



Electronic Animal Identification Systems at Livestock Auction Markets

Adoption Rates, Costs, Opportunities, and Perceptions

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Cover photo courtesy of USDA Natural Resources Conservation Service

Executive Summary

Buyers and sellers of livestock come together at livestock auction markets to discover prices in a public setting. Livestock markets may differentiate themselves by offering electronic individual animal identification and tracking services to their customers. Programs such as the National Animal Identification System (NAIS), marketing alliances, and verification programs are leading to an increased use of animal identification systems. Livestock markets are a primary industry sector where animal movement and identification information can be recorded. This project's purpose was to determine livestock market manager perceptions about animal identification systems, estimate costs of adopting animal tracking systems in auction markets, and assess factors related to adoption of animal ID systems in auction markets. To accomplish these objectives, a national survey of livestock auction markets was conducted in the winter of 2006. Results from completed surveys, representing 189 livestock auction markets, are reported.

Knowledge, Concerns, and Views of the NAIS

- Livestock market operators on average only moderately understand the NAIS program standards (42 percent indicating intermediate level or less understanding), how to adopt the NAIS practices (51 percent indicating they do not fully understand what would need to be done), and the costs of adopting the NAIS at their facilities.
- Many livestock market operators (50 percent) view the NAIS as a threat to their business. However, 20 percent view it as an opportunity.
- In ranked order, livestock operator concerns with the adoption of electronic animal identification tracking technology were cost of technology, reliability of system, cost of operating, cost of necessary facility renovation, impact on speed of sale, additional expertise needs, and data confidentiality.

Knowledge of NAIS Program Standards, Knowledge of How to Adopt NAIS Practices, and Understanding of Costs Necessary to Adopt NAIS

- Livestock market operators that indicated they currently have added, or plan to add, an RFID-tagging service are likely to have more knowledge of the NAIS program standards and more knowledge of how to adopt the NAIS practices and the probable costs involved.
- Managers of facilities that annually sell a large volume of livestock tend to have a higher level of understanding of how to adopt the NAIS practices and are more knowledgeable about NAIS standards than operators of small-volume facilities. This suggests operators of smaller auction markets are an important target to provide more information about the NAIS.
- Managers of facilities that have operating RFID reader systems tend to have more understanding of how to adopt the NAIS practices and of the costs associated with adopting the NAIS.

Perception of the NAIS Impact on Business

- Livestock market operators that have operating RFID reader systems, as well as those that have registered their premises are more likely to perceive the NAIS as an opportunity to their business than livestock markets that have not completed these activities. Auction markets that see opportunities with having electronic animal ID systems have been early adopters. Markets that have not adopted electronic animal ID information technology will need to have their perceptions changed regarding potential value before they are likely to adopt.

Speed of Sale Concerns

- Livestock market managers tend to be highly concerned about adversely affecting sale speed with the adoption of individual electronic animal identification systems. Furthermore, the more volume the auction markets sells, the greater the manager's concern about animal ID systems slowing speed of commerce.

- Affect on sale speed for those livestock markets that have already adopted electronic animal identification and tracking systems is generally less than the perceived impact on speed of sale of those that have not adopted the technology.

Perceptions of Electronic Animal Identification

- Livestock market respondents that have not adopted electronic animal identification systems appear to overestimate costs and needs of such systems.
- Livestock market operators that have adopted RFID technology indicate that new computers and software may need to be purchased; however, sale speed usually does not change with use of an RFID system, and new employees typically do not have to be hired to manage an RFID reader system.

Premises Registration

- At the time of this survey in late 2006, about 56 percent of livestock market operators have registered their premises with the NAIS.
- Only 49 percent of livestock market respondents that viewed the NAIS as a threat had registered their premises compared to 79 percent of livestock market managers that viewed the NAIS as an opportunity.

RFID Technology Adoption

- Only 14 percent of livestock market respondents had adopted RFID reader systems.
- Most livestock markets that adopted reader systems (73 percent) had some part of the system paid for by an outside source. Perhaps some early adopters of RFID technology did so because of cost-share programs that encouraged technology adoption.
- Large-volume markets are more likely to adopt RFID technology than small-volume markets.
- Facilities that have registered their premises are more likely to adopt RFID technology than those that have not registered their premises.

- Livestock markets where a high percentage of cattle are sold with any type of ear tag are more likely to adopt RFID technology than facilities where few cattle are sold with any type of ear tag.

RFID-Tagging Service Addition

- Fifty-five percent of livestock market managers stated they would provide an RFID tagging service for customers if the NAIS were fully implemented.
- Most livestock market survey respondents from the northeastern and northwestern United States plan to add a tagging service.
- Livestock market survey respondents from the southwestern United States expect the highest percent of annual livestock sales to use an RFID tagging service. That is not surprising given that this region has one of the lowest percentages of cattle currently being identified with some type of tag.
- Eighty-five percent of livestock market respondents plan to charge a fee for RFID tagging; however a number of managers are uncertain of the rate they will charge.

RFID Investments

- Twenty-seven livestock market survey respondents have adopted electronic animal identification systems, all of which were RFID reader systems.
- Based on estimated annual costs, economies of scale exist in RFID system adoption, i.e., large-volume livestock markets have lower costs per head. Most auction markets would have annual costs associated with RFID systems of less than \$0.30 per head of cattle sold, with large-volume markets having annual costs that could be less than \$0.11 per head of cattle sold.
- Economies of size are related to intensity of use of RFID reader systems. Small-volume livestock markets that use an electronic reader system intensively (i.e., on a high percentage of cattle sold annually) can compete cost-wise with larger-volume markets that use their reader system on a small percentage of cattle.

Benefits of Electronic Animal Identification Systems

- Preconditioned and RFID-tagged cattle brought a statistically significant and economically important premium of \$2.96 per hundredweight, when compared to cattle that were not preconditioned or RFID tagged at one of three livestock markets where sale data were collected. At the other two sales where sale data were recorded, average premiums paid for RFID-tagged cattle were not statistically different from zero.
- Other studies have found sale price premiums associated with preconditioned cattle. The RFID-tagged cattle market is still somewhat thin and consistent sale premiums will depend on buyer demand and competition for such cattle at any particular market venue.

Tagging Service Investments

- On average, livestock market managers expect 23,130 head of livestock to use an RFID tagging service annually at their facility.
- Livestock market managers, on average expect to charge \$3.34 per head for RFID tagging, excluding the cost of the RFID tag.
- Economies of size exist; markets with higher percentages of livestock using a tagging service will have a competitive advantage over livestock markets that have smaller percentages of livestock using the service.
- Most livestock markets (90 percent) would experience annualized costs of less than \$5.00 per head for an RFID tagging service.

Introduction

Livestock auction markets bring buyers and sellers to a central location to discover prices in a public auction setting. As new industry needs arise and/or as technology changes, auction markets have evolved in the role they play and the services they offer. Livestock markets have an economic incentive to offer a package of marketing services that attracts a large customer base of buyers and sellers. Individual auction markets offer an array of marketing services to differentiate themselves from other auction markets in this competitive business. One way livestock markets have started

to differentiate themselves is by adding electronic individual animal identification and tracking services. Evolving programs such as the National Animal Identification System (NAIS), marketing alliances, and verification programs are increasing demand for and use of electronic individual animal identification.

Collection of individual animal identification and movement information ideally begins when an animal leaves its farm or ranch of origin. Approximately 80 percent of feeder cattle sales occur through local livestock auction facilities or video auction markets.¹ Thus, livestock auction markets are a primary industry sector where animal identification and movement information could be recorded. Some livestock markets have already adopted electronic animal identification and tracking systems, and others are investigating costs and benefits of such systems. Because a large percentage of cattle are marketed through livestock markets, the magnitude of adoption of electronic animal identification and tracking systems at these facilities is an important step in widespread industry collection of individual animal movement information for tracing purposes.

The purpose of this report is to provide information about the adoption of electronic animal identification systems at livestock auction markets based on data collected from a national survey of livestock auctions. The goal is to provide information that is useful to auction markets that are considering adopting animal identification services; to provide facts useful to policy makers and regulators as they consider alternative animal identification and tracking policy options; and to assess needs for knowledge development and dissemination to facilitate animal identification system adoption. Specific objectives include:

- Summarize data collected describing operation size, services offered, and characteristics of livestock markets surveyed
- Determine livestock market operator knowledge levels, concerns with, and perceptions about animal identification systems
- Quantify relationships between auction market characteristics and operator perceptions of electronic animal identification system adoption

¹ Schmitz, et al.

Table 1. *Average Typical Annual Head of Livestock Sold Among Auction Market Survey Respondents.*

Species	Average Annual Head			
	Sold	Standard Deviation	Minimum Head Sold	Maximum Head Sold
Cattle	52,522	45,603	0	320,000
Hogs	2,482	6,921	0	45,000
Sheep	1,457	3,763	0	35,000
Goats	1,029	2,972	0	30,000
Horse	329	959	0	7,800
Other ¹	75	1,003	0	14,000

¹Other includes buffalo, llama, mules, donkeys, and exotic animals

- Assess livestock market participation in the NAIS premises registration and quantify determinants of premises registration
- Estimate determinants of electronic animal identification technology adoption among livestock markets
- Determine the extent of livestock market adoption of RFID tagging services
- Estimate electronic animal identification system investment requirements and associated costs for livestock auction markets
- Determine RFID tagging service investments and costs for livestock auction markets

Data Collection and Demographics of Livestock Markets Surveyed

To collect data necessary to complete the objectives of this study, a national survey was mailed to livestock markets across the United States (a copy of the survey is provided in Appendix A). The survey asked questions pertaining to general characteristics of the livestock market such as size, technology use, and operating expenses; services the livestock market may add to adopt the NAIS components; knowledge and concerns of animal identification and movement tracking; and costs of electronic animal identification systems (realized or anticipated). Livestock markets that had already adopted electronic animal identification systems answered an additional set of survey questions relative to those that had not adopted this information technology.

