and within an individual country, make estimating the true impact of adopting a NTS on a country's exports more complicated. The methods and results presented in the following are not intended to be a definitive set of economic gains the U.S. would experience after adopting a NTS. Rather, these results are presented to establish a starting point for discussions and motivate the industry to holistically consider the real impacts of nationally significant animal identification and traceability systems.

Caution must be taken when interpreting the results of these case study and export demand models.

Of South American countries' results, particular analytical caution is needed due to the extreme volatility in political actions in the region. For example, Argentina's 2005 adoption of an export tariff on beef products reduced its export volumes, even though a NTS was in place that, theoretically, should have increased exports. U.S. beef producers are wise to understand that a NTS is not a "cure all" for beef exports and that countless factors can work to undermine its potentially positive effects.

Finally, the only major beef import market that currently requires traceability is China, meaning U.S. producers and exporters are not currently constrained *without* an NTS. As such, were a NTS to be adopted in the U.S. tomorrow, a large increase in export volumes is *unlikely*. However, a U.S. NTS should not be solely viewed as a way to increase exports but as part of a comprehensive industry approach that mitigates risk and assists in adding value to U.S. beef domestically and internationally.

Data and Econometric Methods

Data for the export demand modeling effort was obtained from the USDA FAS' PS&D database. Annual data on individual country production, consumption, exports, and imports of beef were acquired from 1960-2016. Additionally, data on world beef production, exports, and imports were obtained from the PS&D database.

Price is an important factor in determining the volume of beef a given country will export. Export prices for beef were acquired for the select countries from the UN/COMTRADE database for 1960-2017 (as available). Also critical is the year that countries implemented their NTS. WPI used the following adoption years to create a traceability system dummy variable for the export demand models (Table 1).

Table 1: National Traceability System Adoption Year for Select Countries

| Country | Year Traceability System Enforced |
|----------------|-----------------------------------|
| Argentina | 2003 |
| Brazil | 2006 |
| Canada | 2001 |
| European Union | 2000 |
| Mexico | 2003 |
| New Zealand | 2012 |
| Uruguay | 2006 |

Finally, international trade agreements also play an important role in determining beef exports. For this effort, the number of free trade agreements (FTAs) a given country held with other countries was calculated for each year from the WTO's Regional Trade Agreement database.¹⁷

Regarding econometric methods, this work leverages ordinary least squares regression analysis to determine whether adoption of a NTS had a statistically significant effect on a country's beef exports. Broadly, the equation for estimating a country's beef exports is given by Equation 1:

$$XB_{it} = f(Prod_{i,t-1} + XB_{i,t-1} + XPx_{i,t-1} + Wimp_t + Wexp_t + WXPx_t + trace_{i,t} + FTA_{i,t} + Trend_t + e_{i,t})$$

Where **i** corresponds to an individual country, **t** corresponds to a given year, and:

- ✓ **XB** is the quantity of beef exports,
- ✓ **Prod** is the quantity of beef production,
- ✓ **Cons** is the domestic consumption of beef,
- ✓ **XPx** is the country's own export (FOB) price of beef,
- ✓ **Wimp** is the world beef import volume for year **t**,
- ✓ **Wexp** is the world beef export volume for year **t**,
- ✓ **WXPx** is the world export prices of beef,
- ✓ **trace** is a dummy variable corresponding to whether country **i** had implemented a national traceability system in year **t**,
- ✓ **FTA** is the number of free trade agreements country **i** holds with its trading partners,

¹⁷ WTO, 2017. Available here: <http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx>

- ✓ **Trend** is a linear trend variable,¹⁸
- ✓ **e** is the error term.

Due to differences in data availability for variables in different countries, not all export demand models included the same explanatory variables. Additionally, while some data were available for years going back to 1960, the earlier data appeared less reliable than more recent figures and introduced greater variability into the modeling effort. Consequently, regression models in this research utilized data from 1980 to 2016.

Each export demand model was tested for heteroskedasticity¹⁹ following its estimation. Most models were found to be homoscedastic with no further estimation/transformations needed. Those that were not homoscedastic (e.g., Uruguay's export demand model) were transformed using the BoxCox method.

Results

Results of the econometric models are shown by country in the following section. In some cases, the dummy variable for traceability system(s) adoption was statistically insignificant. In these cases, it is likely that WPI's models omit variables that would increase the explanatory power of the traceability dummy variable. Intuitively, there is no economic explanation for why a country's beef exports should decrease following implementation of a national traceability system(s), especially if, as Murphy et al. 2008 pointed out, traceability is becoming a de facto requirement in international meat trade. However, certain models can only broadly support the hypothesis that a given country experienced higher annual export volumes after adopting a national traceability system.

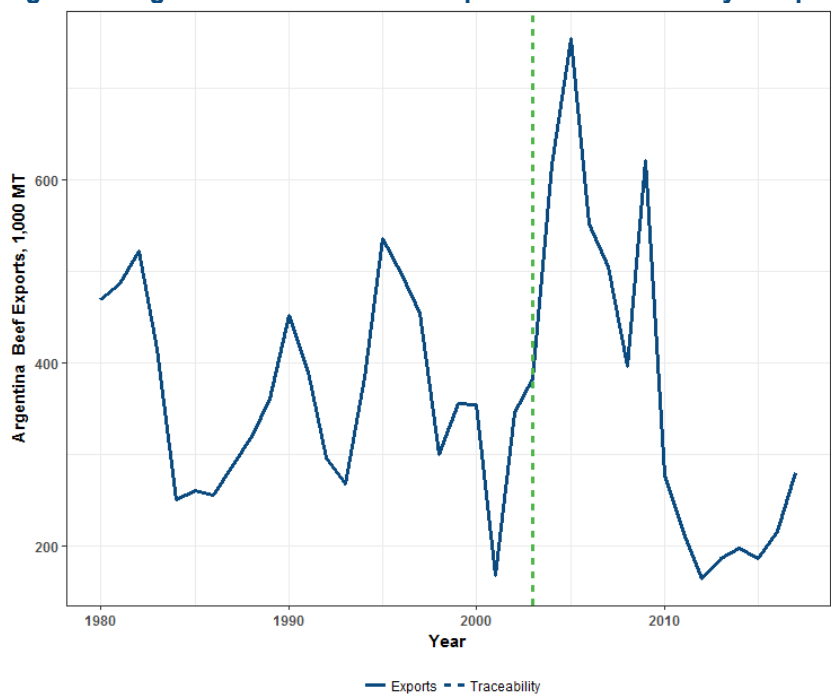
Argentina: As shown in Figure 1, Argentina's beef exports are highly variable from year to year. That said, the country's exports appear to have picked up substantially for three years following the adoption of a NTS in 2003. In 2005, however, a string of political events worked to reduce the volume of exports and, in the long run, encourage the shrinking of Argentina's beef herd and conversion of pastureland to soybean and other row crop production:

- In 2005, Argentina adopted and enforced an export tariff of 15 percent on its beef exports.
- In 2006, an export *ban* was enforced for 180 days, after which exports were limited to 40 percent of the previous year's and fourth-quarter totals.
- In 2007, an export quota based on the type of muscle cut was capped at 70 percent of 2005 exports.
- Finally, the global economic recession in 2007/08 dramatically changed world trade patterns and appears to have further limited Argentina's beef exports.

¹⁸ Trend variables are common in time-series econometrics. A linear trend can be included regardless of whether a linear model is used. Trend variables can be used to help the model to capture effects for which no variable exists. Moreover, trend variables are often used to reduce spurious correlation between two variables that are *trending*. Finally, inclusion of a trend variable frequently increases the stationarity of the independent variable and aids in ensuring the residuals are homoscedastic. In this model, the linear trend (which has values of {1, 2, 3...N} where N is the last observation in the dataset) is included to account for other variables not explicitly included in the model (for example, rising incomes in a key market for the exporting country). Additionally, because many of the variables in these models show a general upward trend, inclusion of the trend variable "detrends" the independent variable and allows for more accurate estimation of the independent variables' influence on the dependent.

¹⁹ Essentially, the condition in which the variability of a given variable is unequal across the range of values of a second variable that predicts it. Available here: <https://www.investopedia.com/terms/h/heteroskedasticity.asp>.

Figure 1: Argentina's Annual Beef Exports and Traceability Adoption²⁰



Despite Argentina's recent history of falling export volumes, the first step in quantifying the impact Argentina's NTS had on its beef exports is examining the three-year average of exports before and after the 2003 NTS adoption. As shown in Table 2, Argentina's beef export volumes more than doubled during the first three years after the enforcement of its NTS. This, however, does not necessarily prove the NTS increased exports – only that a difference exists.

Table 2: Argentina Beef Export Volumes, Three-Year Averages Before and After 2003 Adoption of National Traceability System

| Beef Exports (1,000 MT) | |
|-------------------------|------|
| Before | 289 |
| After | 584 |
| Change | 295 |
| % Change | 102% |

Source: World Perspectives, Inc.

To determine whether the mean export volume was statistically different after Argentina implemented its NTS, a two-sample mean difference test assuming unequal variance was conducted.²¹ Results from this test failed to indicate post-NTS adoption exports were greater than pre-NTS adoption volumes. However, this statistical difference test does not account for other factors which influence export volumes. To account for these factors, more detailed statistical analysis is required.

²⁰ Source: USDA FAS PS&D, World Perspectives, Inc.

²¹ The pre/post-NTS adoption means were derived and tested independently of the regression models above.

The regression model for Argentina's beef exports shows the dummy variable for before/after the country's NTS implementation is statistically different from 0 at the 10 percent level. As such, WPI concludes the NTS had a statistically significant impact on Argentina's beef exports. Further interpretation of the coefficient of Argentina's traceability dummy variable showed Argentina's beef exports were 114 percent greater after implementing the NTS than they would have been otherwise. Some caution must be noted, however, as the r-squared value for the Argentina beef export model suggests only 63 percent of the variation in beef exports is explained by the variables in this model.

- *Conclusions:* Results from this analysis show Argentina's beef export volume more than doubled in the three years after implementing a NTS than in the same period immediately preceding the country's traceability system. While pre/post NTS adoption mean-difference-tests did not suggest a statistically different export volume, regression analysis aimed at identifying causal factors influencing Argentina's beef exports were more illuminating. Specifically, the model results suggest Argentina's beef exports are 114 percent greater than they otherwise would have been, after accounting for other explanatory factors.

Given the maturity of the U.S. beef export market, it is highly unlikely the U.S. will double its beef export volumes solely because it adopts national traceability system(s). Additionally, Argentina serves as a warning that, even with a NTS in place, political changes – along with global economic factors – can quickly work to undermine any export improvement bolstered by the NTS. As such, U.S. producers should not view a NTS as a “silver bullet” for all export challenges, but merely as an enhancement to U.S. beef's reputation.

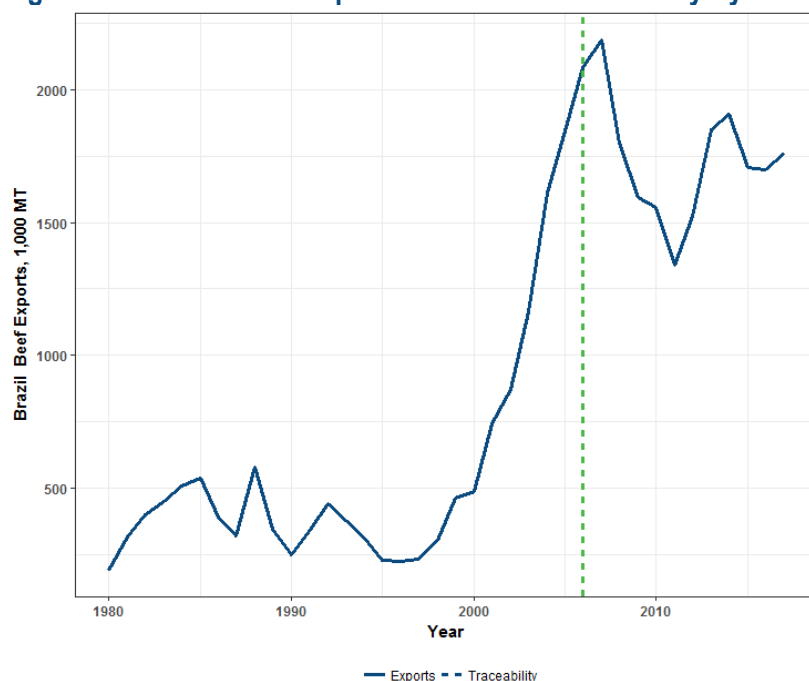
Brazil: Brazil's beef exports have been extremely volatile over the past two decades, starting with the country's precipitous rise in exports in the early 2000's. Brazilian exports grew rapidly as the country benefited from macroeconomic stability, high international commodity prices, and a currency devaluation. The 2005 FMD outbreak in Brazil threatened to disrupt exports from the largest South American country, but the adoption of a NTS²² in 2006 may have helped avoid a more pronounced collapse of export market opportunities.

Despite the adoption of a NTS to the entire beef value chain, Brazil still lost export volume to the EU when the latter country's beef demand contracted sharply during the financial downturn of 2008. Moreover, the volume of beef that met the EU's traceability program requirements was limited. Additional export constraints to Russia slowed beef shipments to that destination and caused a contraction in Brazilian beef exports.

As shown in Figure 2, Brazil's beef exports tumbled lower almost immediately after adopting a value-chain-wide traceability system. While it is intuitively clear no causal link exists between the two events (the demand shift in the European Union and Russia placing restrictions on beef imports from Brazil cannot be directly attributed to Brazil's adoption of the NTS), it is statistically difficult to separate the two. Consequently, this research omits the econometric modeling of Brazil's beef exports in favor of a more qualitative discussion.

²² More precisely, the extension of the 2001-era farm-level identification system for cattle to the entire beef value chain.

Figure 2: Brazilian Beef Exports and Year of Traceability System Adoption²³



- **Conclusions:** The fact that Brazil's traceability system was not entirely sufficient to meet the EU's traceability requirements, and that Russia found it sufficiently lacking as to impose import restrictions, should serve as a warning to the United States. **Not all traceability systems are created equal; failure to implement a nationally significant systems approach could still leave the U.S. industry exposed to export market closure risk.** Conversely, adoption and implementation of nationally significant system(s) may open or expand export opportunities for U.S. beef.

Canada: Like Brazil, Canada's beef exports dropped rapidly after the country implemented its NTS in 2001. Again, the drop-off in exports is not thought to be attributable to the direct implementation of the NTS. Rather, several fundamental, market-shifting events occurred which dramatically changed the landscape of Canada's beef export program.

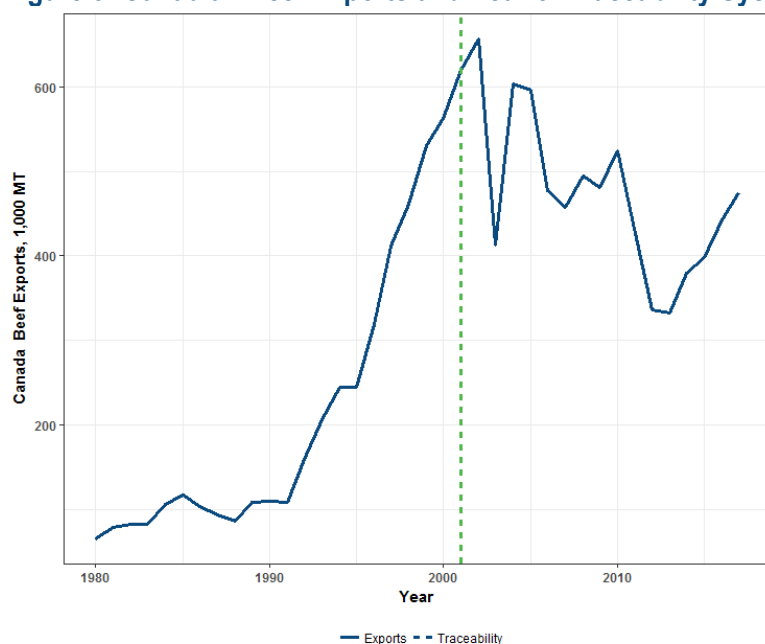
To start, in May 2003 a black Angus cow in Alberta was found to have bovine spongiform encephalopathy (BSE). Immediately following the finding, the U.S. closed its borders to Canadian cattle and beef, as did 40 other countries. The U.S. and Mexico partially lifted their respective bans in August 2003 which mitigated some of the export closure effects. In December 2004 (only one year past the discovery that a Canadian-born cow in a Washington, U.S. herd had BSE), another Alberta dairy cow was discovered to have BSE. The second finding led to a March 2005 U.S. court decision to suspend Canadian cattle and beef imports.

While Canadian beef exports to the U.S. would eventually resume, the BSE events took their toll on Canada's export program. A second factor, the implementation of the U.S.' mandatory Country of Origin Labeling (COOL) program in March 2009, further restricted Canada's beef exports to the U.S. Twine and Rude (2012) found COOL, separate from other exogenous market and policy shocks, caused Canadian cull cow, fed steer, feeder cattle, and beef exports to the U.S. to fall by 25 percent, 27 percent, 31 percent, and 21 percent,

²³ Source: USDA FAS PS&D, World Perspectives, Inc.

respectively. Because the U.S. is Canada's largest market for beef exports, the COOL requirements had a pronounced and continuing effect on Canada's export program.

Figure 3: Canadian Beef Exports and Year of Traceability System Adoption²⁴



Since 2012 Canada's beef exports have rebounded, partly due to changes in world beef export/import dynamics and partly due to changes in U.S. policy. The rapid rise in U.S. fed cattle and beef prices in 2014 encouraged additional imports from Canada. Similarly, the December 2015 decision that the U.S. would stop enforcing COOL requirements on pork and beef helped boost Canadian beef exports to the U.S.

Regression models examining the impact of Canada's traceability program on the country's exports were inconclusive with no model showing a statistically significant coefficient on the traceability variable; WPI was unable to separate the effect of Canada's NTS from the effects induced by other "shocks" (e.g., BSE cases or the U.S. COOL regulation).

Canada's NTS likely created a secondary benefit yet undiscussed in this paper. The NTS, implemented across Canada, likely decreased the response time to identify and isolate the animals infected with BSE. This impact is consistent with the results estimated by Pendell, 2006, who found high-level animal ID reduced the duration of a simulated FMD outbreak in the U.S.

- *Conclusions:* Canadian beef exports, despite being the product of a NTS implemented in 2001, appear to be the victim of a series of unfortunate and unforeseeable events. Animal disease outbreaks in Canada and the U.S. drastically changed the world export landscape while policy changes in the U.S. directly disadvantaged Canadian exports. In such cases, it is critical to remember that, while negative outcomes still occurred, the implementation of the NTS may have mitigated these effects. Moreover, the NTS likely reduced the country's response time to its BSE cases, bringing some added measure of comfort to international trading partners.

²⁴ Source: USDA FAS PS&D, World Perspectives, Inc.

From the U.S. perspective, the Canadian case study shows national traceability systems will not insulate the American beef industry from all possible negative impacts. Risks abound and a NTS is intended to address only some of the possible “shocks” that could occur. Adopting nationally significant traceability system(s), however, would mean the U.S. could improve its response to animal disease outbreaks (Pendell, 2006) and improve opportunities to increase beef exports.