Researchers at Kansas State University developed the survey instrument with assistance from the Livestock Marketing Association (LMA). The surveys and postage-paid return envelopes were mailed by the LMA and the National Livestock Producers Association (NLPA) to their livestock auction market member and nonmember lists.

Both organizations included a personal cover letter with the surveys highlighting the importance of completing and returning the survey (Appendix B contains the cover letters). The organizations also periodically encouraged and reminded their members to fill out and return the survey. LMA and NLPA distributed 1,096 and 60 surveys, respectively. The surveys were mailed in late November 2006 and completed surveys were returned by February 2007. There were also 10 livestock auction markets that were participants in a Kansas pilot study² that completed the survey directly through Kansas State University. Overall, 189 surveys were completed representing a 16 percent (189/1,166) response rate. On November 22, 2006, during the time the surveys were in the mail to the livestock markets, USDA announced that the NAIS would remain a voluntary program. This announcement may have adversely affected the survey response rate and could have influenced how some questions were interpreted and answered by livestock market operators.

Livestock markets that responded to the survey varied in size, structure, and geographic region. Table 1 summarizes the average annual head of livestock sold among the survey respondents. The main species sold at livestock markets were cattle followed by hogs, sheep, goats, and horses. On average, the survey respondents sold 52,522 head of cattle per year ranging from zero to 320,000 head. Figure 1 shows the average number of livestock sold annually among respondents by region. Table C1 in Appendix C contains a list of individual states included in each of the five regions.

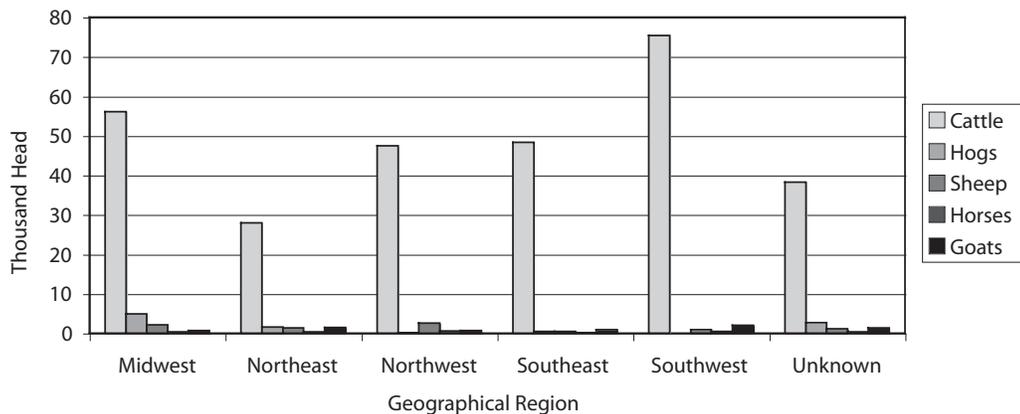
Figure 2 illustrates the regional distribution of survey respondents. The majority of the completed surveys were from auction markets located in the Midwest (42 percent), followed by the Southeast,

² Bolte, et al.

Southwest, Northwest, and Northeast respectively. Respondent region was determined by return address if provided (this was optional) or by the postmark on the return envelope. "Unknown" regions were those without a postmark.

The distribution of reported auction facility market values among respondents is summarized in Figure 3. Thirty-eight percent of livestock markets estimated their facility value to be between \$500,000 and \$1,499,999. Twenty-five percent of survey respondents estimated their facility value to

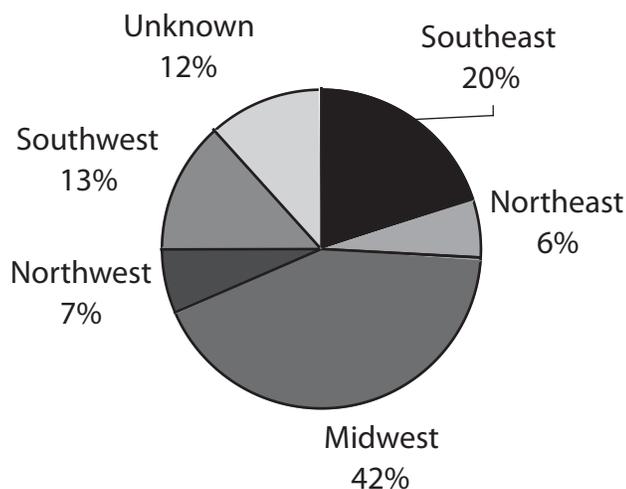
Figure 1. Average Livestock Sold Annually by Region Among Auction Market Survey Respondents.



be between \$250,000 to \$499,999 and 2 percent of livestock markets reported facility values of \$7,500,000 or more.

For those livestock market respondents that sell cattle (all but one), the average number of cattle sold on a peak sale day was 2,108 head. The minimum sold on a peak day was 80 head and the maximum was 17,000 head. The

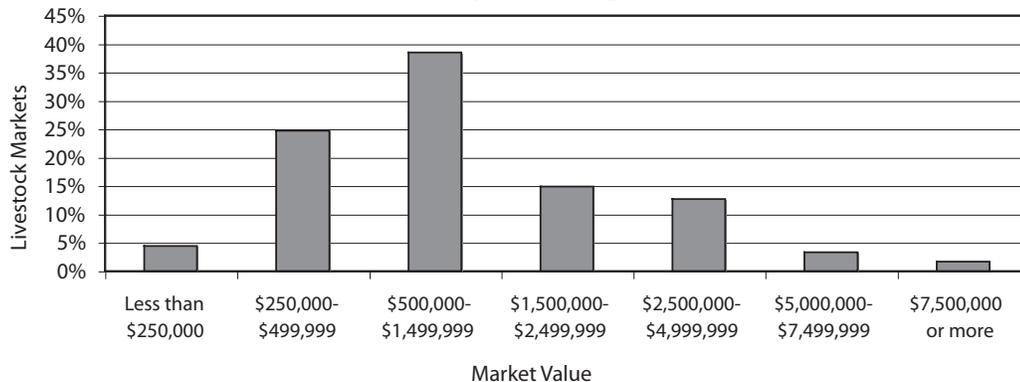
Figure 2. Regional Distribution of Survey Respondents.



average number of cattle sold on a nonpeak sale day was 779 head with the minimum being 35 head and the maximum being 8,000 head. Figures 4 and 5 illustrate the frequencies of peak and nonpeak cattle volumes by livestock markets. Peak sale days refer to times of the year when more cattle are sold per day than normal (i.e., fall weaning). Nonpeak sale days refer to all other times.

On average, 74 percent of cattle lots sold were calves, yearlings, or replacement heifers with the other 26 percent of lots being cows and bulls. Table 2 shows that, on average, 41 percent of calf, yearling, or replacement heifer lots were sold one head at a time, 28 percent were sold in 2- to 10-head lots, 22 percent in 11- to 50-head lots, and 9 percent in lots greater than 50 head. On average, lots of cows/bulls,

Figure 3. Market Value of Facilities Among Survey Respondents.



swine, and goats/sheep sold as single head lots were greater than 50 percent. An estimated 74 percent of calves, yearlings, and replacement heifers are sold in lots of 11 or more head and an estimated 27 percent of cows and bulls are sold in lots of 11 or more head. Only 28 percent of swine are sold in lots of

Table 2. Distribution of Average Lot Size by Species of Livestock, Marketed Through Survey Respondent's Facility.

Livestock Type	Lot Size							
	Single Head		2-10 Head		11-50 Head		Greater than 50 Head	
	Percent of Lots ¹	Estimated Percent of Head ²	Percent of Lots ¹	Estimated Percent of Head ²	Percent of Lots ¹	Estimated Percent of Head ²	Percent of Lots ¹	Estimated Percent of Head ²
Calves, Yearlings, Replacement Heifers	41%	11%	28%	15%	22%	44%	9%	30%
Cows/Bulls	80%	49%	15%	25%	5%	19%	1%	8%
Swine	51%	7%	33%	21%	14%	56%	2%	15%
Goats/Sheep	58%	23%	30%	25%	10%	34%	2%	18%

¹ "Percent of Lots" is the simple average of livestock market respondents.

² "Estimated Percent of Head" is an approximated volume-weighted percentage using the mid-points of size categories for 2-10 head and 11-50 head and 65 head for 50 or greater category.

Figure 4. Number of Cattle Sold on a Peak Day Among Survey Respondents That Sell Cattle.

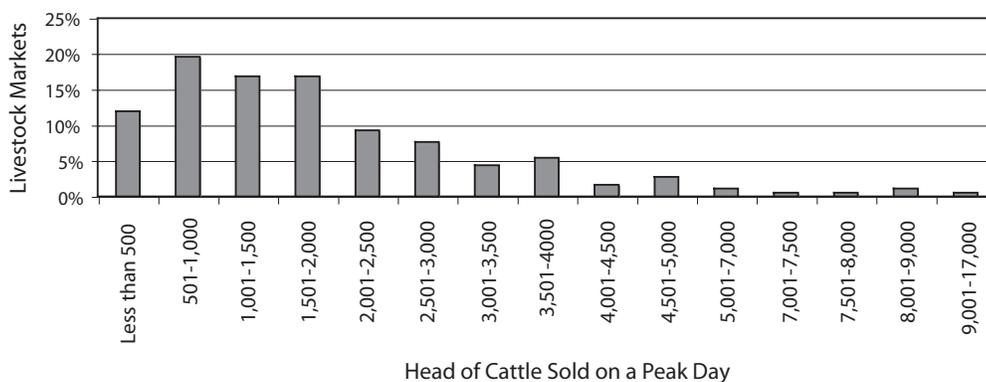
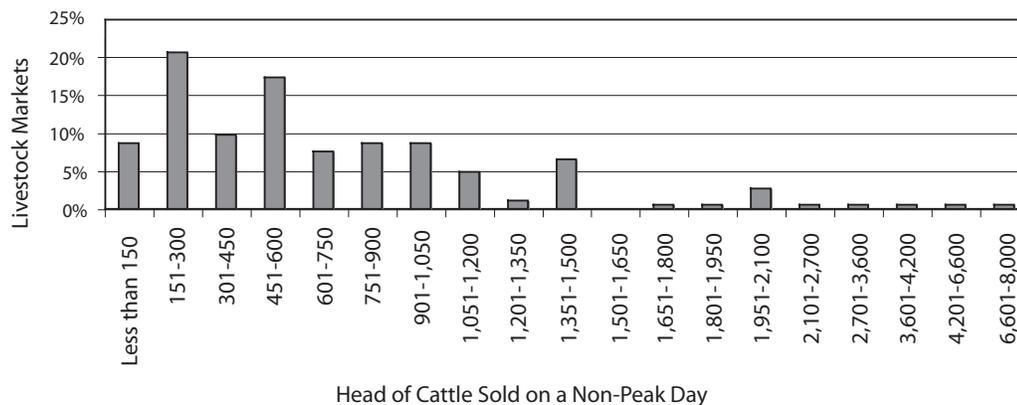


Figure 5. Number of Cattle Sold on a Non-Peak Day Among Survey Respondents That Sell Cattle.



less than 11 head; however, 48 percent of goats and sheep are sold in lots of fewer than 11 head.

Knowledge, Concerns, and Views of the NAIS

The NAIS is a voluntary program (at the federal level) made up of a streamlined information system designed to help animal health officials and producers respond to animal health threats

in a timely manner.³ Electronic individual animal identification systems will most likely be the popular choice of identification among cattle producers. Because of the role auction markets have in being the first market for many cattle, livestock market operator knowledge; concerns and views of the NAIS; and animal identification and movement tracking systems are important to understand. If livestock market operators do not understand the NAIS or animal identification systems, information may be misconstrued. It is important to identify concerns livestock market operators may have about electronic

animal identification systems, so these issues can be addressed.

On average, livestock market operators ranked their knowledge of the program standards of the NAIS at 5.8 (on a scale from 1 to 9, where 1 reflects having no knowledge and 9 indicates extreme

³ NAIS Home Page. <http://animalid.aphis.usda.gov/nais/index.shtml>.

Figure 6. Knowledge of the NAIS Program Standards Among Survey Respondents (Average 5.8).

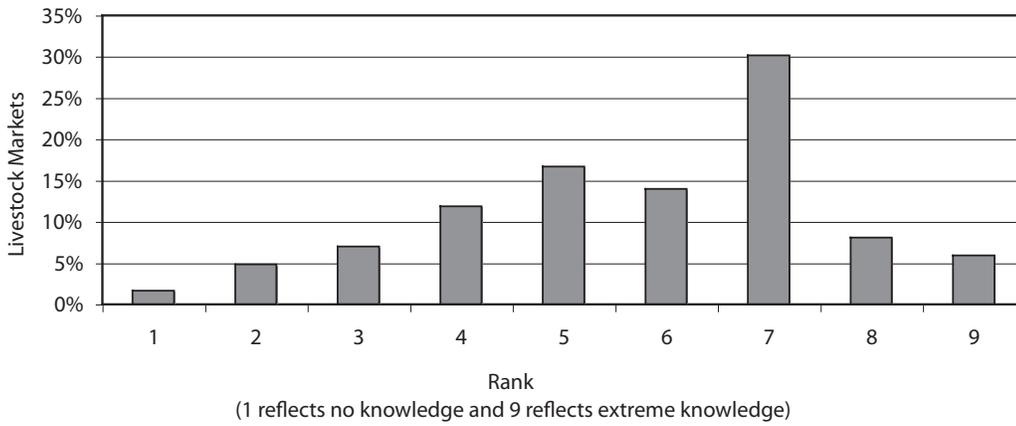


Figure 7. Knowledge of How to Adopt the NAIS Among Survey Respondents (Average 5.2).

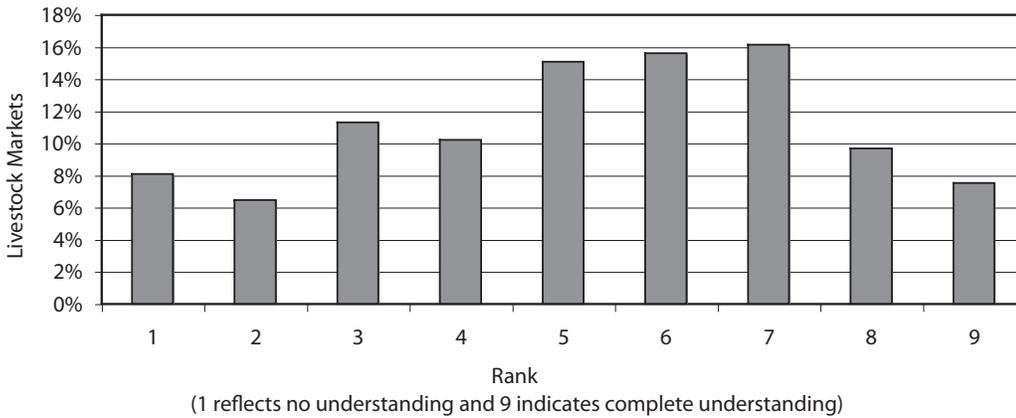
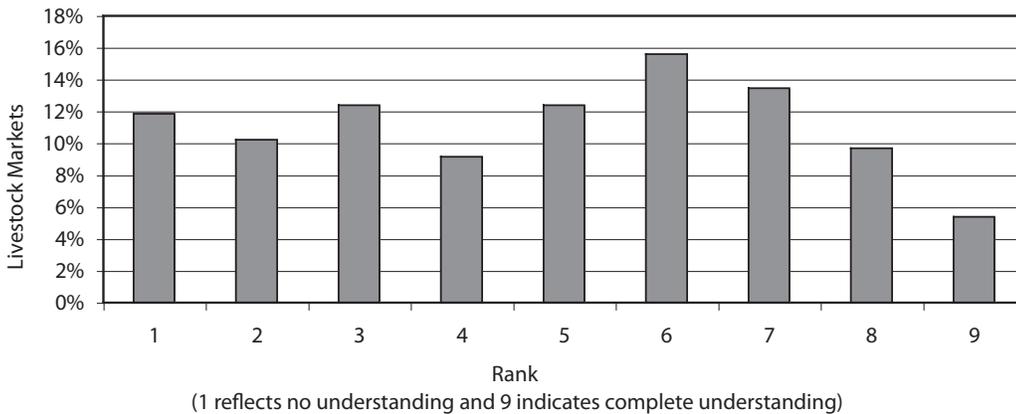


Figure 8. Knowledge of Cost to Adopt the NAIS Among Survey Respondents (Average 4.8).



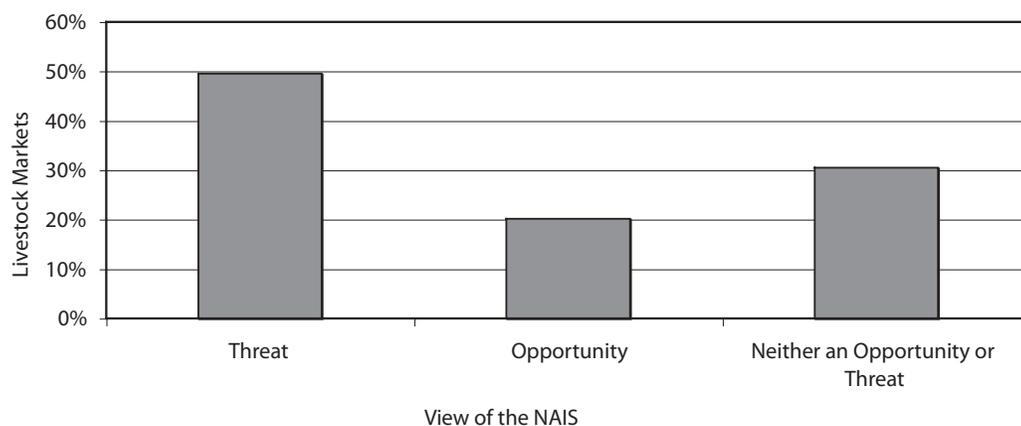
knowledge). This indicates a moderate level of understanding of the NAIS standards among livestock market respondents. Figure 6 shows that only 6 percent of livestock market respondents indicated feeling as though they were extremely knowledgeable (level 9) of the NAIS program standards. Though most auction market operators (58 percent) responded with a knowledge value of 6 or higher, there are still 42 percent indicating intermediate or

less understanding of the NAIS. This indicates further information dissemination and educational programs are need for auction market operators regarding the NAIS.