Further, it is true that Canada was able to regain Chinese market access approximately three years before the U.S. because they have a mandatory animal identification and traceability program in place. In this context, Canada had a distinct advantage over the U.S. as the presence of the Canadian system eased the process of working through regulatory challenges in China.

Mexico: In 2003, Mexico established the National Individual Cattle Identification System (SINIIGA) as a voluntary program that provided an unspecified period for implementation (Murphy, et al. 2008). Ortega and Peel (2010) estimated that approximately 19 percent of Mexico’s cattle have been tagged with SINIIGA tags and only 30 percent of tagged animals have been entered in the central database. Mexico has since targeted expansion of the program as a national priority. Mexico established the program partly to avoid the BSE market disruptions plaguing Canada and the U.S. at the time, and partly to capitalize on opportunities to expand their market share.

As shown in Table 3, Mexico’s beef exports almost doubled during the three years after implementing its NTS as compared to the same period before implementation. This is also the same period when the U.S. and Canada were struggling with reduced beef export demand due to their respective BSE cases. The U.S. accounted for the majority of Mexico’s exports and export growth; note, however, that U.S. buyers do not require Mexican beef to be traceable. Thus, it is difficult to argue that there is any meaningful correlation between Mexico’s decision to introduce traceability and its growth in exports to the U.S. As such, the rise in Mexico’s beef exports can be largely attributed to events beyond the influence of the NTS.

However, the fact that Mexico’s beef exports have continued to rise offers evidence that the export gains were not solely driven by temporary shifts among global beef suppliers.

Table 3: Mexico Beef Export Volumes, Three-Year Averages Before and After 2003 Adoption of National Traceability System

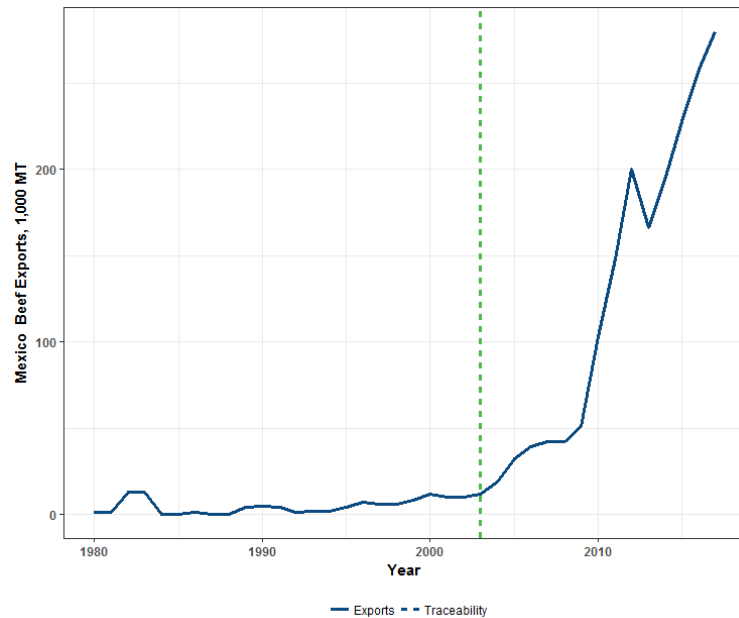
| Beef Exports (1,000 MT) | |
|-------------------------|------|
| Before | 10.6 |
| After | 21 |
| Change | 10 |
| % Change | 97% |

Source: World Perspectives, Inc.

Figure 4 shows the relationship between Mexico’s adoption of its national, voluntary traceability system and its beef export volume. Since adopting its NTS, Mexico’s beef exports have grown at a compounded annual growth rate (CAGR) of 23.2 percent.²⁵ The growth in beef exports is likely attributable to several factors; implementation of the national traceability system may be one of the factors.

²⁵ From 10,000 MT CWE in 2002 to 280,000 MT CWE in 2017.

Figure 4: Mexico's Beef Exports and Year of Traceability System Adoption²⁶



Regression analysis shows the traceability system had a statistically significant impact on Mexico's beef exports. The coefficient on the traceability dummy variable can be interpreted as showing Mexican beef exports are, on average, 108.8 percent higher than they would be otherwise, holding all other factors constant.

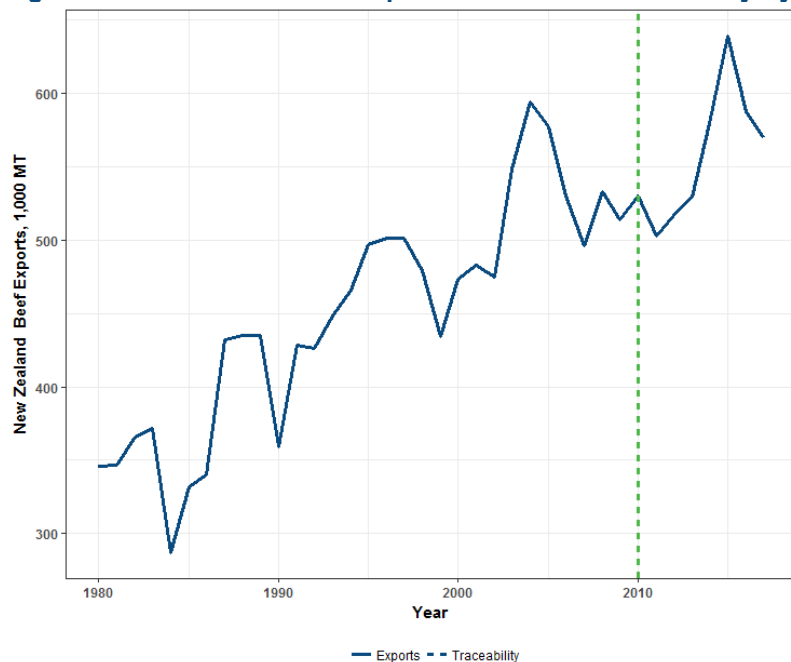
- *Conclusions:* Mexico is a case where a growing industry, global trade disruptions (BSE), and changes to the national cattle/beef traceability system converged to shift a country into a significant global supplier. In 2002, before it adopted the NTS, Mexico ranked as the world's 17th largest beef exporter. In 2017, Mexico had risen to 11th place in the world. While these gains are not attributable to implementing the national traceability system (note the program's relatively low participation rate), the system may have augmented Mexico's export growth.

The lesson for U.S. cattle and beef producers is that the presence of a NTS in the U.S. might aid in capturing market share from other countries should they experience a significant animal disease outbreak. Again, the implication from this case study is not that U.S. beef exports *will* increase following adoption of a NTS, but rather that the NTS could accentuate gains that might otherwise occur. Meanwhile, it is important to note that Mexico can cite their work in the traceability space while engaging in export market access efforts – something the U.S. cannot currently do. Mexico's traceability system is a talking point for the country, especially as it continues its work to overcome animal health challenges and resulting negative perceptions of Mexico's industry among global importers.

²⁶ Source: USDA FAS PS&D, World Perspectives, Inc.

New Zealand: As described earlier in this research, New Zealand's NTS began in force in 2010. Consequently, this leaves few annual observations for WPI's methods to "find" a statistical difference in beef exports before and after the NTS implementation.

Figure 5: New Zealand Beef Exports and Year of Traceability System Adoption²⁷



While the data in Figure 5 seems to show an increase in exports following 2010 NTS implementation, regression models did not show a statistically significant relationship between the traceability dummy variable and New Zealand's exports. Consequently, there is little evidence to confirm or deny the impact New Zealand's NTS implementation has had on its beef export volumes.

Uruguay: Like Argentina, Uruguay's beef exports are volatile from year to year. From 1980 through 2000, the country's annual beef exports ranged from a low of 100,000 MT CWE to a high of 250,000 MT CWE with little discernable trending (Figure 6). In 2000 and 2001, however, Uruguay suffered an FMD outbreak that sharply reduced its export program. This event was partial motivation for the country's 2006 regulation mandating a national animal identification system for cattle. The program's phase-in period was extended several times until it was finalized (i.e., all cattle were required to be registered) in 2013. Uruguay is considered the only country with 100 percent traceability in its national cattle herd.

Statistical models offer little evidence that the country's NTS has significantly impacted its beef exports. While regression models suggest Uruguay's beef exports are 8.2 percent greater, on average, with the NTS than without, the coefficient on the traceability variable is statistically insignificant.

²⁷ Source: USDA PS&D, World Perspectives, Inc.

Figure 6: Uruguay's Beef Exports and Year of Traceability System Adoption²⁸

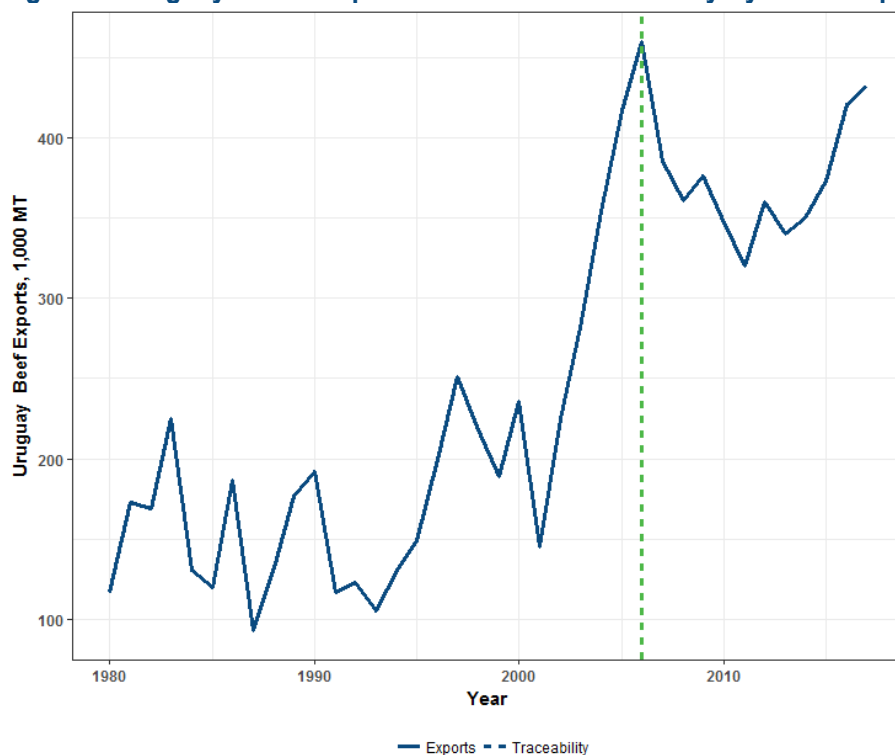


Figure 6 shows a downturn in Uruguay's beef exports at approximately the same time as the world financial crisis. This may have contributed to declining export volumes for Uruguay, as it did for Canada (Twine and Rude, 2012). Uruguay's beef exports have since rebounded and are approaching their 2006 levels. Future research may be able to better determine the true impact Uruguay's NTS has had on its beef export program. Notably, anecdotal comments from industry stakeholders in Uruguay point to the importance that Uruguay's NTS holds as the country attempts to differentiate its beef from competitors in the global marketplace.

Conclusions

With the costs of implementing nationally significant traceability system(s) ranging widely depending on system architecture, U.S. beef industry stakeholders are rightly concerned about cost-benefit analysis. The export demand modeling work conducted in this section offers at least two key case studies that show traceability systems can *support* greater beef export volumes. These case studies do not necessarily mean the U.S. will experience the same export gains, but offer evidence that traceability systems should be considered, among other market and policy signals, when global beef trade dynamics are examined. In Mexico's case, model results suggest Mexican beef exports are 108.8 percent higher after the country implemented its NTS. These results account for changes in other factors, such as Mexican beef production increases and global beef consumption changes. While other variables not included in WPI's models may be influencing Mexico's beef exports, the traceability system was *likely* a contributor to the country's exports.

Similarly, Argentina's beef exports increased after implementing its NTS, rising 114 percent after accounting for other factors. Again, while Argentina may have benefited from fortuitous timing and market conditions

²⁸ Source: USDA FAS PS&D, World Perspectives, Inc.

after implementing its traceability system, statistical analysis suggests the system itself contributed to the country's rise in beef exports.

Analysis of other countries (Canada, Brazil, Uruguay, etc.) showed their adoption of a national traceability system was *not* met with increased exports. Some of these cases – Canada in particular – seem to be due to market and/or political headwinds that overwhelmed any gains afforded by the NTS. One can speculate that their export performance might have been even worse without the expected positive influence of the NTS, but models used in this study do not attempt to answer that question.

The U.S. beef industry is faced with a binary choice: either design, adopt, and implement nationally significant traceability system(s), or continue with the status quo. Failure to be proactive could impact the U.S.' export competitiveness in the world (Schroeder and Tonsor, 2012) and does little to enhance the value of U.S. cattle and beef products. Conversely, the second option offers the opportunity to add value while protecting against the risk of export market loss in the case of an animal disease outbreak. This study should encourage the industry to think critically about short-run costs versus long-run opportunities.

6. Domestic Industry Outreach and Findings

Value Chain Perspectives

The following section provides an overview of the insights and feedback gathered via WPI's industry outreach effort. The goal of this research component was to illuminate the general perspective of each key U.S. industry segment and their respective views on animal identification and traceability, including business considerations such as costs, benefits, incentives, and so on. Naturally, discussion delved into the many traceability programs currently in use across the U.S.

Given the scale of the U.S. beef industry, it was necessary to conduct an organized outreach process. WPI's team started at the state level: taken together, a total of 23 state cattle associations were interviewed. This sample of states accounts for approximately 80 percent of the annual U.S. calf crop, spans the entire geographical U.S. and takes into consideration states with varying mixtures of public and privately-held lands. The top 15 cattle-producing states (based on recently available USDA NASS data for all cattle and calves) were included in the sample. Further, the following states were covered for various reasons:

- Arizona/New Mexico – U.S.-Mexico border states;
- Arkansas/Florida – top producing cattle states in the U.S. Southeast;
- Pennsylvania – top producing cattle state in the U.S. northeast;
- Wyoming/Oregon – brand inspection states, high percentage of public land grazing permittees; and
- Michigan – operates a mandatory, state-based mandatory animal ID system.

State cattle associations have a very strong grasp on their respective state's industry, and their contacts go beyond the cow-calf producer to cattle dealers, auction markets, feeders, packers, related industry organizations, government representatives, the veterinary sector, financial sector, etc. WPI's team pivoted off initial interviews with state-based associations and held discussions with stakeholders at all points along the industry value chain. Before covering state-level dynamics, a brief background on the USDA ADT rule is provided below.

USDA ADT Rule

In 2010, USDA announced an approach for responding to and controlling animal disease outbreaks. This rule is referred to as the Animal Disease Traceability (ADT) framework.

USDA published a proposed rule in 2011, and the final rule was published in 2013. Under the final (mandatory) rule, (unless specifically exempted) livestock aged 18 months-plus moving inter-state must be "...officially identified and accompanied by an interstate certificate of veterinary inspection (ICVI) or other documentation." The term "livestock" refers to cattle, among others. There are several exceptions to the rule, though key components include the age of identified animals and inter-state movement.

State System Highlights

Table 1 below provides a visual glance at select states based on key dynamics in the animal identification and traceability space. Of course, all states are required by Federal law to adhere to USDA ADT regulations

governing interstate movement of livestock, as described above. **USDA highlights the importance of this type of rule in ensuring a rapid response to animal disease events.**

Table 1. State Matrix – Traceability

| State | Association | USDA ADT regulations | State-mandated system | Brand inspection requirement | Cattle ²⁹ | Percentage of producers in farm/ranch-of-origin traceback program |
|-------------------------|-------------------------------------|----------------------|-----------------------|------------------------------|----------------------|---|
| Arkansas | Arkansas Cattlemen's Assn. | ✓ | | ✓ | 780,000 | 5% |
| Arizona | Arizona Cattle Growers Assn. | ✓ | | ✓ | 320,000 | 5% |
| California | California Cattlemen's Assn. | ✓ | | ✓ | 1,820,000 | 25% |
| Colorado | Colorado Cattlemen's Assn. | ✓ | | ✓ | 830,000 | 10% |
| Florida | Florida Cattlemen's Assn. | ✓ | | | 810,000 | 10% |
| Idaho | Idaho Cattle Assn. | ✓ | | ✓ | 930,000 | 10% |
| Iowa | Iowa Cattlemen's Assn. | ✓ | | | 1,090,000 | 15% |
| Kansas ³⁰ | Kansas Livestock Assn. | ✓ | | ✓ | 1,480,000 | 10% |
| Kentucky | Kentucky Cattlemen's Assn. | ✓ | | | 980,000 | 8% |
| Michigan | Michigan Cattlemen's Assn. | ✓ | ✓ | | 410,000 | 95% |
| Minnesota | Minnesota State Cattlemen's Assn. | ✓ | | | 800,000 | 8% |
| Missouri | Missouri Cattlemen's Assn. | ✓ | | | 1,890,000 | 10% |
| Montana | Montana Stockgrowers Assn. | ✓ | | ✓ | 1,470,000 | 10% |
| Nebraska ³¹ | Nebraska Cattlemen | ✓ | | ✓ | 1,700,000 | 5% |
| New Mexico | New Mexico Cattle Grower's Assn. | ✓ | | ✓ | 610,000 | 20% |
| Oklahoma | Oklahoma Cattlemen's Assn. | ✓ | | | 1,870,000 | 8% |
| Oregon | Oregon Cattlemen's Assn. | ✓ | | ✓ | 640,000 | 2% |
| Pennsylvania | Pennsylvania Cattlemen's Assn. | ✓ | | | 560,000 | 3% |
| South Dakota | South Dakota Cattlemen's Assn. | ✓ | ✓ | | 1,690,000 | 35% |
| Tennessee | Tennessee Cattlemen's Assn. | ✓ | | | 840,000 | 5% |
| Texas ³² | Texas & Southwestern Cattle Raisers | ✓ | ✓ | | 4,250,000 | 5% |
| Wisconsin ³³ | Wisconsin Cattlemen's Assn. | ✓ | ✓ | | 1,420,000 | 13% |
| Wyoming | Wyoming Stock Growers Assn. | ✓ | | ✓ | 660,000 | 1% |

Note: data in the right-most column in Table 1 is from World Perspectives, Inc. via industry interviews. Please see additional discussion below.

²⁹ USDA NASS 2016; calf crop measured in head.

³⁰ State brand requirement is effective in only a few Western counties.

³¹ Nebraska's brand inspection rule applies only to Western Nebraska, where the state's cow-calf production is concentrated.

³² Texas has expanded USDA ADT requirements: cattle are required to be *tagged at the point of sale* versus *when they cross the state line* during interstate travel.

³³ Wisconsin has state-mandated premise identification for livestock operations, but that has not evolved into premise identification for movement of cattle.

Additional state-specific details are provided below.

- **California:** California is the fourth-largest cattle producing state (by calf crop, measured in head) in the U.S. Approximately 15 to 30 percent of cattle marketed in the state are age/source verified via a third-party program. **Further, 20 percent of cattle have RFID tags upon arrival to the state's largest feeder.** Note that the state requires source/origin data (using RFID tags) as a prerequisite for any movement of dairy cattle within the state; this rule also applies to beef cattle that move out of the state (as of April 2017).
- **Colorado:** Colorado has no state-mandated system in place for animal identification and traceability. The industry adheres to the USDA ADT regulation and stakeholders participate in a host of voluntary programs, as is the case in most U.S. states. However, the Colorado Cattlemen's Association is currently exploring the creation of a program that emphasizes a series of claim standards, e.g. Non-Hormone Treated Cattle Program (NHTC), adherence to EU import requirements, etc. The demands of the Colorado restaurant/foodservice sector are helping to drive this, and source-verified and quality claims are also being considered as part of the basket of options.

Stakeholders in Colorado believe that a claim-standards approach would provide producers (especially) with multiple marketing opportunities via enrollment in an umbrella-style program. There'd be no hard, lock-in requirement for a single program – producers would buy-in and find a good fit for their operation. Finally, stakeholders expressed that information conveyance and traceability would be inherent in the claim-standards approach.

- **Florida:** The state of Florida has expanded the USDA ADT rule for in-state operators. Directed by the Florida Department of Agriculture and Consumer Services, the Florida Cattle Identification Rule "...is intended to improve the state's ability to trace diseased animals, prevent disease spread in an animal disease emergency, and protect the marketability of Florida cattle." Specifically, the system requires that animals (all cattle age 18 months-plus) moving intrastate (within Florida) be tagged with official identification.³⁴
- **Michigan: Since 2007, Michigan has had a mandatory electronic identification system in place for cattle.** All farms with cattle production have a premise number registered with the state, and any animals leaving the farm must be individually tagged before they leave the premise. Tags can be ordered through several approved vendors; only USDA 840-prefix tags are considered official identification. Redundancies are built in, e.g. several livestock auction markets throughout Michigan are approved by the state to tag cattle as part of the program. There are tag/identification readers present in every auction market in the state as well as in large-scale regional packing plants. Smaller, generally Michigan-based packing plants submit scanned tag lists monthly.

The system was implemented in response to the need for better management of bovine tuberculosis (TN) outbreaks; the impetus was the loss of Michigan's bovine TB-free status in 2000 after the reemergence of cases across the state in 1998. As such, Michigan-based feedlots that bring cattle in from out of state must have a special agreement in place. As a general practice, Michigan feeders are requesting that entities outside of the state tag animals before they ship them into Michigan.

³⁴ Available here: <https://www.freshfromflorida.com/Divisions-Offices/Animal-Industry/Florida-Cattle-Identification> with additional information found here: <https://www.freshfromflorida.com/content/download/38829/857923/SummaryRequirements.pdf>.

Initially, compliance with the system among Michigan’s producers was between 70 and 80 percent – a figure that exceeded expectations, though cow-calf producers were reportedly slower to come on board than dairy operations (approximately 75 percent of Michigan’s cattle are in dairy herds). Today, compliance continues to climb towards 100 percent. The rollout of the system was conducted collaboratively and involved the Michigan Cattlemen’s Association, Michigan Farm Bureau, the state’s veterinary office, and other stakeholders. The outreach and communication process started a full two years before the system was implemented.

The majority of Michigan’s producers are not using the [state’s traceability] system as a record-keeping tool. They have treated this as a requirement, met the requirement, and continued operating. – Michigan beef industry stakeholder.

Michigan’s program is managed by the Michigan Department of Agriculture. Traceability data is stored in an electronic database (www.usaherds.org) that is collectively managed by several state agencies. The Pennsylvania Department of Agriculture owns the software and the National Agribusiness Technology Center is the licensing organization.

- **Montana:** Montana is the eighth-largest cattle producing state (by calf crop, measured in head) in the U.S. Three of the state’s largest cattle markets are currently using RFID tags in all cattle that move through the system; generally, veterinarians employed by the market are logging information in digital form. The owner “point of information” piece that goes with this is the brand inspection (a requirement in Montana). Meanwhile, according to state sources, **75 percent of feeder cattle programs in the state are using RFID tags.**
- **North Carolina:** The North Carolina Department of Agriculture and Consumer Services currently sponsors a *voluntary* program for livestock (and poultry) disease traceability by assigning a premise identification number (PIN) to a specific parcel of land.
- **South Dakota:** South Dakota has expanded the requirements of the USDA ADT rule, such that all cattle entering and leaving the state must have a certificate of veterinary inspection from a state-registered veterinarian. The system includes licensure and accreditation of state veterinarians; traceability information (via backtags) is recorded on certificates managed by the state animal health agency, and data is stored in an electronic database. Direct oversight is provided by the South Dakota Animal Industry Board (SDAIB). Two official forms of identification are recognized: the USDA 840-prefix tag or the National Uniform Ear Tagging System (nine-digits, including a unique state code).³⁵

The SDAIB works closely with USDA APHIS to find commonality in the approach to gathering and managing data. South Dakota has a history of dealing with bovine TB issues, and as such **views animal identification and traceability through the lens of animal disease control/response.**

South Dakota comes at this very much from an animal disease standpoint. If we [the industry] want traceability for animal health purposes, it really

³⁵ Source: South Dakota Animal Industry Board, available here: <http://www.aib.sd.gov/pdfs/ADT%2002-16.pdf>.

needs to be mandatory. Animal disease control is the main benefit of a robust system; producer pushback is a drawback, but this is an ongoing education process. – South Dakota animal health industry representative.

- **Texas:** USDA ADT regulations call for breeding animals 18 months-plus to be tagged when they cross state lines. The state of Texas has expanded that rule to require all breeding animals in Texas to be tagged at the *point of sale*.
- **Virginia:** Led by the Virginia Animal Disease Traceability Working Group – a coalition of animal agriculture organizations – the state is working to 1) increase the use of official and unique identification devices, and 2) capture animal movement records. The Virginia Department of Agriculture and Consumer Services' *Advancing Animal Disease Traceability in Virginia; Strategic Plan 2015-2018* identifies "...efficiently capturing data from interstate livestock movements..." as an area for further progress as the state's beef cattle industry adjusts to the ADT rule.³⁶
- **Washington:** After USDA's publication of the ADT rule, Washington state, led by the Washington State Department of Agriculture, implemented a program to create a central repository for animal health information, change of ownership information, etc. The repository, known as "Animal Tracks" is synchronized with an electronic livestock inspection system, whereby state livestock inspectors use an electronic process to log inspection data as opposed to a paper process.³⁷
- **Wisconsin:** The state of Wisconsin requires that every premise in the state with livestock present be registered via an application form; renewal is required every four years. The program is managed by the Wisconsin Livestock Identification Consortium. While the program does have an animal disease component built into the software, it is not being used due to pushback at the producer level. Reportedly, it was disagreement over the optimum form of tagging – e.g. panel tags, RFID tags, etc. – among beef industry stakeholders that resulted in the tabling of the system's animal disease component. The state's dairy industry is (generally) already using RFID tags for traceability purposes.

Importantly, the premise information gathered as part of this system is managed by a third-party on a private, non-government server. The Wisconsin Department of Agriculture, Trade and Consumer Protection can access the data *only* in the case of an animal disease outbreak.

Via direct quantitative surveying of multiple stakeholders in each of the 23 states targeted as part of this study, WPI's team generated the following estimate: **Approximately 9 to 10 percent of U.S. producers, out of the share that account for over 80 percent of the U.S. cattle herd, are currently participating in a ranch-of-origin style traceability program.** Table 2, below, includes information already detailed in Table 1 but shows states ranked by the percentage of producers currently participating in a farm or ranch-of-origin traceback program.

³⁶ Available here: https://www.aphis.usda.gov/traceability/downloads/adt_states/VA.pdf.

³⁷ Available here: <https://agr.wa.gov/FoodAnimal/AnimalID/ADTproject.aspx>.

Table 2. Percentage of Producers, by State, Participating in Ranch-of-Origin Traceability Program

| State | Cattle (Calf crop, measured in head) ³⁸ | Percentage of producers in farm or ranch-of-origin traceback program |
|--------------|--|--|
| Michigan | 410,000 | 95% |
| South Dakota | 1,690,000 | 35% |
| California | 1,820,000 | 25% |
| New Mexico | 610,000 | 20% |
| Iowa | 1,090,000 | 15% |
| Wisconsin | 1,420,000 | 13% |
| Missouri | 1,890,000 | 10% |
| Kansas | 1,480,000 | 10% |
| Montana | 1,470,000 | 10% |
| Idaho | 930,000 | 10% |
| Colorado | 830,000 | 10% |
| Florida | 810,000 | 10% |
| Oklahoma | 1,870,000 | 8% |
| Kentucky | 980,000 | 8% |
| Minnesota | 800,000 | 8% |
| Texas | 4,250,000 | 5% |
| Nebraska | 1,700,000 | 5% |
| Tennessee | 840,000 | 5% |
| Arkansas | 780,000 | 5% |
| Arizona | 320,000 | 5% |
| Pennsylvania | 560,000 | 3% |
| Oregon | 640,000 | 2% |
| Wyoming | 660,000 | 1% |

Source: World Perspectives, Inc. via industry interviews.

Considering the data in Table 2, even when accounting for programs in key states, there is currently no mix of voluntary animal identification and traceability systems in the U.S. that can be considered nationally significant.

State Associations

There are several considerations shared by state-based cattle associations that came out during discussion. These include:

- ✓ State associations interviewed as part of this research all share the following view: **expanded animal identification and traceability systems are necessary to maintain the overall competitiveness of the U.S. beef industry; it is up to industry to take advantage of a narrowing window and exhibit leadership before an animal disease outbreak or similar catastrophic event results in a blanket system foisted upon the industry with little stakeholder input.**

³⁸ USDA NASS 2016.

- ✓ State cattle associations are generally dissatisfied with the stop-and-start nature of the animal identification and traceability discussion at the national/federal level. They do see an opportunity for an *industry* entity to take a firm leadership role and push an expanded approach forward, though there is shared concern that a misguided or half-hearted effort would result in “more of the same.” Thus, right now there continues to be a general hesitation to support any specific approach, after several “swing and miss” efforts at the national level. In terms of next steps, outreach and communication are extremely important.
- ✓ State associations must balance a diverse constituency, especially in states with large, diversified beef industries. They can – and do – provide input, feedback and direction on behalf of their membership to the higher-level animal identification and traceability discussion. However, they cannot take a leadership role at the U.S. industry level at the expense of their state constituents.
- ✓ State associations made clear that stakeholders – including cow-calf producers but also others all along the value chain – have serious concerns about data privacy when discussing an expanded approach to animal identification and traceability. This concern – whether focused on the potential for malicious hacking, public access to business confidential data, government misuse of information, etc. – was echoed in WPI’s discussions with all sectors of the industry.
- ✓ Ultimately, practical concerns drive state associations: membership levels, funding, and appropriate services to key constituencies. However, state associations do represent a very powerful communication and information sharing entity – they are uniquely positioned to help facilitate discussion up and down the value chain.

Cow-Calf Producers

As noted above, approximately 9 to 10 percent of U.S. cow-calf producers currently participate in voluntary, ranch-of-origin traceback programs. The number of voluntary, third-party programs are too numerous to count; in some cases, these programs have components such as individual animal identification, though they may not have robust animal identification and traceability components. They are broadly categorized below:

- Place of birth, movements (change in ownership, slaughter, etc.),
- Production practices (e.g. never-ever, natural, animal welfare, etc.),
- ADT/health program (Brucellosis, Bovine TB, etc.),
- Breed association registration program,
- Export verification program – e.g. NHTC for the European market.

Also common are programs whereby third-party auditors (e.g. IMI Global) certify/verify specific practices on the ranch that then open any number of marketing opportunities, for example:

- ✓ Source/age verification,
- ✓ Beef Quality Assurance (BQA),
- ✓ Non-Hormone Treated Cattle (NHTC),
- ✓ High Quality Beef (HQB) Quota,
- ✓ Verified Natural Beef, Grass-Fed Beef, etc.,
- ✓ GAP 5-Step Animal Welfare,
- ✓ On-Farm Animal Welfare Audits,
- ✓ American Humane Certified,
- ✓ Non-GMO Project Verification,
- ✓ USDA Organic, etc.

Of course, the above list is best described as a series of **voluntary programs that producers buy into (generally via specific on-farm practices) in exchange for access to niche market segments and/or specific demand channels**. The point is, producers are incentivized to participate in them by the promise of added value.

This key point resonated throughout WPI's interviews with cow-calf producers from over 20 U.S. states. Producers participate in a host of animal identification and traceability programs, and rationales for participating are as diverse as the producers themselves. However, one rationale is paramount: **U.S. cow-calf producers participate based on the marketing value/premium, or the ability to monetize animal identification and/or traceability and thereby generate incremental income**. By providing additional data on herd health, production practices, breed characteristics, etc., a producer can realize a premium when they market their cattle. This rationale is prevalent among both large- and small-scale producers across the U.S., and outweighs additional factors that producers consider when participating in an expanded system.

WPI's research affirmed two additional topline reasons that drive producers to implement animal identification and traceability systems as part of their operations. These include:

- ✓ **Herd management/quality control**. Specifically, the ability to accurately track the performance of animals at the feed yard (e.g. rate of gain) or at slaughter (e.g. grading).
- ✓ **Insurance against animal disease outbreak(s) and resulting value-chain impacts**. Specifically, the fear of being caught on the wrong side of a disease outbreak and/or implicated in a broad-stroke reaction by government agencies to an outbreak. Producers distinctly remember the 2003 BSE outbreak in the U.S. and the subsequent impact it had on cattle prices.

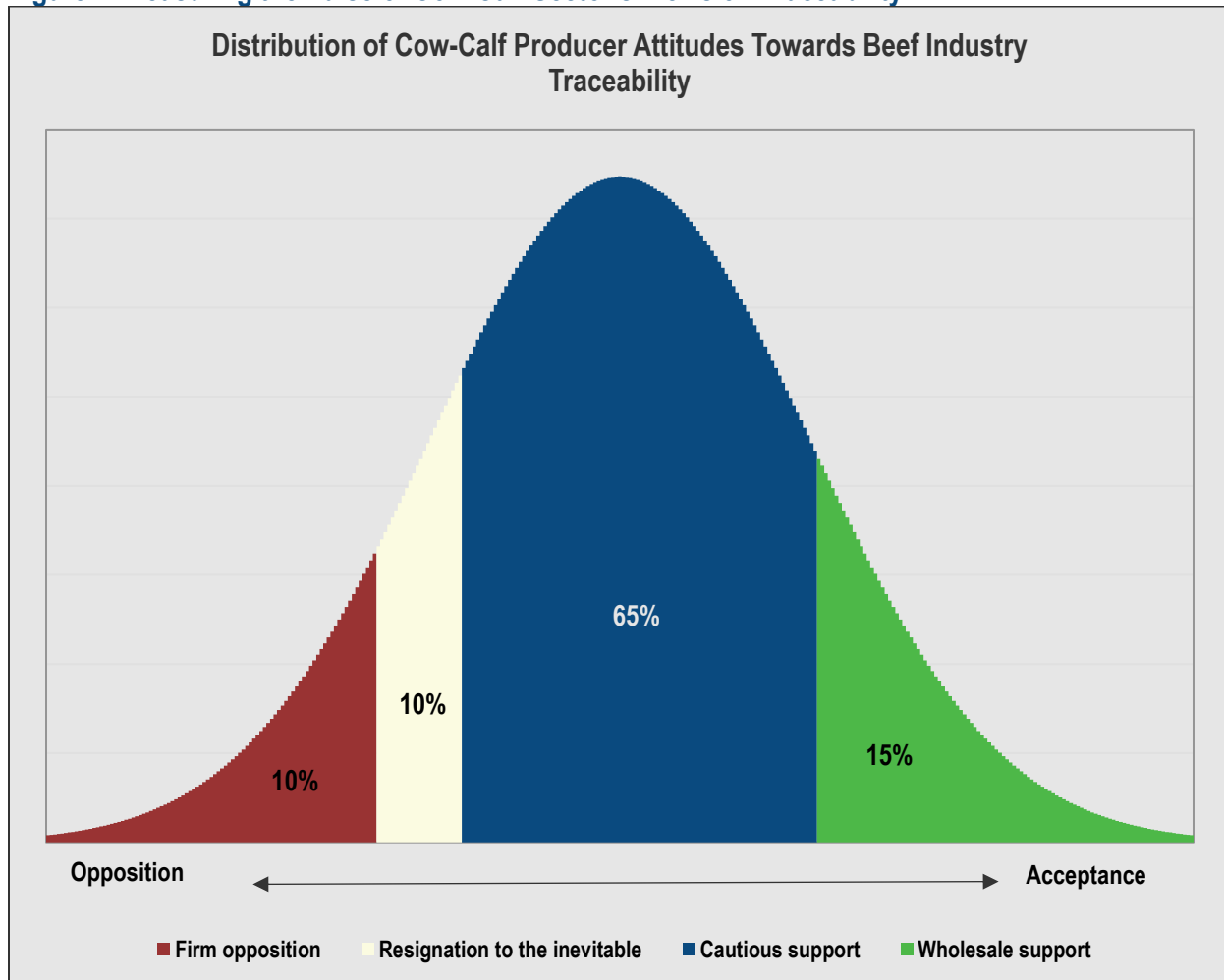
In terms of system architecture, most third-party systems that producers participate in store data in private electronic databases. Increasingly, RFID tags are employed to enable data gathering, tracking and management. Backtagging/back-verification is another popular method for gathering data.

WPI's interviews uncovered concrete examples of proactive industry alignment: As outlined above, even though Montana does not have a mandatory animal identification and/or traceability system beyond the USDA ADT rule, the three largest cattle markets in the state are tagging all cattle that move through their operations with RFID tags, and an accredited veterinarian is logging information from the tags into a digital format. This dynamic was echoed up the value chain by a large-scale (2,000-plus mother cows, 3,000-plus head of stocker cattle annually) operation from Montana that WPI's team interviewed. This entity uses RFID tags in all their animals (and has for over ten years now), enabling them to participate in many voluntary programs and practice enhanced herd management. The interviewee pointed to inventory records as one of the most significant, but overlooked, benefits of adherence to a strict animal identification and traceability approach.

The majority of large operations (1,000-plus head) that WPI interviewed confirmed that they are already practicing some form of voluntary animal identification and traceability. At the same time, most cow-calf interviewees – regardless of the size of their operation – expressed concern regarding potential implementation of a government-mandated system, in many cases citing the value they are already realizing following investments into infrastructure or practices to meet voluntary program requirements.

Language, tone and context are important aspects to consider when trying to draw conclusions from a series of personalized, qualitative interviews. Thus, in terms of the general acceptance among cow-calf producer interviewees regarding an expanded U.S. industry approach to animal identification and traceability, it's best to think in terms of a sliding scale. The graphic below leverages the WPI team's experience in analyzing and synthesizing discussion results from a series of shared questions. Most directly: Figure 1 below summarizes the range of responses to the question of 1) implementation of, or 2) integration with a nationally significant animal identification and traceability approach for cattle.

Figure 1. Measuring the Pulse of Cow-Calf Sector's Views on Traceability.