When asked to rank their level of understanding of what their facility would need to do to adopt the NAIS services, the average response was 5.2 (on a scale from 1 to 9, where 1 reflects having no understanding and 9 indicates complete understanding). This indicates livestock market operators have a moderate level of understanding of what needs to be done to adopt the NAIS at their facilities. Figure 7 shows the responses to this question. Slightly more than half of the auction market operators (51 percent with a score of 5 or less) feel they do not fully understand what they would need to do to adopt the NAIS.

Livestock market operators were asked to rank their level of understanding of the costs likely to be incurred in order to adopt the NAIS services. The average response was 4.8 (on a scale from 1 to 9, where 1 reflects having no understanding and 9 indicates complete understanding). This shows livestock market operators moderately understand the costs they would incur to adopt the NAIS. Figure 8 summarizes the livestock market responses. Not surprisingly, given the results of Figure 7 that indicates most operators do not fully know what

Figure 9. *Livestock Market View of the NAIS Among Survey Respondents.*



they would need to do to adopt the NAIS, a similar percentage of operators indicated they do not know what the costs of adoption would be.

Within the livestock market industry there are several concerns regarding adoption of the NAIS. The following list summarizes how livestock market operators ranked their concerns of seven items related to the NAIS in order from greatest concern to least concern (numbers in parentheses are average responses with 1 being least concern to 5 being greatest concern):

1. Cost of technology (e.g., readers, computers) (4.50)
2. Reliability of electronic animal identification equipment (4.46)
3. Cost of operating the system (e.g., labor) (4.43)
4. Cost of renovations/facility modifications (4.40)
5. Speed of sale adversely impacted (4.29)
6. Additional technology expertise needed (4.16)
7. Confidentiality of the NAIS (3.96)

There are only small differences in the average rankings of the concerns listed, and all are greater than moderate concern on average. However, the greatest concern was the cost of technology, and the least concern was confidentiality. With the adoption of the NAIS systems, costs involved in facility modification, adoption, and operation; assurance of technology reliability and ease of use; and demonstration of how these systems can be implemented without adversely affecting speed of sale are all important concerns of auction market operators.

How livestock markets view the NAIS is also important because this illustrates general feelings of the program among the auction market industry. Figure 9 shows how auction market operators view the overall impact of the NAIS on their businesses. Approximately half of the livestock market operator respon-

dents view the NAIS as a threat to their businesses. Only 20 percent view it as an opportunity and 30 percent view it as neither a threat nor an opportunity. To gain support for the NAIS, addressing concerns of those that perceive the NAIS as a “threat” to their business will be critical.

If a goal is to have the NAIS become broadly adopted by the livestock market industry, more information about the program is needed for livestock market operators. Most livestock market operators are only moderately knowledgeable of the program standards, costs, and adoption needs. Also, concerns of the NAIS and electronic animal identification systems need to be addressed. Finally, for livestock market managers to want to comply with the NAIS, they need to perceive it as more of an opportunity and less of a threat.

Factors Related to Knowledge and Perceptions of the NAIS

In order to determine how individual characteristics of livestock markets relate to levels of knowledge, views, and concern of the NAIS, a statistical modeling procedure, referred to as ordered logit models, was used. The purpose of this analysis is to determine whether there are systematic characteristics of auction markets that relate to survey respondent answers to particular questions. If there are systematic factors related to responses to specific questions, this knowledge can be used to better target information dissemination programs. Livestock market operator knowledge of the NAIS program standards, understanding of how to adopt the NAIS practices, and understanding of costs of the NAIS all were ranked from 1 to 9 (where 1 reflected having no understanding/knowledge and

9 indicated complete understanding/knowledge). How livestock markets viewed the NAIS was ranked from 1 to 3, where 1 = a threat, 2 = neither a threat nor an opportunity, and 3 = an opportunity. How concerned each livestock market was about an adverse change in speed of sale due to the NAIS adoption was ranked from 1 to 5 (1 = least concern, 5 = most concern). Similar explanatory variables were used in analyzing responses to each of these questions.

The following models were estimated to identify determinants of individual livestock market respondent opinions of the NAIS:

Knowledge Questions

$$(1) \text{ standards} = \beta_0 + \beta_1 \text{ herfin} + \beta_2 \text{ cattid} + \beta_3 \ln(\text{lvstk}) + \beta_4 \text{ tagging} + \beta_5 \text{ RFID} + \beta_6 \text{ premises} + \beta_7 \text{ NE} + \beta_8 \text{ SE} + \beta_9 \text{ SW} + \beta_{10} \text{ NW} + e$$

$$(2) \text{ adoption} = \beta_0 + \beta_1 \text{ herfin} + \beta_2 \text{ cattid} + \beta_3 \ln(\text{lvstk}) + \beta_4 \text{ tagging} + \beta_5 \text{ RFID} + \beta_6 \text{ premises} + \beta_7 \text{ NE} + \beta_8 \text{ SE} + \beta_9 \text{ SW} + \beta_{10} \text{ NW} + e$$

$$(3) \text{ costs} = \beta_0 + \beta_1 \text{ herfin} + \beta_2 \text{ cattid} + \beta_3 \ln(\text{lvstk}) + \beta_4 \text{ tagging} + \beta_5 \text{ RFID} + \beta_6 \text{ premises} + \beta_7 \text{ NE} + \beta_8 \text{ SE} + \beta_9 \text{ SW} + \beta_{10} \text{ NW} + e$$

Perception Questions

$$(4) \text{ view} = \beta_0 + \beta_1 \text{ herfin} + \beta_2 \text{ cattid} + \beta_3 \ln(\text{lvstk}) + \beta_4 \text{ tagging} + \beta_5 \text{ RFID} + \beta_6 \text{ premises} + \beta_7 \text{ NE} + \beta_8 \text{ SE} + \beta_9 \text{ SW} + \beta_{10} \text{ NW} + e$$

$$(5) \text{ salespeed} = \beta_0 + \beta_1 \text{ herfin} + \beta_2 \text{ cattid} + \beta_3 \ln(\text{lvstk}) + \beta_4 \text{ tagging} + \beta_5 \text{ RFID} + \beta_6 \text{ premises} + \beta_7 \text{ NE} + \beta_8 \text{ SE} + \beta_9 \text{ SW} + \beta_{10} \text{ NW} + e$$

All variables are defined in Table 3 and summary statistics for the variables are reported in Table 4. The explanatory variables used were selected because they were expected to be the most likely factors that would have an effect on the variables of interest.

Ordered logit models were used to estimate the parameters in equations 1 through 5 to determine how the different explanatory (independent) variables relate to the probability the survey respondent indicated a particular knowledge level about the NAIS, concern of the NAIS, or view of the NAIS. Model estimation results are reported in tables 5 through 9 for equations 1 through 5, respectively.

Changes in probabilities associated with a one-unit change in each explanatory variable were calculated and are referred to as marginal probabilities. Marginal probabilities, reported in tables 5 through 9, sum to zero across rows because as the probability of one response category increases, all others must decrease collectively by that amount. Binary variables do not have marginal probabilities, as they only take on values of one or zero. Thus, the probabilities as binary variables change from 0 to 1 are presented in tables 5 through 9. The probabilities associated with changes in the binary variables were calculated by holding continuous variables at their average values and discrete variables at their most common response.

Knowledge of the NAIS Program Standards

Respondent knowledge of the NAIS standards varied across auction markets (Figure 6), though the most common answer was a 7 (1 = no knowledge to 9 = extreme knowledge). Estimated impacts of factors hypothesized to be related to the level of knowledge are presented in Table 5. Livestock market managers that plan to offer an RFID tagging service stated that they feel more knowledgeable about the NAIS program standards than those that are not planning to add an RFID tagging service if the NAIS were implemented. Holding other factors constant, the probability that an auction market survey respondent planning to add a tagging service indicated a high degree of knowledge of the NAIS standards (response of 7 or higher) was about 55 percent. In contrast, those that do not plan to add a tagging service have a probability of 37 percent of having a response of 7 or higher. Stated knowledge about the NAIS program standards was not related to whether the auction market had registered its premises, the region of the country the market was located relative to the Midwest, the diversity of livestock sold at the market, the RFID adoption, or the percentage of cattle that the auction market sells that have any type of identification tag.

Livestock market operators that sell greater volumes of livestock annually are likely to have more knowledge of the NAIS standards (response of 7 or higher) than operators of markets that sell fewer head of livestock annually. Figure 10 shows the probability of responses of 7 or greater (high knowledge), 3 or lower (low knowledge), and 4 to 6

Table 3. Variable Definitions Used in Statistical Models.