Quantitative Survey – Cow-Calf Producers

To provide broader context to the findings of WPI's producer interviews, a large-scale quantitative producer survey was conducted to generate additional data and insights centered around a series of animal identification and traceability questions. The survey featured over 600 unique responses from U.S. cow-calf producers (majority); smaller samples of dairymen, farmer-feeders, feedlot operators, seedstock-purebred operations, and stockers were gathered as well.

- *A note on methodology:* It is important to ensure response differences between groups in a quantitative survey are *statistically significant* and not due to chance. Testing whether response

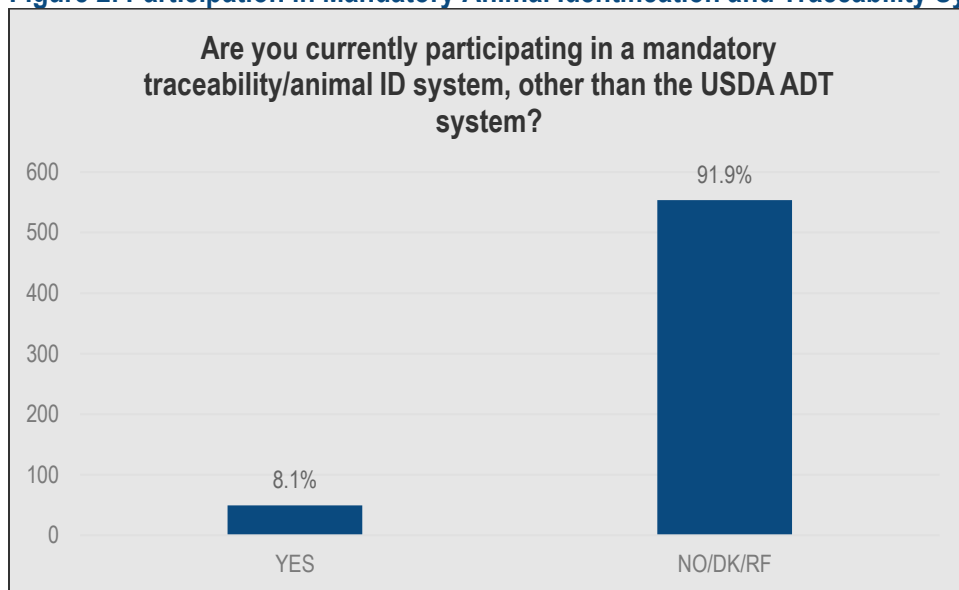
differences are statistically different or not allows more accurate conclusions to be drawn from the survey. Without this statistical analysis, it could be possible to draw false conclusions that two groups may respond differently to incentives, when, in fact, the difference is only due to opinions of individuals surveyed and not to factors influencing the entire industry.

Conducting statistical difference/significance tests results in a numeric probability that survey response differences are *meaningfully different* from each other. For example, a survey showing 55 percent of cattle feeders support “A” and 65 percent of beef packers support “A” may yield the result that these responses are statistically different at the 90 percent confidence level. Put simply, based on the data and the testing method, an analyst can be 90 percent certain that beef packers show a higher level of support for “A” than cattle feeders. **Ascertaining statistically different responses is critical for leaders in the beef industry to understand what motivates certain groups and what barriers hinder others.**

For the survey detailed below, pairwise independent Z-tests for un-pooled proportions were made on every response grouping to every question in the quantitative survey. For example, consider a question that had five response choices (Strongly Disagree to Strongly Agree, for example) that was asked of five groups within the industry (cow-calf, stocker, feedlot, dairy, and packer). WPI’s analysis tests each response level for each group against the other groups for statistical difference (i.e., “Strongly Agree” for packers was tested against “Strongly Agree” for feeders, cow-calf, etc.). Results that are statistically different are indicated with superscript letters in the following analysis tables. As noted in each table, upper case letters indicate responses between groups were statistically different at the 90-plus percent confidence level ($P \leq 0.10$). As noted earlier, leaders in the beef industry should pay special attention to the statistically difference responses as they offer deeper insight into the views of each level in the supply chain.

The following quantitative survey insights generally corroborate the key findings from WPI’s more personalized, qualitative interviews.

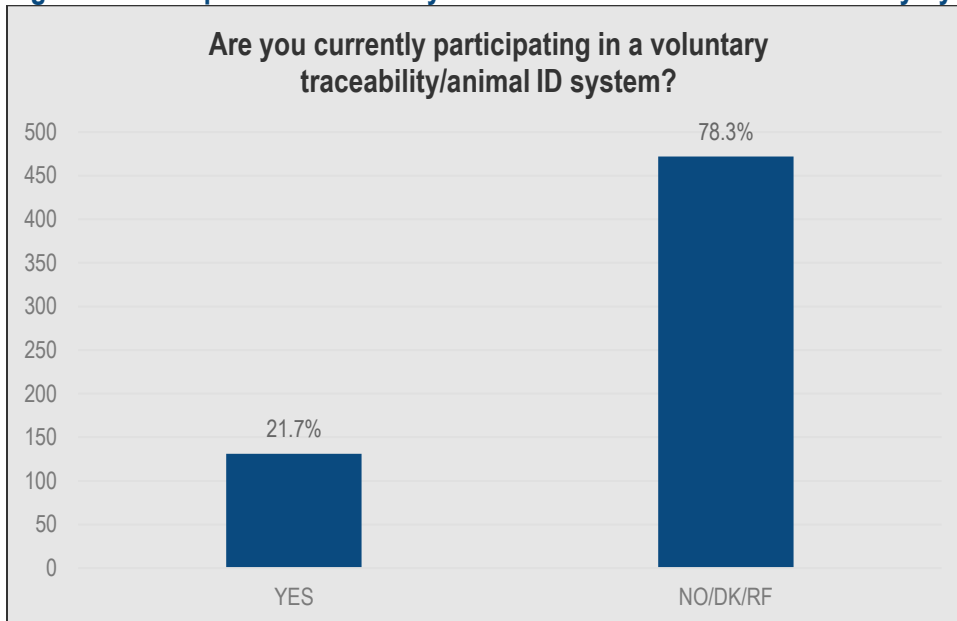
Figure 2. Participation in Mandatory Animal Identification and Traceability Systems.



Source: Aspen Media and World Perspectives, Inc.

Nearly 91 percent of respondents are not participating in a mandatory system (aside from USDA's ADT rule, Figure 2). In data that is corroborated by WPI's industry interviews, approximately 22 percent of respondents are participating in some type of voluntary system (Figure 3).

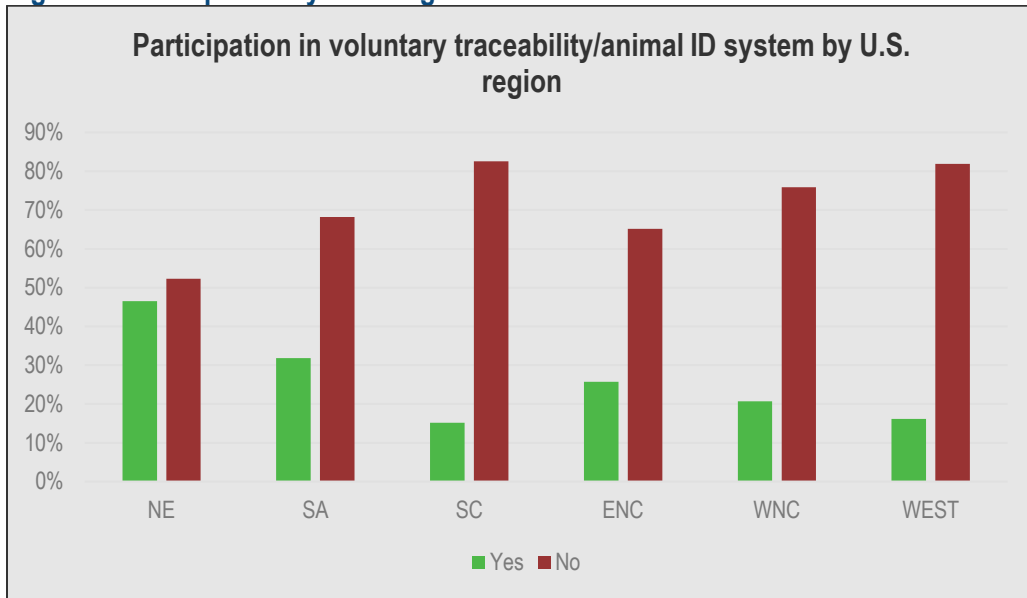
Figure 3. Participation in Voluntary Animal Identification and Traceability Systems.



Source: Aspen Media and World Perspectives, Inc.

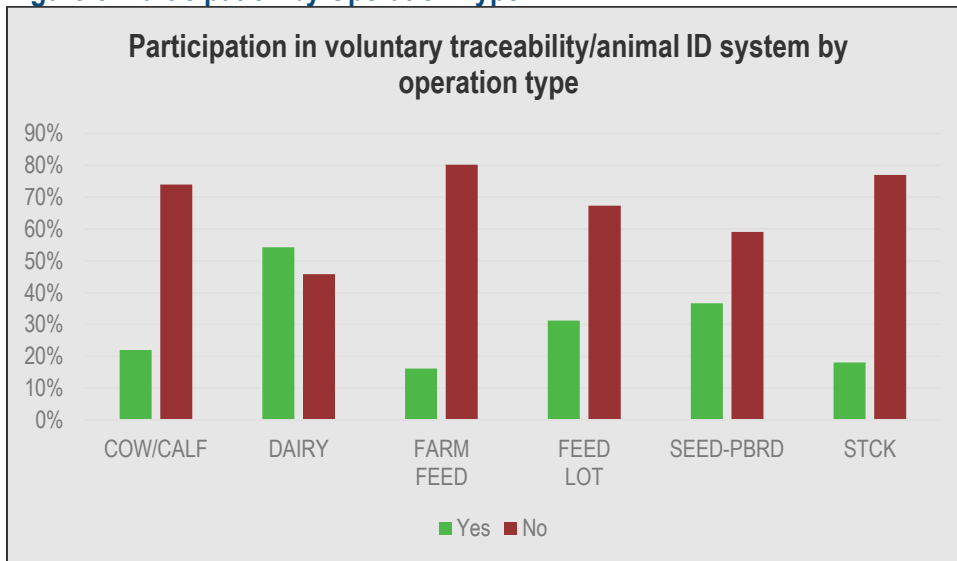
The following three charts (Figures 4, 5, and 6) detail participation in voluntary systems broken out by U.S. region, operation type and herd size. Note especially the participation in voluntary systems by dairy industry stakeholders. Of further interest is the fact that larger operations (by herd size) are more likely to voluntarily participate in a traceability system. These results are corroborated by the discussions WPI had with large-scale cow-calf operators across the U.S.

Figure 4. Participation by U.S. Region.



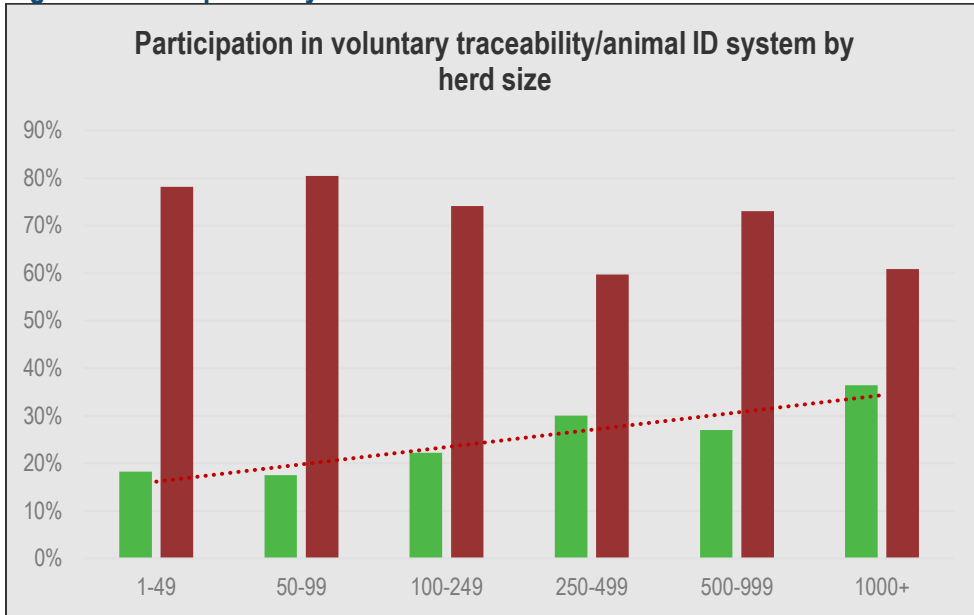
Source: Aspen Media and World Perspectives, Inc.

Figure 5. Participation by Operation Type.



Source: Aspen Media and World Perspectives, Inc.

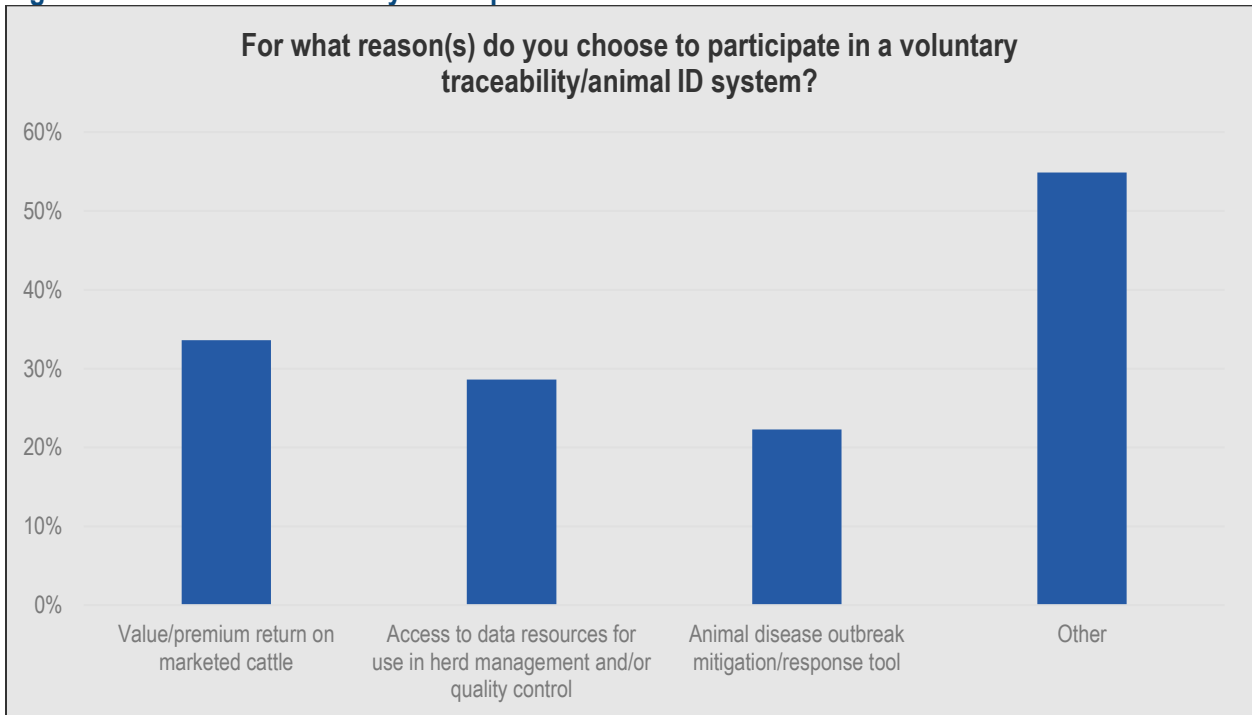
Figure 6. Participation by Herd Size.



Source: Aspen Media and World Perspectives, Inc.

Figure 7 (below) details the reasons why respondents choose to voluntarily participate in traceability systems. Note that the “Other” respondents generally were supplemented by verbatim comments regarding the opportunity to add value/earn a premium, and thus those responses do not add a significantly different perspective to the survey’s overall results.

Figure 7. Reasons for Voluntary Participation.



Source: Aspen Media and World Perspectives, Inc.

In further analyzing the data, large producers (500-plus head) had a higher propensity to indicate value/premium return on marketed cattle as their reason for adopting a voluntary traceability program. Similarly, large (500-plus head) and small (1-99 head) producers were more likely to indicate animal disease outbreak mitigation/response as the reason they adopted a voluntary traceability/animal ID system. The first finding may indicate **larger producers are more aware of (or better able to capture) premium pricing for traceable cattle while the latter perhaps indicates a greater sensitivity to disease outbreaks.**

Table 3: Responses for Why Producers Chose to Participate in a Voluntary Traceability/Animal ID System by Herd Size.

| | Herd Size (in head) ³⁹ | | | |
|--|-----------------------------------|----------------------|----------------------|----------------------|
| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
| Value/premium return on marketed cattle | 30.0% | 32.4% | 37.2% | 53.8% ^{A,B} |
| Access to data resources for use in herd management and/or quality control | 26.7% | 27.0% | 27.9% | 43.6% |
| Animal disease outbreak mitigation/response tool | 26.6% ^B | 5.4% | 18.6% ^B | 23.1% ^B |
| Other | 60.0% | 43.2% | 46.5% | 48.7% |

A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response ("row").

Note that **feedlot operations place a statistically significant emphasis on disease outbreak mitigation/response as the primary factor for adopting a voluntary traceability program.** Feedlots also placed a greater emphasis on data/record keeping/herd management.

³⁹ For pairwise tests between multiple groups, it is common to assign an alphabetical value to each of the groups for indication within the table of which group was compared to the others. That is what these superscripts assigned to the herd size number indicate; one could say herd size 1-99 is group "A," 100-249 is group "B," etc. In the table itself, superscripts assigned to the percentage results indicate that a certain response proportion is different from the other group indicated by its superscript.

Table 4: Responses for Why Producers Chose to Participate in a Voluntary Traceability/Animal ID System by Operation Type.

| | Cow-Calf ^A | Dairy ^B | Farmer Feeder ^C | Feedlot ^D | Seedstock/ Purebred ^E | Stocker ^F |
|--|-----------------------|--------------------|----------------------------|----------------------------|-------------------------------------|----------------------|
| Value/premium return on marketed cattle | 35.7% | 24.3% | 36.2% | 44.6% | 23.0% | 38.3% |
| Access to data resources for use in herd management and/or quality control | 29.2% | 28.8% | 17.3% | 68.8% ^{A,B,C,E,F} | 19.8% | 27.3% |
| Animal disease outbreak mitigation/response tool | 22.2% | 24.3% | 21.3% | 58.0% ^{A,B,C,E,F} | 12.8% | 13.7% |
| Other | 58.0% | 46.9% | 58.3% | 43.4% | 63.5% | 50.8% |

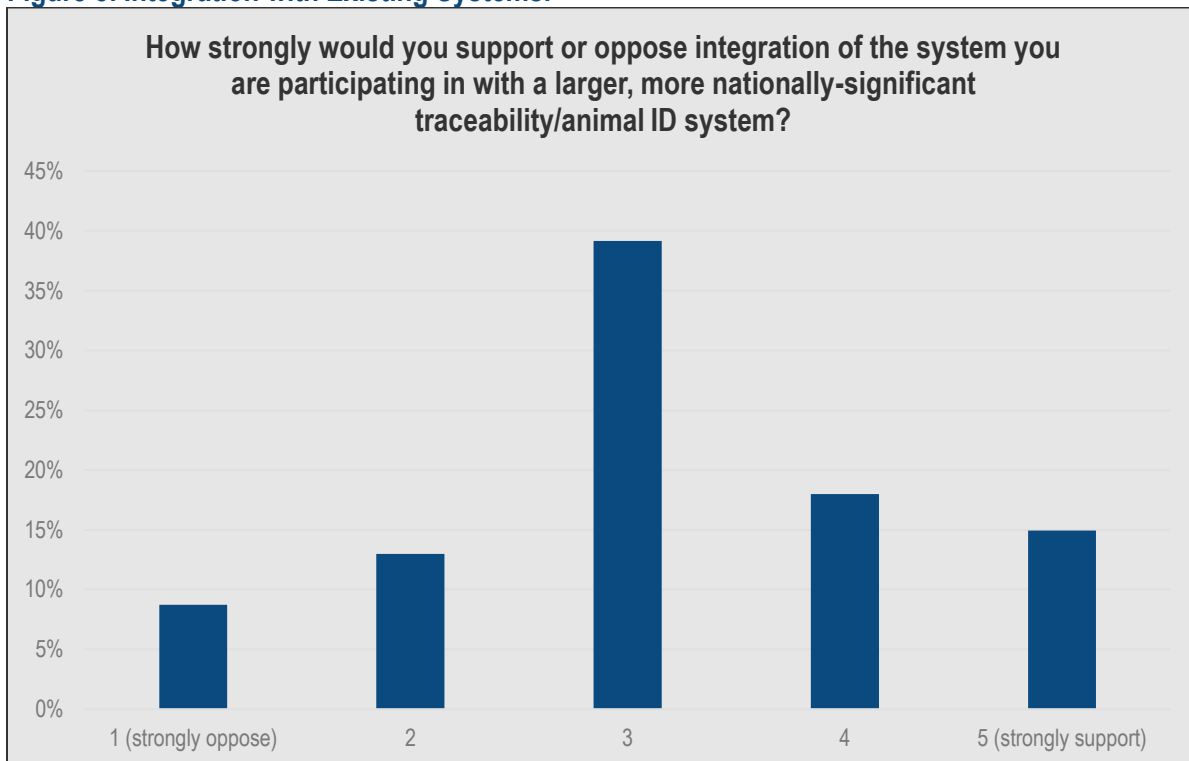
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Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response ("row").

Integration of existing systems with a larger, nationally significant system is an important issue to understand when considering potential ways forward for the industry. Figure 8 (below) measures support of the system integration approach. **The significant number of "Neutral" respondents provide a target audience for increased communication and outreach regarding the potential for system(s) integration.**

Figure 8. Integration with Existing Systems.



Source: Aspen Media and World Perspectives, Inc.

Meanwhile, large (500-plus head) producers had a higher response rate strongly supporting integration of the voluntary traceability system they currently employ with a nationally significant system. Small (1-99 head) producers had a much higher response rate of being neutral to integration of such a system.

Table 5: Support or Opposition to Integration with a Larger, Nationally Significant Traceability System by Herd Size.

| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
|----------------------|------------------------|----------------------|----------------------|----------------------|
| 1 (strongly oppose) | 6.7% | 10.8% | 16.3% | 10.3% |
| 2 | 13.3% | 16.2% | 14.0% | 5.1% |
| 3 | 50.0% ^{B,C,D} | 24.3% ^D | 25.6% ^D | 7.7% |
| 4 | 13.3% | 21.6% | 25.6% | 33.3% |
| 5 (strongly support) | 10.0% | 24.3% | 14.0% | 33.3% ^{A,C} |
| Don't know | 6.7% | 0.0% | 4.7% | 10.3% |

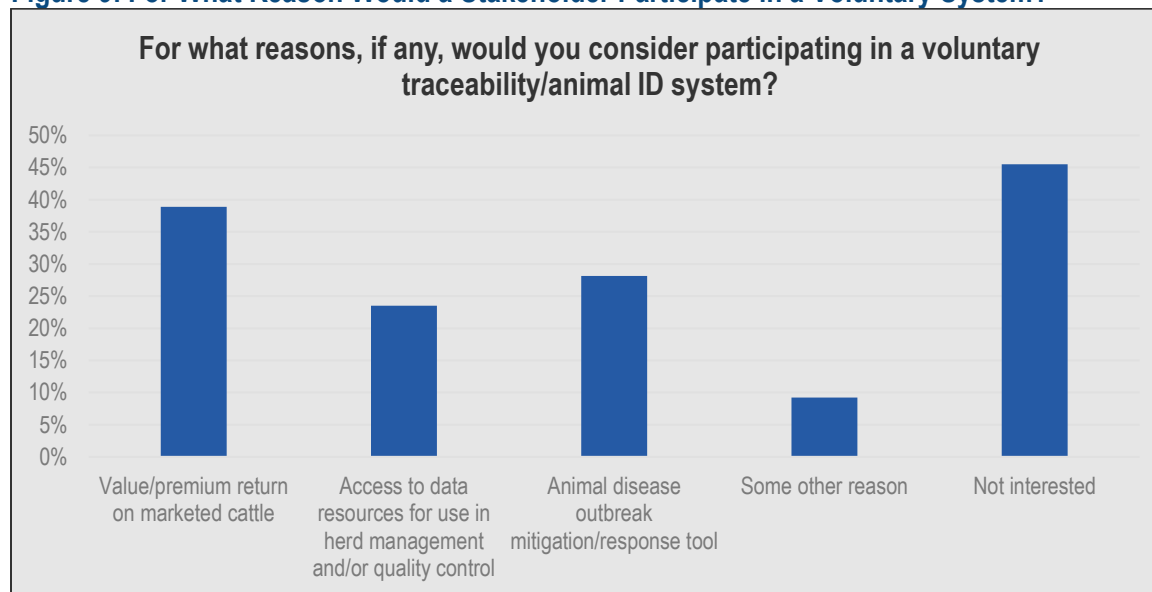
A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response ("row").

Respondents that are currently not participating in a voluntary system offer several reasons why they might be interested in participating below (Figure 9). The opportunity exhibited by the results of this question is that over half of respondents can identify a reason that would incentivize them to participate in a voluntary system.

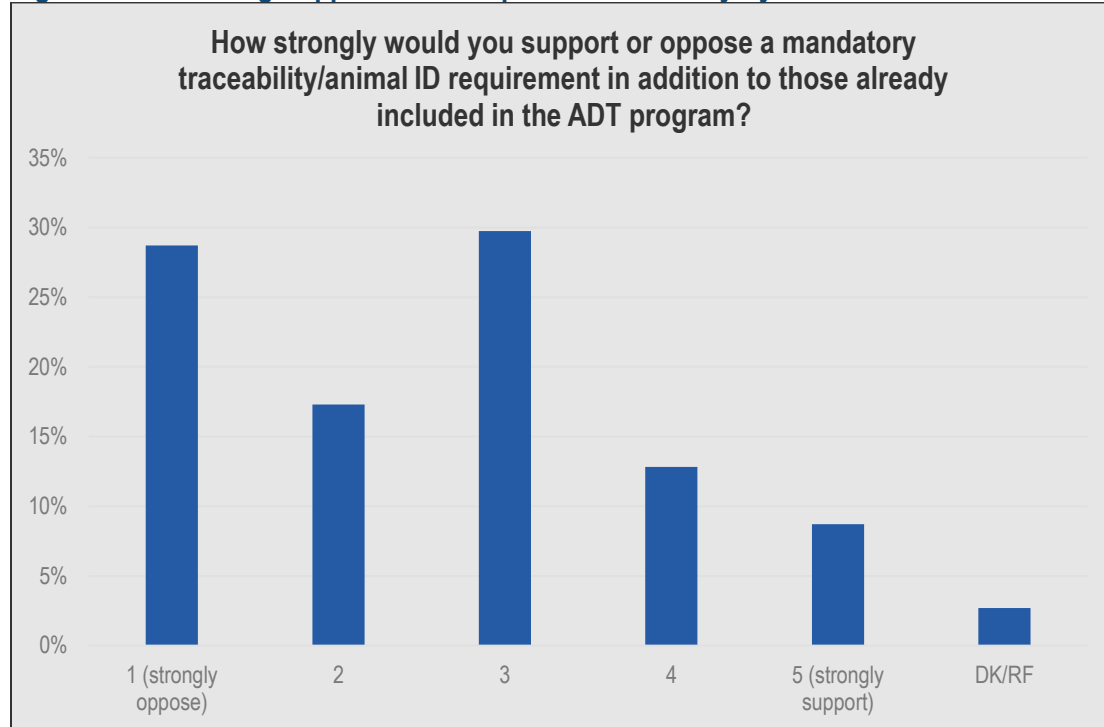
Figure 9. For What Reason Would a Stakeholder Participate in a Voluntary System?



Source: Aspen Media and World Perspectives, Inc.

In Figure 10 (below) support/opposition to a mandatory system (e.g. one that goes beyond the current ADT rule) is measured. At first glance opposition is strong. However, again, **the “Neutral” respondents represent an opportunity: they are a target audience for expanded outreach and communication as discussion on next steps proceeds.**

Figure 10. Measuring Support for an Expanded Mandatory System.



Source: Aspen Media and World Perspectives, Inc.

Further analysis reveals that the idea of a mandatory traceability system has limited support across all types of beef/cattle operations. The majority of respondents either “strongly oppose” or “oppose” a mandatory system with only 11 percent of respondents, on average across operation type, “strongly supporting” a mandatory system. While the neutral respondents represent a key target audience, overall the responses to this question underscore the challenge the U.S. beef industry faces in changing producers’ philosophical value system to implement a nationally significant traceability system(s) approach.

Table 6 shows that there is little statistically significant difference in producer opposition/support for a mandatory system across operation type. The survey responses show stocker operators are more likely to view a mandatory system as “neutral” than are cow-calf, dairy, or feedlot operators. Farmer/feeders are more likely to be “neutral” in their support than are stocker operations. Dairy operations had a statistically significant and higher propensity to answer they “didn’t know” how they felt about a mandatory system, but this is hardly a useful finding from which to draw conclusions. The conclusion that can be drawn, however, is that the U.S. beef industry, regardless of where individual operations fall along the value chain, has limited support for a mandatory traceability system.

Table 6: Strength of Opposition/Support to a Mandatory Traceability/Animal ID Requirement by Operation Type.

| | Cow-Calf ^A | Dairy ^B | Farmer Feeder ^C | Feedlot ^D | Seedstock-Purebred ^E | Stocker ^F |
|----------------------|-----------------------|------------------------|----------------------------|----------------------|---------------------------------|------------------------|
| 1 (strongly oppose) | 32.0% | 23.8% | 25.5% | 23.7% | 29.4% | 29.8% |
| 2 | 16.5% | 22.2% | 13.8% | 16.2% | 11.3% | 29.0% |
| 3 | 26.7% | 22.1% | 36.3% ^F | 37.3% | 28.2% | 22.1% ^{A,B,D} |
| 4 | 13.2% | 10.6% | 14.2% | 8.6% | 22.1% | 14.6% |
| 5 (strongly support) | 9.6% | 6.5% | 8.7% | 12.4% | 4.7% | 4.4% |
| Don't know | 1.9% | 14.8% ^{A,C,D} | 1.5% | 1.9% | 4.2% | 0.0% |

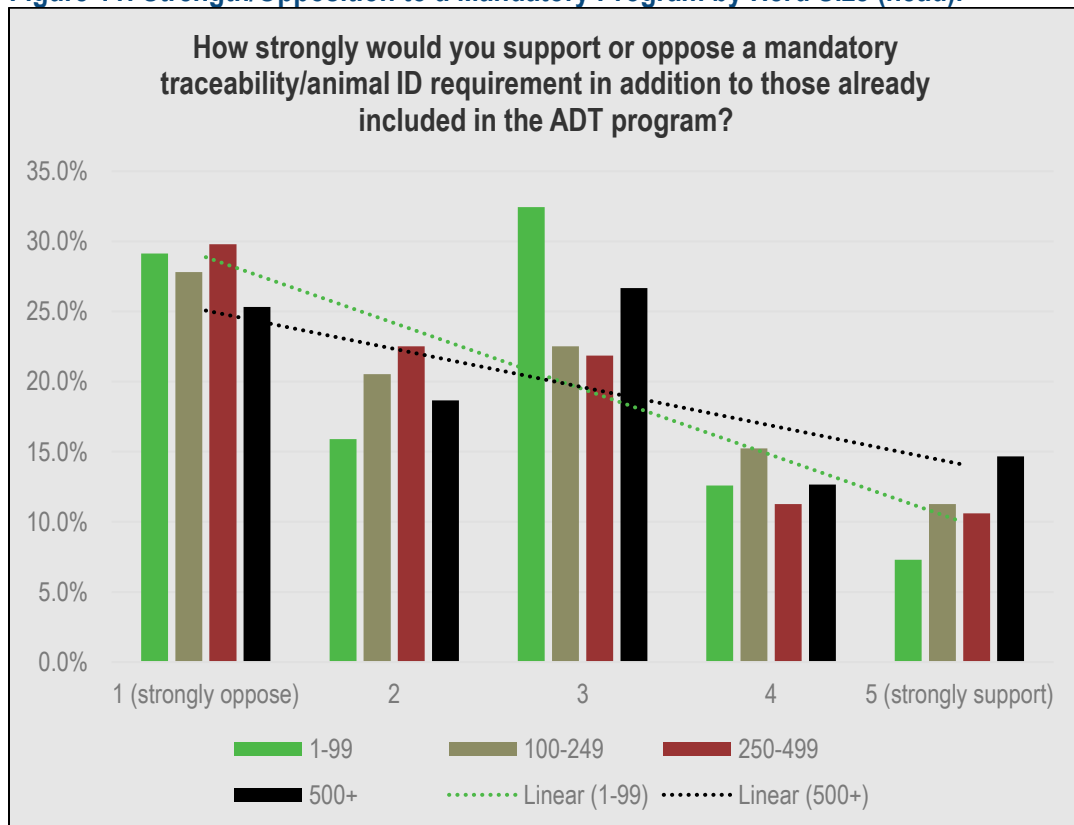
A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response ("row").

Figure 11 and Table 7 show moderate opposition (nearly a quarter of all responses, regardless of herd size, "strongly oppose") to a mandatory system. The results are slightly more supportive for operations with over 500 head (as shown in the black line and Table 7).

Figure 11: Strength/Opposition to a Mandatory Program by Herd Size (head).



Source: Aspen Media and World Perspectives, Inc.

Table 7: Strength of Opposition/Support to a Mandatory Program by Herd Size.

| | Herd Size (in head) | | | |
|----------------------|----------------------|----------------------|----------------------|--------------------|
| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
| 1 (strongly oppose) | 29.1% | 27.8% | 29.8% | 25.3% |
| 2 | 15.9% | 20.5% | 22.5% | 18.7% |
| 3 | 32.5% ^{B,C} | 22.5% | 21.9% | 26.7% |
| 4 | 12.6% | 15.2% | 11.3% | 12.7% |
| 5 (strongly support) | 7.3% | 11.3% | 10.6% | 14.7% ^A |
| Don't know | 2.6% | 2.6% | 2.6% | 2.0% |

A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response ("row").

Data storage and management (i.e. data privacy) is a key issue when considering nationally significant animal identification and traceability systems; industry stakeholders all expressed concerns about data security and, rightfully so, are skeptical that any one entity could ensure complete data protection. However, Table 8 shows that respondents assume that member/industry associations would be most effective in ensuring data confidentiality under an expanded approach

Table 8. Comparative Effectiveness of Entities in Ensuring Data Confidentiality.

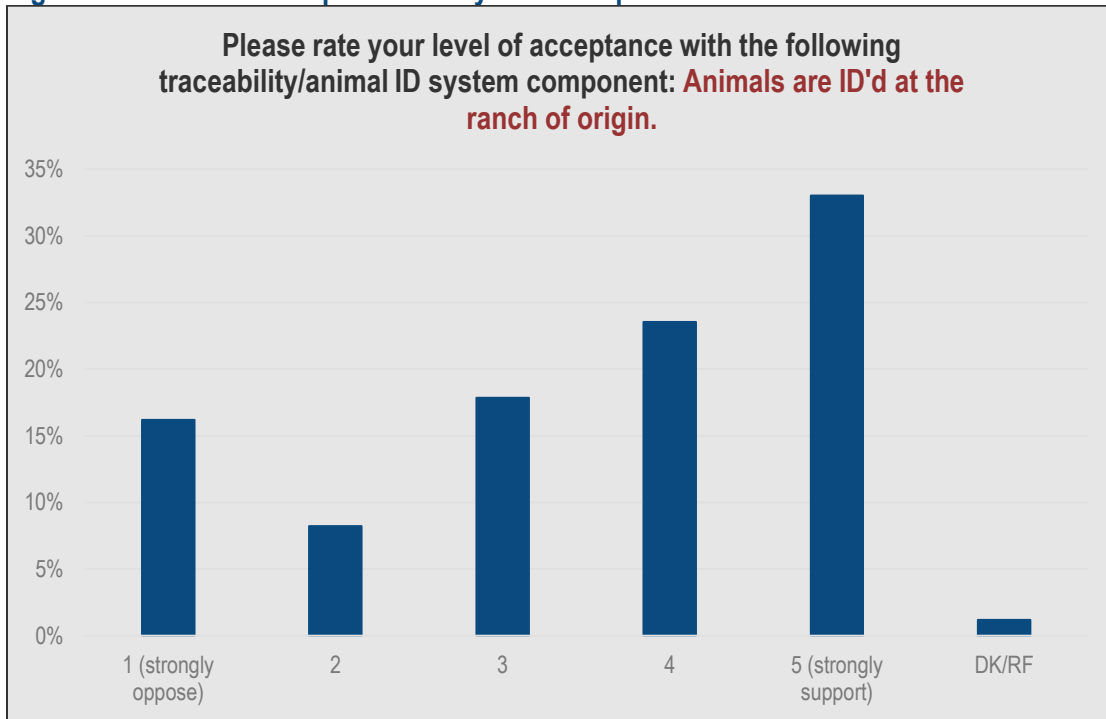
| Entity type | Percent of 4 (effective) or 5 (very effective) responses |
|--------------------------------|--|
| Member/industry association(s) | 31% |
| Private, third-party firms | 27% |
| State government agency(s) | 21% |
| Federal government agency(s) | 15% |

At the other end of the response spectrum, 58 percent of respondents feel that Federal government agency(s) would be either ineffective or very ineffective at ensuring data confidentiality, compared to only 32 percent of respondents that feel member/industry association(s) would be either ineffective or very ineffective at ensuring data confidentiality.