Dependent Variables	Definition
<i>adoption</i>	Understanding of how to adopt the NAIS practices (1 = no understanding to 9 = complete understanding)
<i>costs</i>	Understanding of the costs associated with adopting the NAIS (1 = no understanding to 9 = complete understanding)
<i>salespeed</i>	Level of concern of the NAIS adversely affecting sale speed (1 = low concern to 5 = high concern)
<i>standards</i>	Knowledge of the NAIS program Standards (1 = no knowledge to 9 = extremely knowledgeable)
<i>view</i>	Livestock market respondent view of the NAIS (1 = threat, 2 = neither threat or opportunity, 3 = opportunity)
Independent Variables	Definition
<i>cattid</i>	Categorical number representing the percentage of cattle currently sold with any type of identification tag (1 = 0-25%, 2 = 26-50%, 3 = 51-75%, 4 = 76-100%)
<i>herfin</i>	Herfindal-type index measuring the concentration of species sold at a livestock market (1 = many different species sold to 10 = one species sold ¹)
<i>ln(lvstk)</i>	Continuous variable measuring the natural log of the total number of livestock sold at a livestock market annually.
<i>premises</i>	Binary variable equal to 1 if the livestock market has registered their premises with the NAIS, 0 otherwise
<i>RFID</i>	Binary variable equal to 1 if the livestock market currently uses a RFID reader system, 0 otherwise
<i>tagging</i>	Binary variable equal to 1 if the livestock market will offer a RFID tagging service when the NAIS is fully implemented, 0 otherwise
<i>NE</i>	Binary variable equal to 1 if livestock market from the Northeast region of U.S., 0 otherwise
<i>NW</i>	Binary variable equal to 1 if livestock market from the Northwest region of U.S., 0 otherwise
<i>SE</i>	Binary variable equal to 1 if livestock market from the Southeast region of U.S., 0 otherwise
<i>SW</i>	Binary variable equal to 1 if livestock market from the Southwest region of U.S., 0 otherwise
<i>Midwest/Unknown</i>	Base/Default region
β_i	Parameter coefficients to be estimated by the modeling procedure

¹ *Herfindal calculations: A livestock market's herfindal index is the summation of all of the squared specie shares for each facility. The specie shares were calculated by taking the number of head of one species sold annually at a livestock market divided by the total number of livestock sold annually at the facility, multiplied by 100, squared, and divided by 1,000. This procedure was repeated for each species sold at a facility.*

(moderate knowledge) by size of livestock market. The probability of a livestock market operator having a high level of knowledge (7 to 9) increases as the size of the facility increases. Likewise, the probability of a livestock market manager having little to no knowledge (1 to 3) or only moderate

knowledge (4 to 6) increases as livestock markets get smaller.

Knowledge to Adopt the NAIS Practices

Results of the model explaining factors related to auction market respondent understanding of what the facility would need to do to adopt the NAIS practices (Figure 7) are reported in Table 6.

Table 4. Summary Statistics of Variables Used in Statistical Models.

Variable	Mean	Most Common Response ¹	Standard Deviation	Minimum	Maximum
<i>adoption</i>	5.23	7	2.30	1.00	9.00
<i>costs</i>	4.81	6	2.41	1.00	9.00
<i>salespeed</i>	4.29	5	1.24	1.00	5.00
<i>standards</i>	5.75	7	1.89	1.00	9.00
<i>view</i>	1.73	1	0.78	1.00	3.00
<i>cattid</i>	1.74	1	1.04	1.00	4.00
<i>herfin</i>	8.56		2.00	2.30	10.00
<i>ln(lvstk)</i>	10.67		0.87	6.76	12.68
<i>premises</i>	0.56	1	0.50	0.00	1.00
<i>RFID</i>	0.14	0	0.35	0.00	1.00
<i>tagging</i>	0.55	1	0.50	0.00	1.00
<i>NE</i>	0.06	0	0.24	0.00	1.00
<i>NW</i>	0.07	0	0.25	0.00	1.00
<i>SE</i>	0.20	0	0.40	0.00	1.00
<i>SW</i>	0.13	0	0.34	0.00	1.00

¹ “Most Common Response” is not displayed for continuous variables.

Table 5. Ordered Logit Estimates for Response to Statement: Rate your knowledge of the NAIS, regarding program standards. (1=no knowledge to 9= extremely knowledgeable)

Variable	Parameter Estimate ¹	P-Value	1	2	3	4	5	6	7	8	9
Intercept	-2.0697	0.2931	Probabilities								
tagging = 1	0.7259	0.0123	0.0078	0.0254	0.0434	0.0833	0.1505	0.1449	0.3731	0.0972	0.0745
tagging = 0	Default		0.0159	0.0503	0.0801	0.1359	0.1996	0.1515	0.2756	0.0537	0.0375
RFID = 1	0.6818	0.1332	0.0039	0.0131	0.0232	0.0475	0.0976	0.1117	0.4122	0.1535	0.1372
RFID = 0	Default		0.0078	0.0254	0.0434	0.0833	0.1505	0.1449	0.3731	0.0972	0.0745
premises=1	0.1723	0.5559	0.0078	0.0254	0.0434	0.0833	0.1505	0.1449	0.3731	0.0972	0.0745
premises=0	Default		0.0092	0.0300	0.0505	0.0947	0.1640	0.1498	0.3533	0.0851	0.0634
NE	-0.5893	0.3102	0.0139	0.0443	0.0718	0.1253	0.1925	0.1532	0.2959	0.0604	0.0427
SE	-0.5061	0.1664	0.0128	0.0410	0.0671	0.1190	0.1875	0.1535	0.3080	0.0648	0.0463
SW	-0.4025	0.3193	0.0116	0.0372	0.0615	0.1112	0.1807	0.1533	0.3228	0.0707	0.0510
NW	0.2589	0.6466	0.0060	0.0198	0.0344	0.0679	0.1297	0.1343	0.3962	0.1173	0.0944
Midwest/ Unknown	Default		0.0078	0.0254	0.0434	0.0833	0.1505	0.1449	0.3731	0.0972	0.0745
			Marginal Probabilities								
herfin	0.0364	0.5976	-0.0003	-0.0009	-0.0014	-0.0023	-0.0029	-0.0012	0.0039	0.0027	0.0025
cattid	0.0151	0.9214	-0.0001	-0.0004	-0.0006	-0.0010	-0.0012	-0.0005	0.0016	0.0011	0.0010
ln(lvstk)	0.5337	0.0021	-0.0041	-0.0130	-0.0206	-0.0339	-0.0425	-0.0181	0.0565	0.0391	0.0368

Log-Likelihood Function = -341.8824 Number of Observations = 183

¹ Parameter estimates for “limits” with p-values in parentheses: Limit 2: 1.4776 (0.0042), Limit 3: 2.3598 (<.0001), Limit 4: 3.1902 (<.0001), Limit 5: 4.0509 (<.0001), Limit 6: 4.6700 (<.0001), Limit 7: 6.4232 (<.0001), Limit 8: 7.3698 (<.0001).

Livestock market operators that indicate they would likely add an RFID tagging service in the future are 36 percent probable to admit high knowledge of how to adopt the NAIS practices; whereas it is 19 percent probable of facilities not likely to offer

RFID tagging, holding all other variables constant. Survey respondents that have adopted RFID reader systems have 62 percent probability of high knowledge, and respondents that have not adopted RFID reader systems have 36 percent probability of high

Figure 10. Probability of a Livestock Market's Level of Knowledge of the NAIS Program Standards Based on Annual Livestock Sales.

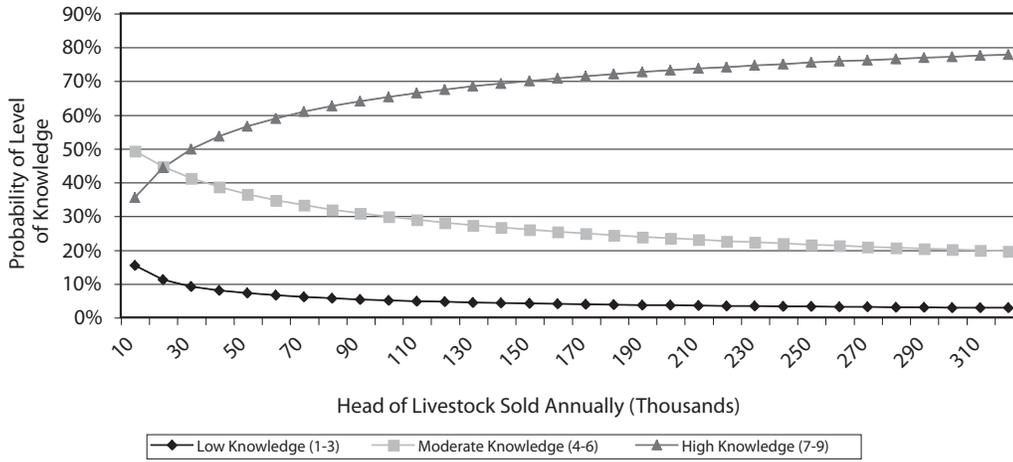
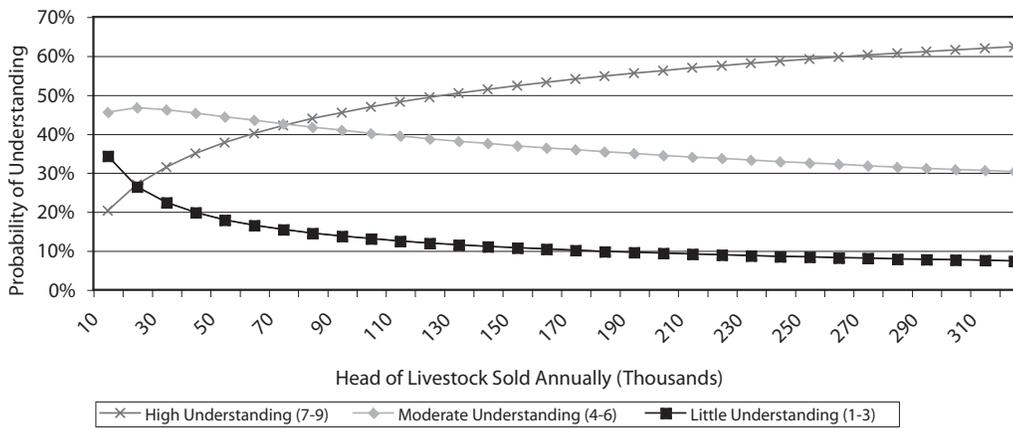


Figure 11. Probability of a Livestock Market's Level of Understanding of How to Adopt the NAIS Practices Based on Annual Livestock Sales.



knowledge, all else constant. Unrelated to operator knowledge of the NAIS were whether the market had registered its premises, the auction facility location compared to the Midwest, the diversity of livestock sold by the market, and the percentage of cattle the market sold that had an identification tag.