Figures 12-17 detail levels of acceptance among respondents for different components of animal identification and traceability systems. These include:

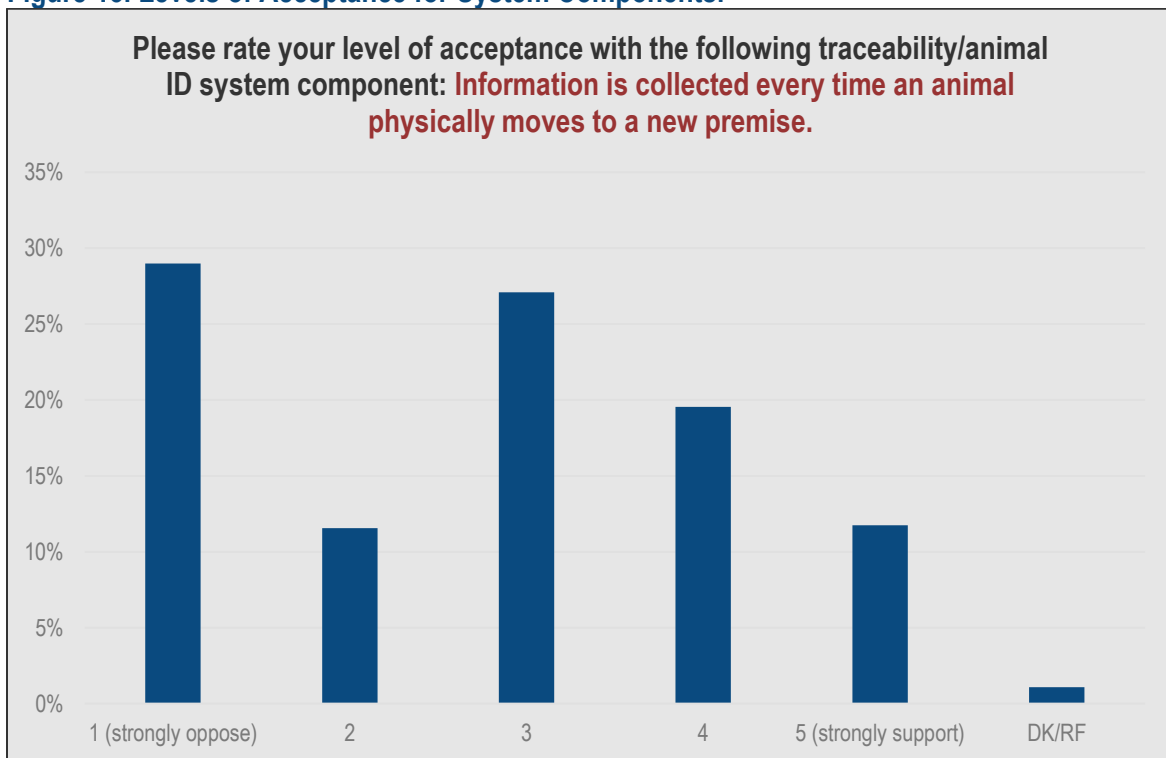
- ✓ Identifying animals at the ranch of origin: **garnered strong support.**
- ✓ Collecting information every time an animal physically moves to a new premise: **garnered marginal support.**
- ✓ At point of slaughter, birth premise data on each animal is recoverable/recorded: **garnered marginal support.**
- ✓ RFID/electronic tags are the primary tool to capture information: **garnered marginal support.**
- ✓ Information is stored in an easily retrievable format: **garnered strong support.**
- ✓ Information is made available to government entities only in the event of an animal disease outbreak: **garnered strong support.**

Figure 12. Levels of Acceptance for System Components.



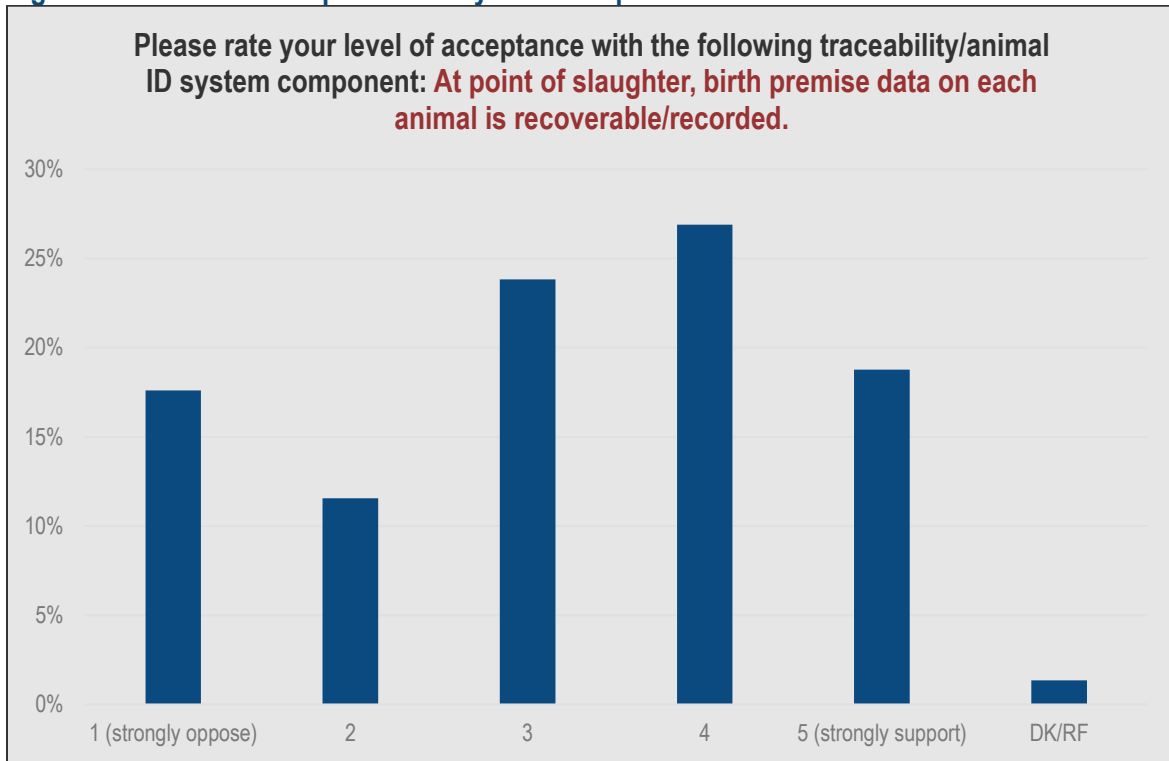
Source: Aspen Media and World Perspectives, Inc.

Figure 13. Levels of Acceptance for System Components.



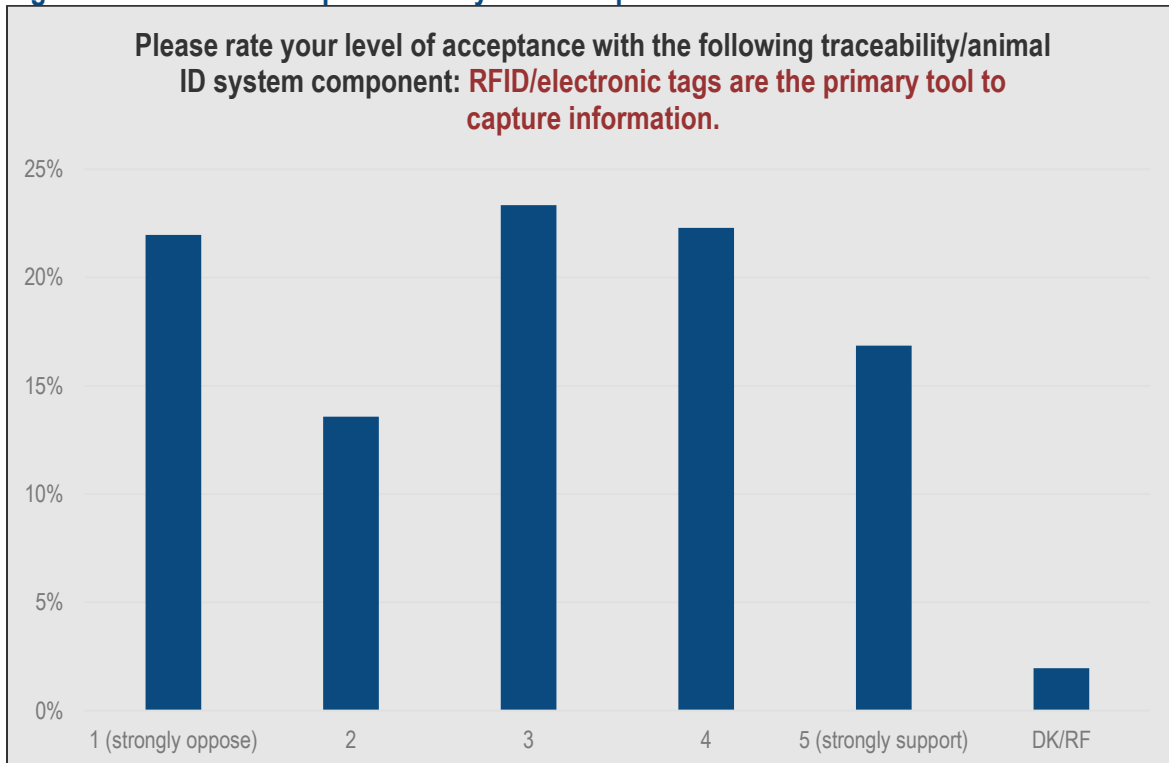
Source: Aspen Media and World Perspectives, Inc.

Figure 14. Levels of Acceptance for System Components.



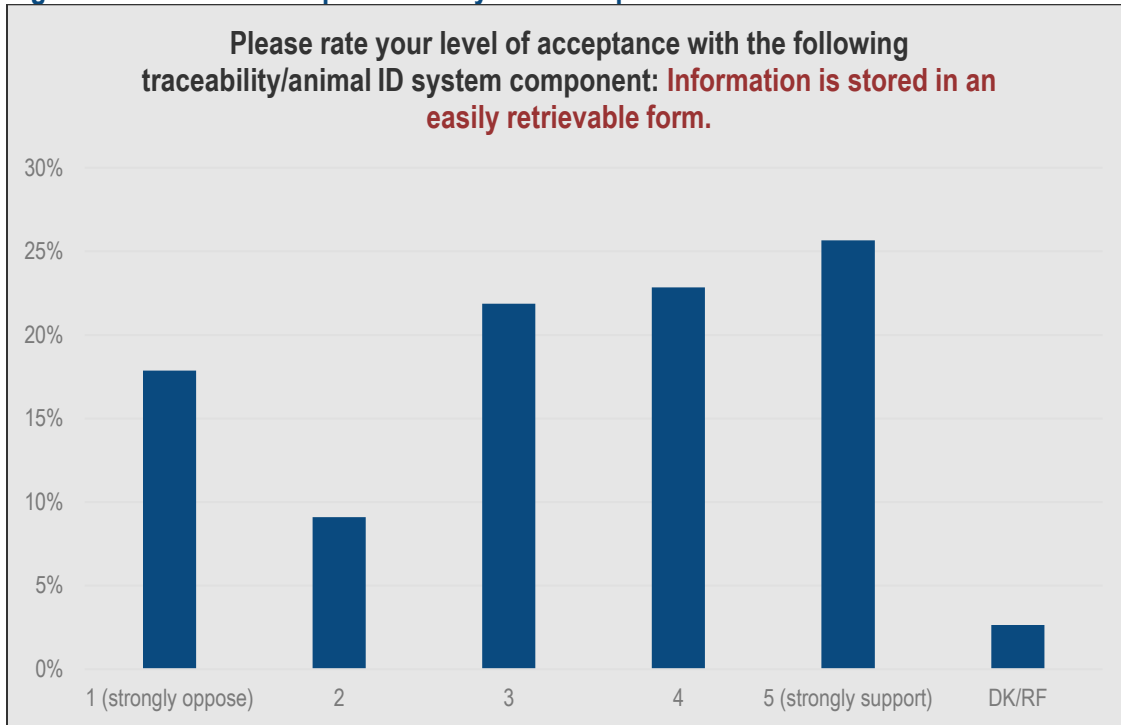
Source: Aspen Media and World Perspectives, Inc.

Figure 15. Levels of Acceptance for System Components.



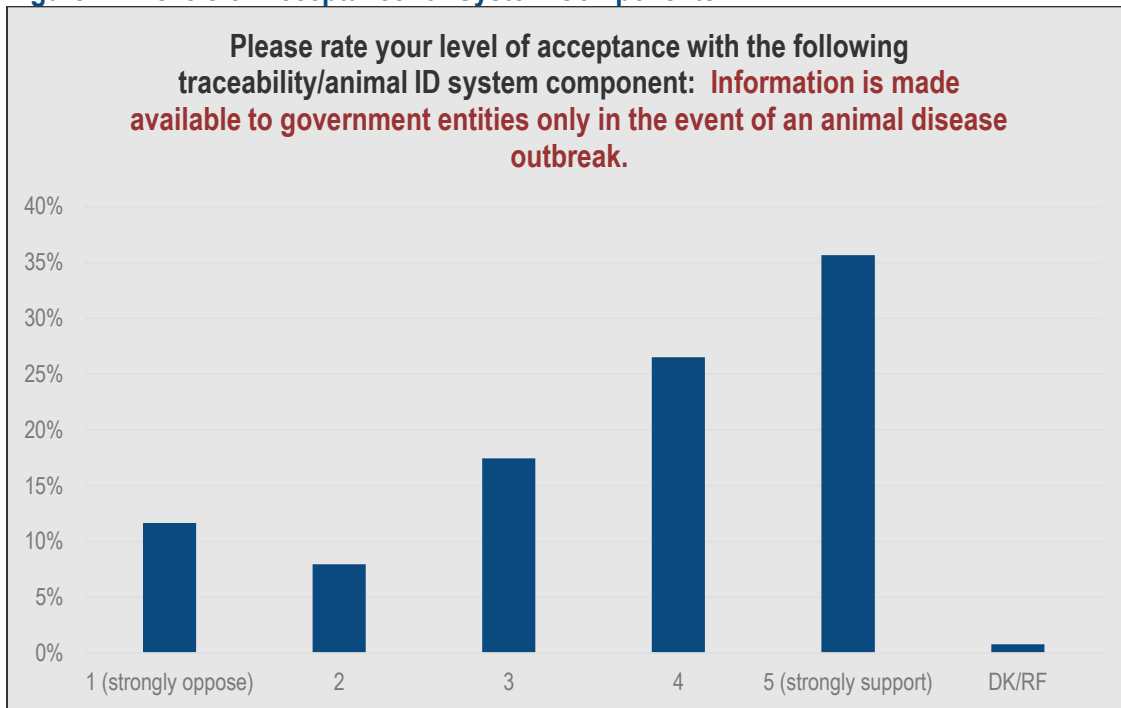
Source: Aspen Media and World Perspectives, Inc.

Figure 16. Levels of Acceptance for System Components.



Source: Aspen Media and World Perspectives, Inc.

Figure 17. Levels of Acceptance for System Components.



Source: Aspen Media and World Perspectives, Inc.

Digging deeper into system components, Table 9 shows large (500-plus head) cattle operations are far more likely than small/medium sized operations to strongly support identifying animals at the ranch of origin. Medium-sized (250-499 head) operations are more likely to moderately oppose this traceability requirement.

Interestingly, feedlot operations showed greater support (38.5 percent “strongly support”⁴⁰) for identifying animals at the ranch of origin than did other operation types. This could be driven by the fact that operations at the last stage of the live animal marketing chain have a heightened realization of the value of ranch-of-origin traceability. Or, it could be that feedlots would “feel” less of the burden/cost for implementing this type of traceability. Further research into this area is warranted.

Table 9: Strength of Support/Opposition to Traceability/Animal ID System Component “Animals are ID’d at the Ranch of Origin” By Herd Size.

| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
|----------------------|--------------------|----------------------|----------------------|----------------------|
| 1 (strongly oppose) | 16.6% | 17.2% | 15.9% | 12.0% |
| 2 | 8.6% | 6.0% | 11.9% ^{B,D} | 4.7% |
| 3 | 19.2% ^D | 16.6% | 15.2% | 11.3% |
| 4 | 23.2% | 21.9% | 23.8% | 28.7% |
| 5 (strongly support) | 31.1% | 37.7% | 31.8% | 42.7% ^{A,C} |
| Don't know | 1.3% | 0.7% | 1.3% | 0.7% |

A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response (“row”).

There appears to be only moderate support for collecting animal ID/traceability information each time an animal is physically moved to a new premise. Approximately 41 percent of respondents either “opposed” or “strongly opposed” this type of traceability requirement, and the results did not vary significantly by operation size. Operations with 500 head or more showed greater support for such a system than did those operations with 100-499 head. Small (1-99 head) operations showed the least support for this type of system component.

⁴⁰ Statistically different at the 95 percent level.

Table 10: Strength of Support/Opposition to Traceability/Animal ID System Component “Information is Collected Every Time an Animal Physically Moves to a New Premise” by Herd Size.

| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
|----------------------|-------------------|----------------------|----------------------|----------------------|
| 1 (strongly oppose) | 29.8% | 27.8% | 30.5% | 22.7% |
| 2 | 11.3% | 11.3% | 15.2% | 10.7% |
| 3 | 27.8% | 26.5% | 23.2% | 26.0% |
| 4 | 20.5% | 15.9% | 12.6% | 24.0% ^{B,C} |
| 5 (strongly support) | 9.9% | 17.2% ^A | 15.2% | 14.7% |
| Don't know | 0.7% | 1.3% | 3.3% | 1.3% |

A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response (“row”).

Large operations (greater than 500-plus head) showed greater support for using RFID/electronic tags as the primary method for capturing information. Similarly, small-medium (less than 500 head) operations are more likely to strongly oppose using these tags as a key component of an expanded approach.

Table 11: Strength of Support/Opposition to Traceability/Animal ID System Component “RFID/Electronic Tags are the Primary Tool to Capture Information” by Herd Size.

| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
|----------------------|--------------------|----------------------|----------------------|----------------------|
| 1 (strongly oppose) | 17.9% ^D | 16.6% ^D | 19.9% ^D | 14.7% |
| 2 | 11.9% | 8.6% | 13.2% | 11.3% |
| 3 | 23.2% | 27.2% | 22.5% ^D | 25.3% |
| 4 | 28.5% | 23.2% | 21.9% | 24.7% ^B |
| 5 (strongly support) | 17.2% | 23.8% | 19.9% | 22.7% ^{A,B} |
| Don't know | 1.3% | 0.7% | 2.6% | 1.3% |

A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response (“row”).

Two points of *agreement* were evident in the survey responses:

- First, there is broad support that a **nationally significant traceability system(s) approach should store associated data in “easily retrievable form” for future use.** Operations with 500-plus head were especially likely to support this idea.
- Similarly, respondents showed a strong propensity to “agree” or “strongly agree” that such **data should be made available to government entities in the event of a disease outbreak.** These responses may indicate that, while the U.S. beef industry does not outwardly support a mandatory system, they see government entities (e.g. USDA, APHIS, etc.) as a partner in mitigating the impacts of animal disease outbreaks.

Table 12: Strength of Support/Opposition to Traceability/Animal ID System Component “Information is Stored in an Easily Retrievable Form” by Herd Size.

| | 1-99 ^A | 100-249 ^B | 250-499 ^C | 500+ ^D |
|----------------------|-------------------|----------------------|----------------------|----------------------|
| 1 (strongly oppose) | 19.2% | 14.6% | 15.2% | 14.7% |
| 2 | 8.6% | 11.9% | 8.6% | 9.3% |
| 3 | 22.5% | 20.5% | 19.9% | 20.7% |
| 4 | 23.8% | 19.2% | 25.2% | 18.0% |
| 5 (strongly support) | 23.2% | 31.1% | 26.5% | 36.7% ^{A,C} |
| Don't know | 2.6% | 2.6% | 4.6% | 0.7% |

A, B, C, and D superscripts represent responses by herd size.