Figure 11 illustrates that livestock markets that sell more livestock annually are more likely to have a higher level of understanding of how to adopt the NAIS practices. Smaller livestock markets, that sell fewer livestock, are more likely to have moderate or little understanding of how to adopt the NAIS practices.

Understanding of Costs Necessary to Adopt the NAIS

Overall, livestock market operators showed a wide range of understanding of costs associated with adopting the NAIS (Figure 8). Table 7 reports the results of estimating equation (3) to determine factors related to knowledge of costs of adoption. Livestock market managers that plan to offer an

RFID tagging service in the future have a 32 percent probability of responding with a 7 or higher, whereas facilities that do not plan to offer a tagging service in the future have only a 17 percent probability of responding with a 7 or higher. Livestock market operators that have RFID reader systems in place are more likely to be more knowledgeable (60 percent probability of responding with a 7 or higher) of the NAIS costs than those auction market respondents that do not currently use RFID reader systems (32 percent probability of responding with a 7 or higher). Unrelated to operator understanding of costs associated with adopting the NAIS included whether the market had registered its

premises, auction facility location compared to the Midwest, diversity of livestock sold by the market, percentage of cattle the market sold that had an identification tag, and auction market sales volume.

Perception of the NAIS Impact on Business

Livestock market operators have diverse perceptions regarding whether the NAIS represents a threat or an opportunity to their operations (Figure 9). Factors related to these perceptions are reported in Table 8. Livestock market operators that have RFID reader systems in place have a 54 percent probability of perceiving the NAIS as an opportunity for their businesses; while livestock market operators that do not have RFID reader systems in use have only a 22 percent probability of perceiving the NAIS as an opportunity for their businesses. Also, livestock market managers that have registered their premises have a 22 percent probability of perceiving the NAIS as an opportunity for their

Table 6. *Ordered Logit Estimates for Response to Statement: Rate your level of understanding of what this facility needs to do to adopt the NAIS practices. (1=do not understand to 9= completely understand)*

Variable	Parameter		1	2	3	4	5	6	7	8	9
	Estimate ¹	P-Value									
Intercept	-4.825	0.011	Probabilities								
tagging = 1	0.854	0.003	0.050	0.047	0.095	0.095	0.167	0.188	0.196	0.094	0.068
tagging = 0	Default		0.110	0.091	0.157	0.128	0.176	0.147	0.116	0.046	0.030
RFID = 1	1.068	0.014	0.018	0.018	0.040	0.046	0.101	0.159	0.258	0.185	0.175
RFID = 0	Default		0.050	0.047	0.095	0.095	0.167	0.188	0.196	0.094	0.068
premises=1	0.160	0.584	0.050	0.047	0.095	0.095	0.167	0.188	0.196	0.094	0.068
premises=0	Default		0.058	0.053	0.106	0.103	0.173	0.184	0.181	0.083	0.058
NE	0.673	0.251	0.026	0.026	0.056	0.062	0.128	0.180	0.247	0.150	0.125
SE	-0.185	0.598	0.059	0.054	0.108	0.104	0.174	0.183	0.178	0.082	0.057
SW	-0.270	0.519	0.064	0.058	0.114	0.108	0.176	0.180	0.170	0.076	0.053
NW	0.412	0.466	0.034	0.032	0.070	0.074	0.145	0.188	0.231	0.127	0.099
Midwest/Unknown	Default		0.050	0.047	0.095	0.095	0.167	0.188	0.196	0.094	0.068
Marginal Probabilities											
herfin	0.103	0.121	-0.005	-0.004	-0.007	-0.005	-0.004	0.002	0.010	0.007	0.007
cattid	0.095	0.513	-0.005	-0.004	-0.006	-0.005	-0.004	0.002	0.009	0.007	0.006
ln(lvstk)	0.542	0.002	-0.026	-0.022	-0.037	-0.027	-0.024	0.010	0.051	0.039	0.034

Log-Likelihood Function = -371.91536 Number of Observations = 183

¹ Parameter estimates for “limits” with p-values in parentheses: Limit 2: 0.709 (0.000), Limit 3: 1.507(<.0001), Limit 4: 2.034 (<.0001), Limit 5: 2.760 (<.0001), Limit 6: 3.530 (<.0001), Limit 7: .588 (<.0001), Limit 8: 5565 (<.0001).

Table 7. *Ordered Logit Estimates for Response to Statement: Rate your level of understanding of costs you will incur to adopt the NAIS at this facility. (1=do not understand to 9= completely understand)*

Variable	Parameter		1	2	3	4	5	6	7	8	9
	Estimate ¹	P-Value									
Intercept	-1.443	0.448	Probabilities								
tagging = 1	0.814	0.004	0.075	0.083	0.109	0.092	0.135	0.190	0.164	0.099	0.052
tagging = 0	Default		0.156	0.143	0.153	0.107	0.130	0.142	0.096	0.049	0.024
RFID = 1	1.174	0.007	0.025	0.031	0.046	0.046	0.084	0.169	0.233	0.214	0.151
RFID = 0	Default		0.075	0.083	0.109	0.092	0.135	0.190	0.164	0.099	0.052
premises=1	0.272	0.355	0.075	0.083	0.109	0.092	0.135	0.190	0.164	0.099	0.052
premises=0	Default		0.097	0.102	0.126	0.100	0.138	0.178	0.140	0.079	0.040
NE	-0.727	0.237	0.144	0.137	0.150	0.107	0.132	0.149	0.103	0.053	0.026
SE	-0.411	0.239	0.110	0.112	0.134	0.103	0.138	0.170	0.129	0.070	0.035
SW	0.318	0.456	0.056	0.065	0.089	0.080	0.126	0.196	0.191	0.126	0.070
NW	-0.280	0.624	0.097	0.102	0.126	0.100	0.138	0.178	0.140	0.079	0.040
Midwest/Unknown	Default		0.075	0.083	0.109	0.092	0.135	0.190	0.164	0.099	0.052
Marginal Probabilities											
herfin	0.079	0.249	-0.005	-0.005	-0.005	-0.003	-0.002	0.003	0.007	0.006	0.004
cattid	0.219	0.133	-0.015	-0.014	-0.014	-0.007	-0.004	0.007	0.019	0.017	0.011
ln(lvstk)	0.185	0.279	-0.013	-0.012	-0.012	-0.006	-0.004	0.006	0.016	0.015	0.009

Log-Likelihood Function = -378.60854 Number of Observations = 183

¹ Parameter estimates for “limits” with p-values in parentheses: Limit 2: 0.839(<.0001), Limit 3: 1.499(<.0001), Limit 4: 1.928(<.0001), Limit 5: 2.483(<.0001), Limit 6: 3.280(<.0001), Limit 7: 4.233(<.0001), Limit 8: 5.407(<.0001).

Table 8. Ordered Logit Estimates for Response to Statement: Is the NAIS a threat or opportunity to your business? (1 = threat, 2 = neither threat or opportunity, 3 = opportunity).

Variable	Parameter Estimate ¹	P-Value	1	2	3
Intercept	-3.345	0.125	Probabilities		
tagging = 1	0.114	0.714	0.411	0.367	0.221
tagging = 0	Default		0.439	0.359	0.202
RFID = 1	1.399	0.005	0.147	0.318	0.535
RFID = 0	Default		0.411	0.367	0.221
premises=1	0.568	0.078	0.411	0.367	0.221
premises=0	Default		0.552	0.309	0.139
NE	1.368	0.028	0.151	0.322	0.528
SE	-0.031	0.938	0.419	0.365	0.216
SW	-0.772	0.111	0.602	0.282	0.116
NW	0.120	0.843	0.383	0.375	0.243
Midwest/Unknown	Default		0.411	0.367	0.221
			Marginal Probabilities		
herfin	0.041	0.588	-0.010	0.003	0.007
cattid	-0.164	0.317	0.040	-0.011	-0.028
ln(lvstk)	0.266	0.174	-0.064	0.019	0.046
Log-Likelihood Function = -176.26663 Number of Observations = 183					
¹ Parameter estimate for "limit" with p-value in parentheses: Limit 2: 1.617 (<.0001)					

businesses while livestock market operators that have not registered their premises only have a 14 percent probability of thinking of the NAIS as an opportunity. Livestock markets located in the Northeast have a 53 percent probability of viewing the NAIS as an opportunity compared to a probability of less than 25 percent for other regions. In contrast, markets located in the Southwest have a 60 percent probability their operators perceive the NAIS as a threat to their businesses.

Speed of Sale Concerns

Most livestock market managers surveyed were highly concerned about speed of sale being adversely affected if they adopted the NAIS practices such as RFID tag use (Figure 12). Factors related to these perceptions are reported in Table 9. While managers of livestock markets from the Northeast region have the lowest probability of concern among regions, managers in this region still have a 53 percent probability of being highly concerned (response of 4 or 5) about sale speed being adversely affected. Figure 13 shows operators of all sizes of livestock markets have a probability greater than 70 percent of being highly concerned (response of 4 or 5) of sale speed being slowed if they adopt the NAIS practices. Furthermore, the larger the auction

market, the more highly concerned the operator is that adopting the NAIS practices could slow down speed of commerce. This is logical, as larger volume markets must keep cattle moving through the sale ring relatively quickly to not have overly lengthy sale days that could alienate customers. With these high levels of concern, the effort for livestock markets to adopt NAIS practices must focus on ways to ensure that speed of commerce is not adversely affected.

Perceptions of Electronic Animal Identification

Operators of livestock markets without electronic animal identification systems installed answered survey questions pertaining to what they perceived would need to be done at their facilities to use these systems. Similarly, managers of livestock markets that currently have electronic animal identification systems installed answered the same questions regarding what was done at their facilities to use these systems. Tables 10 and 11 display the differences in expected and actual changes needed to install electronic animal identification systems. Differences exist in what livestock market operators expect will happen and what actually does happen when reader systems are installed.

The most common type of electronic animal identification readers in livestock markets were

Figure 12. *Concern of Impact on Speed of Sale Among Survey Respondents (Average 4.29).*

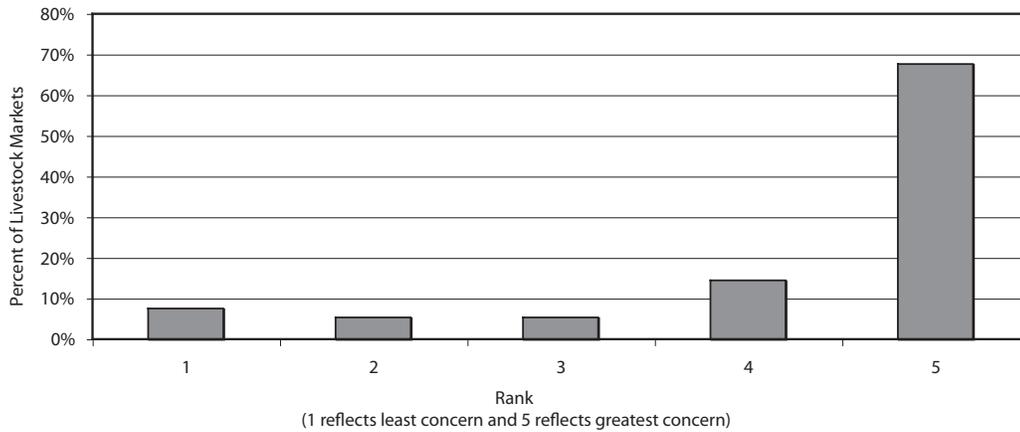
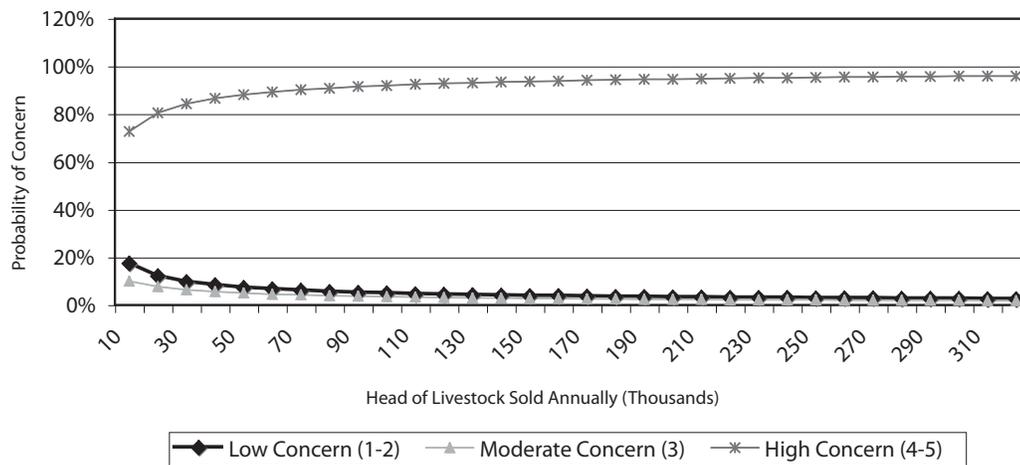


Figure 13. *Probability of a Livestock Market's Level of Concern Of Sale Speed Being Adversely Impacted by the NAIS.*



RFID stationary panel readers. This is also what most livestock market managers would anticipate using. However, 30 percent of livestock market operators indicated they were uncertain what type of reader they would install at their facility if they adopted animal identification and recording systems. Smaller livestock markets may only need a handheld reader, but livestock markets that sell larger volumes would probably require stationary panel readers to maintain speed of commerce.

Livestock market operators indicate the location in the facility where they would likely install a reader system is different whether they have or have not actually installed a system. Most managers of livestock markets indicated they would install a reader system in the unloading area or before the sale ring if they adopted this technology. While some readers have been installed in the unloading area or immediately before the sale ring, most reader systems have been installed immediately after the sale ring. The reason for this location is to place

the reader system after a market transaction has taken place. Seller and buyer information, along with individual animal identification information, can then be captured electronically.

Forty-six percent of livestock market respondents anticipated the need to buy a new computer in order to use an electronic animal identification system. Of those that have already adopted this technology, 48 percent bought a new computer after installation of the reader system indicating perceptions match actual in this case. In addition, 71 percent of livestock market managers anticipate they would need to buy a new software package if a reader system was installed. However, of

the livestock markets that already have systems in place, only 44 percent actually purchased new software to use with their reader systems. This difference in responses could be because livestock market operators that have installed readers are more progressive and already use software that complies with a reader system, or because livestock market operators do not realize that many software providers can modify existing software to make it compatible with a reader system. In fact, 63 percent of livestock markets that currently are using RFID technology upgraded their software package so it would work with a reader system.

Most livestock market respondents (61 percent) perceived that the speed of sale would slow down with the addition of an electronic animal identification system (Table 11). Specifically, livestock market operators expect the speed of sale will slow down on average 30 percent (range of 10 percent to 75 percent) per hour with technology adoption. However, in livestock markets that already

Table 9. Ordered Logit Estimates for Response to Statement: Concern of speed of sale being adversely impacted by the NAIS adoption. (1 = low concern to 5 = high concern).

Variable	Parameter Estimate ¹	P-Value	1	2	3	4	5
Intercept	-3.120	0.181	Probabilities				
tagging = 1	-0.364	0.311	0.039	0.039	0.053	0.144	0.726
tagging = 0	Default		0.027	0.028	0.039	0.114	0.792
RFID = 1	-0.653	0.230	0.072	0.068	0.084	0.197	0.579
RFID = 0	Default		0.039	0.039	0.053	0.144	0.726
premises=1	-0.418	0.257	0.039	0.039	0.053	0.144	0.726
premises=0	Default		0.026	0.027	0.037	0.110	0.801
NE	-1.780	0.011	0.192	0.141	0.138	0.221	0.308
SE	-0.643	0.149	0.071	0.067	0.084	0.197	0.582
SW	0.322	0.572	0.028	0.029	0.040	0.117	0.785
NW	-0.042	0.950	0.040	0.040	0.054	0.148	0.717
Midwest/Unknown	Default		0.039	0.039	0.053	0.144	0.726
			Marginal Probabilities				
herfin	0.083	0.317	-0.003	-0.003	-0.003	-0.007	0.017
cattid	-0.305	0.076	0.011	0.011	0.013	0.026	-0.061
ln(lvstk)	0.629	0.004	-0.023	-0.022	-0.026	-0.054	0.125

Log-Likelihood Function = -170.54755 Number of Observations = 183

¹Parameter estimates for "limits" with p-values in parentheses: Limit 2: 0.741 (0.002), Limit 3: 1.318 (<.0001), Limit 4: 2.244 (<.0001).

installed electronic animal identification systems, 79 percent of the operators indicated they experienced no change in sale speed. Furthermore, those that experienced a change in sale speed, reported only an average 13 percent per hour reduction. Across all livestock markets that adopted RFID reader systems, on average, livestock market operators experienced the speed of sale to decrease 3 percent per hour. None of the livestock markets experienced faster sales after installation of a reader system.