Superscripts next to herd size in the column headers assign an alphabetical value to that group.

Uppercase superscripts within the body of the table indicate that response is statistically different at the 90 percent level from the group with the corresponding alphabetical superscript. Statistical difference is only tested within the same response (“row”).

Cattle Dealers and Marketing Entities

WPI’s team engaged in a series of discussions with representatives of the cattle marketing sector, including firms that broker cattle in value-added programs as well as video/Internet sales. All interviewees were familiar with animal identification and traceability systems; one California-based contact recently participated in a large-scale pilot program with the state department of agriculture that was more robust than any voluntary programs currently available to producers. The pilot program used one specific type of UHF tag; this improved consistency and resulted in 99 percent tag readability.

Cattle dealers know very well that their export partners want more robust traceability data, and they recognize that there is value in being able to market cattle via various avenues. An interviewee with a large Western U.S. cattle marketing service noted that at least 20 percent of the cattle he sells come with age/source data; upwards of 50 percent of his clients use third-party verification for specific practices. These existing efforts by proactive producers allow them to get a premium for the animals they sell. Thus, as it stands, the market is working.

However, the marketing sector is **generally supportive of an expanded approach to U.S. animal identification and traceability; the main benefit of expansion in this space is increased marketability.** Dealers want to provide their clients with as many marketing options as possible, and an expanded traceability approach provides another marketing avenue that could lead to higher returns for clients. Further, processes are more fluid when stakeholders up and down the value chain – producers, dealers, auction markets, veterinarians, etc. – are familiar with shared requirements and can operate accordingly.

One point of consensus among the marketing sector is that traceability alone is not enough to guarantee a premium price. Programs such as NHTC or GAP combine traceability with other stipulations to make a more holistic program, which in turn may be more attractive to a producer.

Increased marketability does not always lead to increased profitability; if the time and monetary costs of being involved in an expanded [traceability] program outweigh the marketability increase, producers will be reluctant to change. – Western U.S. cattle dealer.

While acknowledging that movement towards an expansion of the current U.S. approach is warranted, the cattle marketing sector emphasizes the importance of considering market dynamics and producer concerns of marketability versus profitability.

Auction Markets

Auction markets form a very interesting link in the U.S. beef value chain. On the one hand, there are many small-scale facilities dotting the U.S. that serve cow-calf producers from relatively isolated rural areas. These auction markets are not only the primary avenue for local cow-calf operators to market their cattle; they also serve as a conduit for market/policy information as well as a forum for discussing pressing industry issues. Contrastingly, there are numerous large, regional auction markets that handle hundreds of thousands of head of cattle annually. When discussing the issue of animal identification and traceability with these entities, conversation focused on the market's specific place in the value chain and where/how the burden of cost would fall under an expanded approach. More specifically, costs associated with electronically tagging animals and managing the resultant data are paramount.

Both small- and large-scale auction markets serve very important roles in the value chain. However, the large-scale operations are generally better set up to (and in many cases already are) process animals that are part of expanded animal identification and traceability programs – e.g. RFID-tagged animals. Some operations can electronically identify cattle as they come off the truck with relative ease; one of the largest auction markets in the Western U.S. currently uses its own approach to electronic identification that includes ID'ing at the facility followed by a back-office process to correlate tags and animal identification to match cattle throughout the value chain. **The next step in the evolution of the industry, in one interviewee's perspective, is accurate, fast-paced group/lot identification at the auction market to quicken the process of electronically identifying cattle.** In terms of infrastructure and labor costs, larger auction markets noted that if they are already processing cattle, utilizing technology to easily track additional animal identification and traceability data would not be cost prohibitive.

Several interviews with small-scale auction markets yielded additional insights. While larger operators might see a significant number of cattle come through their markets that have already been ID'd at the farm of origin, the consensus among managers of smaller entities is that few of the cattle they process are ID'd at the farm. Rather, the (generally) small-scale cow-calf operators that they serve are more likely to defer to the auction market for appropriate tagging and assurance that their animals are compliant with relevant regulations. This means that a fairly high percentage of the cattle that move through their facilities may not have been handled much at all and, in some cases, may lack any form of identification. When considering this constituency, infrastructure costs, labor costs, speed of commerce, and the health/safety/shrink on animals are immediately brought to the forefront as significant business considerations.

Auction markets both large and small share a few viewpoints – including recognition of opportunities and concerns – regarding expanded animal identification and traceability systems. These include:

- **Speed of commerce is a crucial aspect of an auction market's operational efficiency.** Adding required steps in the processing of cattle could potentially decrease efficiencies; adding costs (infrastructure and labor) to mitigate impacts on operational efficiency would have a ripple effect that could disproportionately impact small cow-calf operators, as added costs at the auction market would need to be passed on. Auction market owners do not want their facilities to become tagging stations.

- Even in cases where auction markets are tagging cattle for producers enrolled in voluntary animal identification and traceability programs *while* maintaining a healthy speed of commerce, costs (e.g. \$1.50-3 per tag) must be passed on to the cow-calf producer.
- **Ultimately, market signals must drive any expanded animal identification and traceability system(s).** Auction market interviewees pointed to the historical case of Japan's age/source verification requirements; when the market presented an opportunity, the industry responded, and the system worked.
- Likely due to their position as participants in the first point of sale for many cattle, **auction market managers expressed concern regarding the attempt to link disease surveillance and control with traditional marketing.**
- From the perspective of the auction market sector, a cost-benefit analysis clearly favors animal identification and traceability in mother cows versus feeder cattle. Perfecting group/lot identification of feeder cattle is an option, but individually ID'ing feeder cattle would have too many attendant costs and would slow the pace of commerce too much. Neither the cow-calf sector, auction markets or feeders would want to bear the cost.
- Interviewees agree that the industry needs to be proactive in moving discussion forward before a government-mandated system potentially results in negative impacts across the value chain.
- Auction market owners identified a prospective next step:
 - Program expansion could potentially start at the state level, with a recognized body providing national coordination and standardized tags (e.g. RFID) ensuring data continuity. Starting at the state level may enable an easier transition from localized, value-added programs to an expanded animal identification and traceability approach (see above "State System Highlights" for details on states that are already operating expanded programs).

Cattle Feeders

The broad-stroke perspective of the cattle feeder sector regarding animal identification and traceability is as follows: most major facilities are already well versed in processing, managing and marketing cattle that are involved in voluntary value-added programs. Thus, support for an expanded system(s) approach was generally strong, with the caveat that a market-driven approach will provide the highest benefit to the largest number of industry stakeholders.

Of critical importance to feeders is the tagging process. If a system(s) mandated a specific tag, then feeders may end up being liable or processing all untagged cattle that arrive at their feedlot – a potentially costly effort. Group/lot identification using RFID tags is the most attractive component discussed with the feedlot sector, as this would give feedlots the ability to maintain the speed of commerce and keep the costs inherent in individual animal identification down.

Packers

Brester et al. (2011) estimated that packers would bear a lower relative cost than both cow-calf operators and feedlots if the industry were to adopt significant traceability system(s). Spinning forward, WPI's research found significant levels of support among packers for an expanded animal identification and traceability approach in the U.S. Costs – aside from marginal compliance costs – were not seen as prohibitive, as value capture opportunities and market premiums are expected to outweigh costs.

Packers interviewed as part of WPI's research acknowledged that their sector would, under any scenario – voluntary, mandatory, etc. – incur less cost versus other value chain stakeholders. The caveat offered was

that, in the case of a food safety issue, packers would be potentially more vulnerable than ever given the expanded body of consistent, transparent, traceable information.

Agriculture Finance

Several of the top lenders in U.S. agricultural finance were interviewed to gauge understanding around animal identification and traceability, and all interviewees stated it was unlikely that any ag lender would offer a lower percent interest rate to a client if they adhered to a specific traceability approach. Like all stakeholders in the beef industry value chain, banks are looking to add value, and the implementation of nationally significant system(s) would not immediately change the way that banks lend to producers. However, some interesting points came out of the discussion:

- The ag finance sector realizes that traceability is a topic of interest right now, and lenders are starting to look more closely for these types of programs when inspecting operations.
- Banks conduct standard inspections of cattle operations in advance of lending, reviewing both the physical operation and business aspects such as liquidity, cash flow, performance management, etc. Adherence to a system(s) that improves the value of the operation, confirms the quality of the cow herd, is formally audited by a third party such as USDA, etc. – for example, consider a producer whose cattle are enrolled in the NHTC program – can be very favorable when a bank is considering the big picture and evaluating its risk in extending financial support. Thus, **a robust traceability approach would certainly add to an operation's profile and supplement the traditional measurements that drive ag lending decisions.**
- Ultimately, however, the risk profile of a cattle industry stakeholder is made up of numerous aspects and lending decisions are made accordingly.
- Export contracts provide a formal paper trail that could have implications for lending: for example, **if an export contract stipulates that animal traceback is required, a bank might allow a customer to leverage against that contract and obtain financing.** Depending on size, scope and frequency, this dynamic could allow a producer that has invested in a robust system, and has regular export opportunities, to leverage their dollar further than their competitors.
- If USDA were to mandate a given system, banks may be burdened by requirements – or even the expectation – that they help ensure compliance among their clients. This is a concern.
- Ag finance is very interested in blockchain technology, and interviewees view animal identification and traceability through the lens of cryptocurrency and blockchain. **Traceability could potentially be more attractive to a wider group of stakeholders if it were tied to a blockchain system.**

Dairy Sector

The research efforts contributing to this report focused primarily on the U.S. beef industry. However, it is noted that, generally speaking, animal identification and traceability requirements are more robust in the dairy industry than in the beef industry. California, for example, requires source/origin data and RFID tags for both intrastate and interstate movement of dairy cattle. This requirement came on the books in April 2017.⁴¹ Oregon operates a similar program for its dairy industry. In Michigan, where 75 percent of the state's cattle are found in the dairy sector, compliance with the state-mandated traceability system (2007) was rapid among dairy operators. Contrastingly, the initial compliance rate among beef producers was lower and continues to climb towards 100 percent.

⁴¹ https://www.cdfa.ca.gov/ahfss/Animal_Health/ID_Info.html

Note that this study's large-scale producer survey included a small sample of dairy industry respondents. Approximately 54 percent of dairy industry respondents affirmed that they are participating in a voluntary traceability/animal identification system, versus only 22 percent in the beef cow-calf sector.

Figure 1. Participation in a Voluntary Traceability/Animal Identification System by Operation Type.



Source: Aspen Media and World Perspectives, Inc., 2017

Further, dairy industry stakeholders noted the industry's ongoing emphasis on animal identification and traceability – based on the current mix of third-party, state-based and federal requirements.

7. Cost-Benefit Analysis

The primary concern of most industry stakeholders when presented with the prospect of adopting animal identification and traceability systems is cost. Note, however, that this report did not presume to develop, emphasize nor prescribe a single traceability system. Thus, without the details of a specific system, no analysis of direct cost can be produced. Collaborative discussion on the development of systems may follow the publication of this report. Indeed, this report is intended to facilitate such a discussion, and further consideration of potential costs, as well as benefits, as called for by the industry's LRP.

The proper framework in which costs should be considered is from a net cost perspective, i.e. the gross operating cost minus the value of any benefits. This section is crafted as a cost-benefit analysis, encompassing several concepts framing how, based on this report's findings, both the costs and benefits of animal identification and traceability systems should be approached and, therefore, best understood.

Direct Costs

In Section 5, WPI's literature review detailed several past studies that attempted to quantify the costs of traceability for the industry. As these studies were conducted in previous years, WPI's team converted values into today's (2017) dollars for reference:

- Using Brester et al.'s approach, the total cost of 100 percent implementation – of source and age verification system(s) – across the U.S. beef industry would reach \$386 million in today's dollars.
 - Costs would vary by sector, firm type, size of operation, etc.
 - For cow-calf operations already tagging cattle, costs would range from \$2.65-4.65/head, versus \$5.56-6.12/head for operations not currently tagging cattle.
 - Stocker costs range from \$0.15-0.82/head.
 - Feedlot costs range from \$0.13-0.55/head.
 - Packing plants have a volume-weighted average cost of \$0.19/head.

The cow-calf sector bears almost 60 percent of the cost based on Brester et al.'s methodology.

- WPI's primary research included discussions with industry stakeholders who are currently participating in animal identification and traceability programs. From these discussions, WPI's team generated the following direct cost example:
 - For a 1,000-head cow-calf operation that already processes cattle on at least an annual basis (e.g. Brucellosis vaccination):
 - Costs for an RFID tag range between \$0.70 per tag to \$2.50 per tag.
 - The approximate cost for electronic wand units, necessary to scan animals as they are processed, is \$1,300.
 - Infrastructure costs are minimal given existing processing facilities.
 - Marginal labor costs for tagging/processing are minimal.
 - Administrative costs present the highest real costs to be borne by this type/size of cow-calf operator. Data is logged primarily for use in adherence with a system's requirements, but the time/cost will depend on the extent that an operator wants to leverage data to, for example, improve herd management. Anecdotal comments from WPI's interviews point to longer hours devoted to up-front development of a

database or recordkeeping system, but from that point the administrative burden decreases substantially.

- Based on these considerations, the high-end cost per head for a 1,000-head cow-calf operation to participate in an animal identification and traceability system would be approximately \$3.80/head, with additional real costs required to cover administrative time.
- Smaller cow-calf operations that lack any existing cattle processing facilities could face significantly higher up-front costs. A small-scale operation might need to invest in cattle handling facilities and would have to amortize those up-front costs over a small number of animals, significantly increasing the per-head costs compared with other operations of larger scale.
- Finally, WPI emphasizes again that the specific system requirements, and understanding costs by size/type of operation, requires further analysis of implementation costs versus mid-run amortized costs.

Benefits and Opportunity Costs

Producers can use animal identification and traceability systems, in some cases, to gain a premium price for cattle. Indeed, age and source verification can be used to earn a premium, including for those cattle sold through an auction market, directly to a feedlot or to a packer. Other programs built around production practices (e.g. NHTC, animal welfare, grass fed, etc.) can require traceability for verification, and to link the animal and carcass through to the label claims. These programs can also provide a premium price; however, they may also limit the marketing outlets to certain feedlots or packers. Export certification programs also require some form of animal identification and traceability and can add value to the animal and/or carcass.

The above examples can be considered the direct benefits for which animal identification and traceability systems hold potential. Such systems could also provide indirect benefits: understanding the impact of indirect benefits of animal identification and traceability necessitates a focus on opportunity costs of *not* having a robust approach.

Take, for example, the potential impacts of animal disease outbreaks.

Post-incident analysis (Coffey et al) of the 2003 BSE event found the U.S. industry suffered as much as \$4.7 billion in losses, with export value collapsing 82 percent (from \$3.14 billion to \$550 million). This impact has led to additional research to examine probable impacts of a future outbreak.

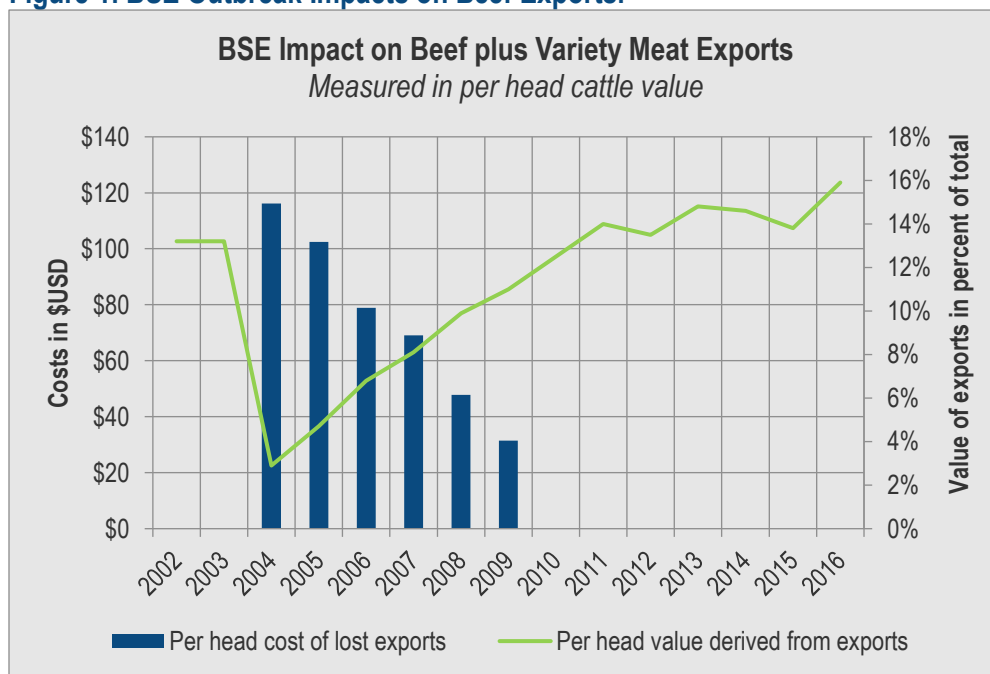
- Converting the results of one study (Pendell et al) into 2017 dollars yields the following:
 - Assuming a 25 percent loss of U.S. export market share in the case of an animal disease outbreak,⁴² the U.S. livestock and meat complex would suffer total losses of \$7.567 billion. The feeder and slaughter cattle sector would bear the brunt of losses: between \$3.4-5 billion.
 - A similar study estimated that the number of cattle depopulated due to an FMD outbreak decreased by 65 percent *if* a robust animal identification system was in place; costs fell from \$559 million (no robust system in place) to \$196 million (robust system in place). This study points to the cushioning effect that animal identification and traceability systems can have in mitigating the severity of impacts from animal disease outbreaks.
 - Additional state-level analysis by Pendell et al found that a disease outbreak impacting five large Kansas feedlots could result in losses of \$1.193 billion (in 2017 dollars).

⁴² This percentage represents the size of South Korea's share of U.S. beef exports prior to the 2003 BSE outbreak.

For the purposes of this discussion, WPI conducted an analysis of the opportunity costs of BSE with regard to lost exports on the per-head value of cattle. This analysis used actual historical data from USDA and was targeted to show not just the out-of-pocket losses from the BSE-related export interruption, but rather the opportunity cost losses to the value of cattle based on closed export markets.

After the December 2003 BSE outbreak, it took until 2010 before beef exports' contribution to overall fed cattle prices was restored to normal levels. Over the past 15 years – excepting those 6 recovery years – the contribution of beef exports to the total fed cattle price has averaged about 10 percent. If that 10 percent average would have been maintained for the years 2004 through 2009, per-head value of cattle would have been higher by up to \$92 in 2004, and \$13.50 in 2009, as the chart below shows. Total out-of-pocket and lost potential opportunity costs totaled \$10.7 billion over those years.

Figure 1. BSE Outbreak Impacts on Beef Exports.



Source: USDA, CattleFax, AgriTrends, World Perspectives, Inc.

Robust animal identification and traceability systems likely would not have *completely* prevented the closure of international markets that led to the reduction in export values detailed in Figure 1. However, they could have mitigated the impact by speeding the recovery time for export market re-opening. If all the closed markets were recovered in half the time, total losses and opportunity costs would have been \$6.3 billion, or in other words, total fed cattle value potentially would have been a cumulative \$4.4 billion greater over the years 2007, 2008, and 2009.

There has been additional work on opportunity costs vis-à-vis export markets. For example: USDA APHIS commissioned a study in 2009 that estimated losses inherent in not implementing a system based mainly on reduced export market access. In 2017 dollars, those losses are assumed to be \$1.5 billion over ten years.

Understanding how system(s) might pay for themselves and generate monetary benefits still requires prospective analysis. Pendell et al (2010) found that a 34 percent increase in exports would offset the costs of a 90 percent system adoption rate. If this is correct, exports would have to increase by \$892 million to cover 90 percent-adoption-level costs. If those costs have stayed constant over time, this figure equates to a 14 percent increase from 2016 export levels (which totaled \$6.358 billion). A 14 percent increase in exports is significant, and it is worth noting the annual increase in export value from 2012 to 2013 and from 2013 to 2014 were 12 percent and 16 percent, respectively. Moreover, January-November 2017 export values are up 14 percent from the same period in 2016.

For a complementary analysis, USDA APHIS' conclusion that a 23 percent increase in beef exports would cover the costs of a 70 percent adoption rate for an animal identification and traceability system is similarly converted into 2016 export values. A 23 percent increase in 2009 beef exports is roughly equivalent to \$709 million dollars. This figure is approximately 11 percent of 2016 beef exports. The 34 percent increase from 2009 beef export values required to pay for 90 percent adoption rates is the equivalent of \$1.05 billion, or 17 percent of 2016 exports. These findings are summarized in the table below.

Table 1. Analysis of Prospective Scenarios – System Adoption Costs and Exports.

| Study | Voluntary Adoption Rate | Export Increase Required | Export Base Year | Est. Adoption Cost (Mill. \$)* | Cost as % of 2016 Beef Export Value* | Per-Head Costs* |
|-----------------------|-------------------------|--------------------------|------------------|--------------------------------|--------------------------------------|-----------------|
| Pendell, et al., 2007 | 90% | 34% | 2007 | \$892.0 | 14% | \$8.69 |
| USDA APHIS, 2009 | 70% | 23% | 2009 | \$708.7 | 11% | \$6.91 |
| | 90% | 34.10% | 2009 | \$1,050.8 | 17% | \$10.24 |

Source: various sources, World Perspectives, Inc.

*World Perspectives, Inc. analysis, not a finding of the study listed in the leftmost column.

Additionally, analysis conducted by WPI estimates the annual adoption cost of 70 percent and 90 percent traceability levels is between \$6.91 and \$10.24 per head. Note these figures are simply average costs spread across the number of animals in the 2017 beef supply chain and *do not* account for efficiencies gained through the beef value-chain. Consequently, it is likely adoption costs for some industry segments (feedlots, for example) will be lower than others (e.g., cow-calf operations).

Summary

Again, WPI did not emphasize any one traceability system or specific architecture in this report. To avoid misleading readers, the above section offers a framework whereby traceability costs are considered from a net cost perspective – e.g. gross operating costs minus the value of any benefits. **When considering the points covered, the potential for negative domestic and international market impacts in the event of an animal disease outbreak – or the opportunity costs inherent in *not* adopting an expanded U.S. systems approach – seem to outweigh any general cost projections for an expanded approach.** Put succinctly, traceability may be viewed as an insurance policy, and analysis supports the conclusion that thinking of it in these terms is the most realistic and effective way to frame a cost-benefit analysis. And, importantly, taking the short-term view focused on costs does not allow for understanding costs and benefits within the proper framework.

Finally – keeping in mind that costs will always be attendant in a traceability system(s) adoption – it is helpful to revisit the reasons why animal identification and traceability systems are becoming a global norm. Reasons for nationally significant system(s) adoption across the world include:

- ✓ Accountability – both to foreign governments/regulatory agencies as well as foreign and domestic consumers.
- ✓ Maintenance or regaining of foreign market access.
- ✓ Management of animal health issues.
- ✓ Investment in long-term industry practices that provide insurance in the case of animal disease.
- ✓ For use as a talking point and/or tool in market access negotiation efforts.

8. Key Findings: Opportunities and Obstacles

To recap, the methodologies employed by WPI's team have resulted in credible qualitative and quantitative information about animal identification and traceability in the U.S. Circling back to the industry's 2016-2020 LRP, that document clearly states that this study should increase the level of understanding regarding opportunities in the traceability space. Therefore, this section considers the sum of findings detailed above and presents them as:

1. **A series of opportunities for the overall industry.** These are meant to be used by the industry to facilitate discussion on next steps; they can serve as a foundation for understanding while helping to mitigate miscommunication and/or misconceptions. Should the decision be made to expand the U.S. industry's approach to animal identification and traceability, these opportunities are critical to underpinning outreach and communication efforts.
2. **A series of obstacles to expanded system adoption broken out by key industry sector.** Along with the opportunities inherent in an expanded U.S. industry approach to animal identification and traceability, there are obstacles relevant to the cow-calf, feeder and packer sectors. These obstacles are presented below to ensure that discussion on next steps considers impacts on key groups. Only by understanding obstacles – and weighing them against opportunities – can the industry effectively engage in productive discussion on next steps.

Adopting a Nationally Significant System: Opportunities

- ✓ **As of the publication of this report, the U.S. beef cattle industry is presented with the opportunity to take a proactive leadership role in discussions on an expanded U.S. approach to animal identification and traceability.**
 - The *advantage* gained by the U.S. industry if a proactive approach is taken is relative control of, and ability to direct, the discussion on an expanded traceability systems approach. It is, in other words, a chance for the industry to control its own destiny.
 - By acting proactively, the U.S. industry can refine communication and outreach to key target audiences, identify system components that are acceptable to the majority of the industry, ensure a realistic timeframe for system(s) rollout, etc.
 - The stage is set for a large stakeholder to kick off informed discussion on industry adoption of a nationally significant approach. If industry does not take the first step and show proactive leadership, a void remains that could be filled by a U.S. government agency.
 - Note that in most of the international systems that WPI profiled in this report, this opportunity for industry to drive discussion in the animal identification and traceability space was rendered irrelevant by a catastrophic event (e.g. animal disease outbreak) that led a government agency to rapidly implement a (in many cases mandatory) system. So long as the U.S. industry does not move the discussion forward with a unified voice, the chance for an event to take place that results in rapid system implementation – with little industry feedback – remains.

- ✓ **Borrowing the best practices of existing domestic and global programs, the U.S. industry can develop a hybrid approach that balances costs with benefits and optimizes management.** If the industry is proactive and discussion proceeds to the point of specific system development, the U.S. can create an optimal hybrid approach that includes:
 - An independent leadership body that is representative of the industry;
 - An approach to data management that maintains business confidentiality while ensuring a practical approach to data availability in the case of an animal disease outbreak; and
 - System(s) components that are acceptable to a significant percentage of industry stakeholders.

Importantly, this report presents critical survey data that provides feedback regarding specific system(s) components. For example:

- 62 percent of producers support the idea that information (generated by an animal identification and traceability system) should be made available to government entities in the event of a disease outbreak.
- 57 percent of producers support animal identification at the ranch of origin.
- 49 percent of producers support the idea that information (generated by an animal identification and traceability system) should be stored in an easily retrievable format.
- 46 percent of producers support recording/recoverability of birth premise data at point of slaughter.

In addition to identifying key target audiences and areas for discussion, this survey data constitutes real, actionable information – specifically, that core groups of U.S. cattle industry stakeholders show support for key animal identification and traceability system(s) concepts and components. This data can be employed to 1) further discussion on best practices and a U.S.-specific hybrid approach, and 2) correct the misperception that key industry segments are unwilling to engage in productive discussion on animal identification and traceability.

- ✓ **With a nationally significant approach in place, the impacts of a catastrophic animal disease outbreak would be cushioned – thereby lessening both the length and severity of economic consequences.** This fact is supported by a growing body of analysis, including in the previous section of this report. Nationally significant animal identification and traceability system(s) act as insurance policies for the industry: with them, the industry proactively protects its domestic and global markets. Without, the industry remains susceptible to major, negative economic impacts.
- ✓ **Domestic market opportunities can be captured.** Often overlooked, there are many domestic market opportunities should the U.S. industry adopt nationally significant animal identification and traceability system(s). Already, major industry players such as Wal Mart and McDonalds have committed to developing holistic sustainability programs that include food traceability as a key component. The “farm-to-fork” mentality is not a phenomenon; it is increasingly being defined as an objective, with actual components already implemented, by stakeholders along the value chain. Under nationally significant traceability system(s), the industry could:
 - Leverage data to further confirm the quality and safety of U.S. beef;
 - Further develop niche programs that add value to the cow-calf, feeder and packer sectors;
 - Proactively establish a level of transparency unprecedented in the U.S. agri-food system;

- Capture value from consumers exhibiting “willingness to pay” for traceable products;
 - Establish and grow qualitative industry-consumer relationships by articulating an industry-wide story that is supported by the processes and data inherent in a nationally significant approach.
- ✓ **The industry can position itself to better capture value on the global export market as opportunities are presented.** Global protein demand is increasing, and the U.S. could better position itself to maintain existing markets and grow new markets if a nationally significant approach to animal identification and traceability was adopted.
- Existing data does not affirm that U.S. exports would jump significantly with the adoption of expanded system(s); however, **nationally significant animal identification and traceability system(s) would equip the industry with another tool to maximize its competitive advantage in the global beef trade.** A common example is China: with nationally significant traceability system(s) in place and appropriate market signals driving demand, China has the potential to become a top market for U.S. beef exports. Other countries have taken this step and can cite the presence of a traceability system in their domestic industry as an influencing factor during market access negotiations.
- ✓ **Operational management efficiencies up and down the value chain could be enhanced under an expanded approach.** Adherence to traceability system(s) that provide data back to producers, feeders and packers would enable these stakeholders to analyze that data and improve the efficiency of their operations. Many U.S. feeders already use data to enhance quality control. Control of additional herd data would enable producers to identify areas for improvement – calving history, birth weights, rate of gain, etc. – and use that data to both increase on-ranch efficiencies and pursue new marketing avenues.
- ✓ **This analysis reflects a technology neutral system(s) approach.** There are existing tools available to industry that can – and are – being leveraged to ensure robust, effective animal identification and traceability in the U.S. and a growing number of other beef exporting countries. Based on WPI’s research, an increasing number of industry stakeholders are familiar with such tools. Development in other areas is ongoing and may have linkages to future approaches:
- RFID (both low frequency and ultra-high frequency) as well as other electronic identification options.
 - Blockchain and other data-driven architecture.
 - DNA and other biologically-driven areas of research.

Adopting Nationally Significant System(s): Obstacles

The following is a series of obstacles to expanded system(s) adoption broken out by key industry sector.

Cow-Calf Sector

The obstacles to adoption of nationally significant animal identification and traceability system(s) from the perspective of the cow-calf sector include:

- The burden of cost for an expanded approach – whether mandatory or voluntary – would fall heaviest on the cow-calf sector. As has been clearly addressed throughout this report, exact costs greatly depend on system architecture.
- Costs – again, dependent on system architecture – may vary depending on herd size. In some models, smaller producers face higher per-head costs as they cannot spread fixed costs across as many animals. Further, producers without cattle processing infrastructure would face capital investment costs. Larger producers would likely face higher overall costs.
- Premiums for certain identifiable and traceable qualities could be offset by discount(s) for non-valued qualities.
- With costs potentially varying based on herd size, discussion and/or disagreement could deepen philosophical divides between large and small cow-calf operators.
- Capturing marginal economic benefits to producers from animal identification and traceability requires intentional effort and cooperation of other parties (feeders and packers).
- The process of outreach and communication that preceded the implementation of the current USDA ADT rule was generally described as inadequate and *not* inclusive from the perspective of the cow-calf sector. This has resulted in skepticism regarding how the next discussion on nationally significant system(s) proceeds. This skepticism was very evident in WPI's qualitative and focus group discussions with cow-calf operators across the U.S.

Feeder Sector

The obstacles to adoption of nationally significant animal identification and traceability system(s) from the perspective of the cattle feeding sector include:

- Feedlots are an intermediary for cattle movement; the primary benefit of animal identification and traceability marketing is enjoyed by the packer.
- Marginal economic benefits to feedlots from animal ID and traceability requires intentional effort and cooperation of other parties (producers and packers).
- Systems that require gathering or maintaining production, performance and carcass data, as well as pen and production group separation, translate to additional costs.
- Depending on system architecture, feedlots may be responsible for providing premise ID if untagged cattle arrive at a feedlot or be unable to sell cattle to packers.
- Individual/premise ID required for point of first sale (if at feedlot) could be costly and logistically difficult if borne by feedlots.
- Dead stock/animal disease outbreaks at feedlots would have to be reported to proper authorities under certain system types.

- Feedlots could bear the burden of integrating data on imported feeder cattle from Mexico and Canada.
- Traceability requirements that would necessitate 24- to 48-hour tracking and ID could require feedlots to process and move cattle more quickly than current procedures.
- Premiums for certain identifiable and traceable qualities could be offset by discount(s) for non-valued qualities.

Packer Sector

The obstacles to adoption of nationally significant animal identification and traceability system(s) from the perspective of the packer sector include:

- Marginal economic benefits to packers from animal identification and traceability requires intentional effort and cooperation of other parties (producers and feeders).
- Depending on system architecture and scope, packers would face compliance costs.
- Traceability, especially extended to wholesale and retail beef cuts, means more liability is placed on packers regarding foodborne illness.
- A mandatory system approach could result in renewed calls for country-of-origin labeling and other retail/consumer regulations.

9. WPI Assessment and Conclusions

WPI's team has been immersed in all aspects of the subject of animal identification and traceability throughout the development of this report. Leveraging the team's familiarity with the subject as well as 30-plus years of experience in agricultural market and policy analysis, the following section provides an assessment of the situation. This is offered independently by WPI's team; at a minimum, it is intended to serve as a starting point for industry discussion on how the findings of this report can be maximized to meet the goals of the industry LRP.

Based on the sum of findings generated via WPI's comprehensive methodology, the following conclusions are made with regard to developing an approach to animal identification and traceability. The basic tenets of a system(s) are that it:

- ✓ Is industry driven.
- ✓ Is managed and overseen by an entity that includes both private and government interests.
- ✓ Maintains data privacy.
- ✓ Is equitable to all industry sectors.
- ✓ Is compatible with common industry practices.
- ✓ Operates at the speed of commerce.
- ✓ Is credible in domestic and international markets.

The key principles above reflect the findings, data, analysis, industry-provided insight, and lessons learned from reviewing other countries' efforts at animal identification and traceability, as detailed in this report. The evidence and background for the above concluding principles is distilled below.

- An **industry-driven** approach allows the cattle and beef value chain to develop a structure that best suits the entire industry with the opportunity to minimize unnecessary costs and maximize shared benefits. It also facilitates the adoption of a realistic timeframe for system(s) rollout, and assures that implementation can be done proactively, rather than reactively. For example, some of the global systems profiled in this report were reactive responses to industry problems and/or catastrophic events and thus did not preempt or help contain certain market shocks that cost the cattle and beef sector value. WPI's own analysis and literature review of other studies regarding the industry impact of BSE showed that lost value extended beyond out-of-pocket costs to include opportunity costs from value that was forgone.
- The management and oversight of nationally significant animal identification and traceability system(s) becomes crucial to function. According to WPI's discussions with stakeholders, systems designed and managed by the industry would be more likely to enhance value captured by the industry by responding to market signals, whereas a program solely run by the government would likely be focused on compliance. There is, however, a necessary role for both objectives, i.e. value enhancement and compliance. For example, virtually all industry stakeholders understand the need for a federal government component to an identification and traceability approach for the purposes of controlling and containing an animal disease outbreak. Therefore, any such system(s) should be **managed and overseen by an entity that includes both private and government interests**. Such a "hybrid" governing body would be made up of industry leaders and representatives, plus certain government officials with the appropriate jurisdiction over veterinary and food safety issues. This

structure borrows from some of the “best practices” of existing global traceability programs. Moreover, a private-public hybrid governance structure is a familiar model to the agricultural and livestock sectors.

- One major issue related to the management and oversight of animal identification and traceability systems is the matter of data privacy. Throughout WPI’s stakeholder outreach and discussions, a major concern up and down the cattle and beef value chain was *how* to develop an approach that **maintains data privacy**. In that regard, 58 percent of the industry stakeholders surveyed for this study considered the federal government either “ineffective” or “very ineffective” in maintaining confidentiality and data privacy. This was revealed to be an issue in WPI’s discussions with industry stakeholders in other countries that had implemented animal identification and traceability systems. Again, some countries – notably Australia, which has a similar “freedom of information” statute as in the U.S. – have taken steps to address those concerns, partly through a hybrid industry and government management and oversight approach.
- The benefits to any specific sector of the cattle and beef value chain which could accrue from a nationally significant animal identification and traceability system(s) approach depend on the intentional effort and cooperation of other sectors in that chain. Therefore, any viable system(s) must be **equitable to all industry sectors** in terms of compliance burden and benefit sharing in order for all segments of the industry to participate.
- It was clear in interviewing industry stakeholders that there is currently significant participation in a host of animal identification and traceability programs, driven by one factor: the ability to realize additional value. That value could come in the form of a price premium from additional marketing value, or from production efficiencies in herd management driven by performance data. Indeed, all segments of the cattle and beef value chain have shown a willingness to adopt animal identification and traceability systems which can be *monetized*. To do so, these systems must be implemented in a way that is **compatible with common industry practices**; otherwise overhead outweighs benefits.
- To be equitable to all sectors, as well as compatible with common industry practices, any system(s) must be able to operate at the **speed of commerce** so as not to impose greater compliance and regulatory costs on any one sector. Further, disruptions to the current pace of business throughout in the industry are likely to have economic consequences both up- and downstream. For example, at the auction market level, bottlenecks created in the throughput of cattle due to animal identification and traceability, or any slowdown in the process which adds to shrink or other disproportionate overhead costs, could send bearish price pressures upstream (toward producers) and bullish pressure downstream (toward packers).
- The final component of an animal identification and traceability system(s) is that the approach is **credible in domestic and international markets**, in keeping with the beef industry’s LRP to adopt a system(s) that “enhances both domestic and global trust in U.S. beef and ensure(s) greater access to export markets.” The difference between a system that solely imposes costs and an approach that creates value opportunities is how the consumer views the value proposition, either from a food safety or product attribute perspective. The credibility of system(s) will add value by inducing consumers to 1) pay a higher price, 2) purchase a greater quantity, or 3) maintain market share in the face of competition. WPI’s interviews and literature review found evidence of added value from

domestic programs (as referenced above) as well as evidence of an enhanced “willingness to pay” for ID’d and traceable beef in export markets. Further, U.S. beef exports must compete with beef originating from countries with animal identification and traceability systems. WPI’s analysis concluded that relatively modest gains in domestic and/or export demand for beef can offset the costs for adoption of a nationally significant traceability system(s) amortized over a period as short as 10 years.

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