Among the livestock markets with RFID readers installed, the average sale speed was 210 cattle sold per hour on a nonpeak sale day, with a minimum of 43 and a maximum of 800. On peak sale days, the livestock markets with RFID reader systems averaged 307 cattle sold per hour, with a minimum of 67 and a maximum of 900. Livestock markets that experienced a change in sale speed sold, on average, 160 cattle per hour on nonpeak sale days and 283 cattle per hour on peak sale days. Livestock markets that did not experience a change in sale speed sold an average of 194 cattle per hour on nonpeak sale days and 308 cattle per hour on peak sale days. This shows livestock markets that sold fewer cattle per hour tended to experience a change in sale speed more than livestock markets

that sold more cattle per hour. Speed of sale is an important factor affecting auction market costs and customer participation, so it is important to know how it might affect livestock markets installing reader systems.

About half of the livestock market respondents (46 percent) think they would need to hire new employees after installing an electronic reader system (survey responses ranged from 1 to 15 new employees). However, only 25 percent of livestock market respondents that have adopted electronic readers indicated they had to hire new employees. Livestock markets that did hire new employees on average hired two new employees. When averaged across all livestock markets that have installed RFID reader systems, this represents an additional half-time employee hired. Thus, livestock market operators who have not adopted an electronic animal identification system tend to overestimate the amount of labor needed to operate this technology. On average, employees at these facilities spent a total of 6.5 hours per week managing the RFID reader system. The maximum number of hours spent per week managing the RFID reader system reported was 60 and the minimum was zero.

Table 10. Comparison between Expected and Actual Changes when Adopting Electronic Animal Identification Systems in Livestock Auction Markets.¹

	Expected by Those Without RFID Reader Systems	Actual by Those With RFID Systems
Types of Readers		
Hand-held Reader	26.4%	29.7%
Stationary Panel Reader	40.8%	62.2%
Other	2.5%	8.1%
Uncertain	30.3%	0.0%
Number of Responses ²	201	37
Reader Locations		
Unloading Area	26.6%	24.3%
Load-out Area	7.7%	2.7%
Sorting Area	5.4%	5.4%
Immediately Before Sale Ring	22.5%	18.9%
Immediately After Sale Ring	11.7%	43.2%
Other	5.0%	5.4%
Uncertain	21.2%	0.0%
Number of Responses ²	222	37
Need to Buy a New Computer		
Yes	46.0%	48.1%
No	16.8%	51.9%
Uncertain	37.3%	0.0%
Number of Observations	161	27
Need New Software		
Yes	70.8%	44.4%
No	4.3%	55.6%
Uncertain	24.8%	0.0%
Number of Observations	161	27

¹ Expected changes when adopting RFID by livestock market managers that have not adopted RFID systems in their facilities. Actual changes when adopting RFID according to livestock market managers that have adopted RFID systems in their facilities.

² Survey Respondents had the option to choose more than one response.

Information in tables 10 and 11 suggests that livestock market operators tend to overestimate the changes required or that would occur, by adopting an electronic animal identification system. If livestock market operators overestimate what they will need to change at their facilities to install electronic animal identification systems, it may deter them from offering this service to customers. It is important for livestock market managers to understand the actual changes that will occur after adding electronic animal identification systems so they can make decisions that are best for their businesses.

Premises Registration

Premises registration is an important foundation of the NAIS. It allows a rapid, accurate, and cost-effective method of tracking a disease outbreak.⁴ By premises being registered, producers at risk can be identified and contacted quickly. Livestock markets are considered useful premises to be registered with the NAIS, because they are livestock commingling sites. Of the livestock market survey respondents, 56 percent had registered premises, 35 percent did

⁴ "Premises Registration Fact Sheet." NAIS Homepage. <http://animalid.aphis.usda.gov/nais/index.shtml>.

Table 11. Comparison between Expected and Actual Changes when Adopting Electronic Animal Identification Systems in Livestock Auction Markets.¹

	Expected Change by Those Without RFID Reader Systems				Actual Change by Those With RFID Systems			
	Response	Avg. ²	Min ³	Max ³	Response	Avg. ²	Min ³	Max ³
Change in Speed of Sale								
Slower Sale	61%	30%	10%	75%	21%	13%	5%	30%
Faster Sale	3%	16%	5%	25%	0%			
No Change	20%				79%			
Uncertain	16%				0%			
Total	100%				100%			
Number of Responses	160				24			
New Employees Hired								
Yes	46%	4	1	15	25%	2	1	3
No	3%				75%			
Uncertain	51%				0%			
Total	100%				100%			
Number of Responses	156				24			

¹Expected changes when adopting RFID by livestock market managers that have not adopted RFID systems in their facilities. Actual changes when adopting RFID according to livestock market managers that have adopted RFID systems in their facilities.

²Average refers to the average percentage change in speed of sale or average number of new employees hired.

³Minimum and maximum refer to the minimum and maximum percentage change in speed of sale and number of new employees hired.

not have registered premises, and 9 percent did not know if the livestock market had been registered.

Of the premises registered among survey respondents, Figure 14 shows that 46 percent were located in the Midwest and the Northeast had the least at only 5 percent. However, all regions had more than 40 percent of livestock markets with registered premises (Figure 15). Among survey respondents from the Midwest, 63 percent of the livestock markets had their premises registered. Similarly, 56 percent of the livestock markets from the Southeast and 52 percent from the “Unknown” regions had their premises registered. Figure 16 shows the relationship between livestock market premises registration and size of livestock market. Each “size of livestock market” category had 30 to 32 respondents. Larger livestock markets tend to have their premises registered more often than smaller livestock markets, but this is not a particularly strong relationship. Livestock markets that sell between 33,000 and 40,000 head of cattle annually have the most registered premises, and livestock markets that sell between 40,500 and 52,500 head of cattle annually will most likely know if their premises are registered. All livestock markets that had electronic animal identification systems

installed had registered their premises. However, only half of livestock markets that did not have animal identification systems installed had registered premises.

A livestock market operator’s view of the NAIS also influences if they will complete premises registration. Of those who view the NAIS as an opportunity for their businesses, 79 percent had registered their premises; whereas, only 49 percent of livestock market operators who view the NAIS as a threat to their businesses had registered their premises. Also, 55 percent of livestock market operators that do not think the NAIS is an opportunity or a threat to their businesses have registered their premises.

To summarize, premises registration is most likely to be completed by livestock market managers that are from the Midwest, sell 33,000 to 40,000 head of cattle per year, use an electronic identification system, or view the NAIS as an opportunity. Premises registration is least likely to be completed by livestock markets located in the Northeast, who sell fewer than 19,000 head of cattle annually, do not use an electronic identification system, or view the NAIS as a threat.

Figure 14. *Livestock Market Premises Registration by Region, Among all Survey Respondents.*

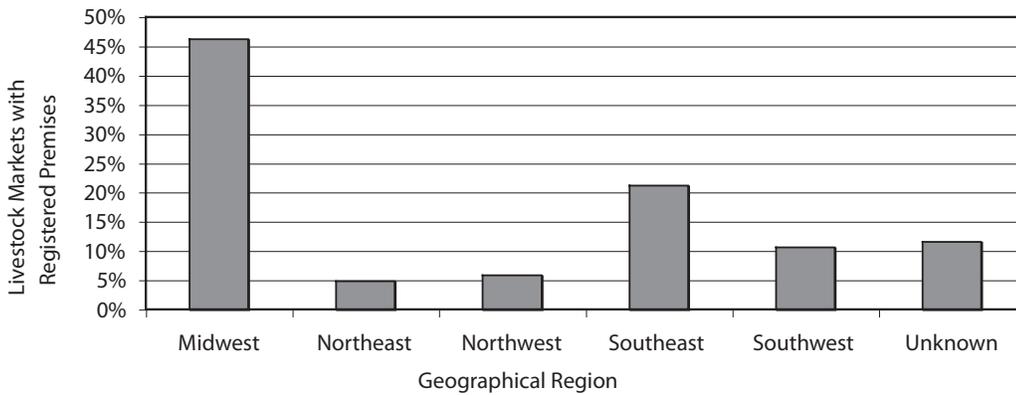


Figure 15. *Percent of Livestock Markets Within a Certain Region, With Registered Premises, Among Survey Respondents.*

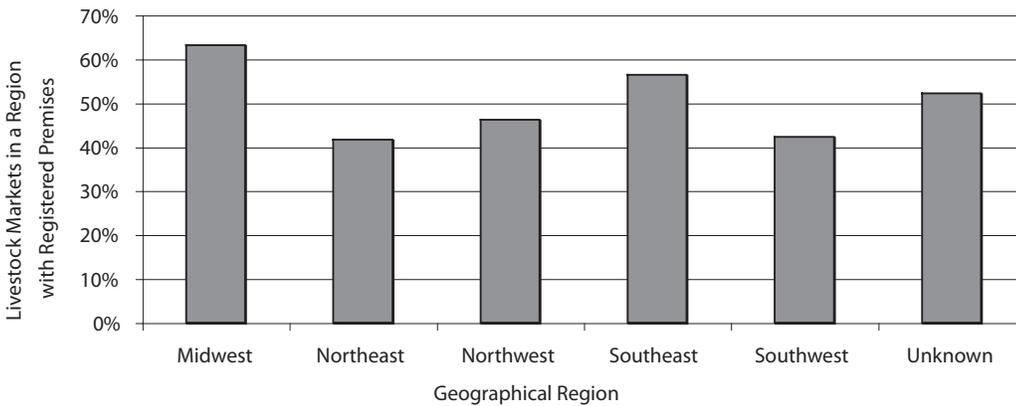
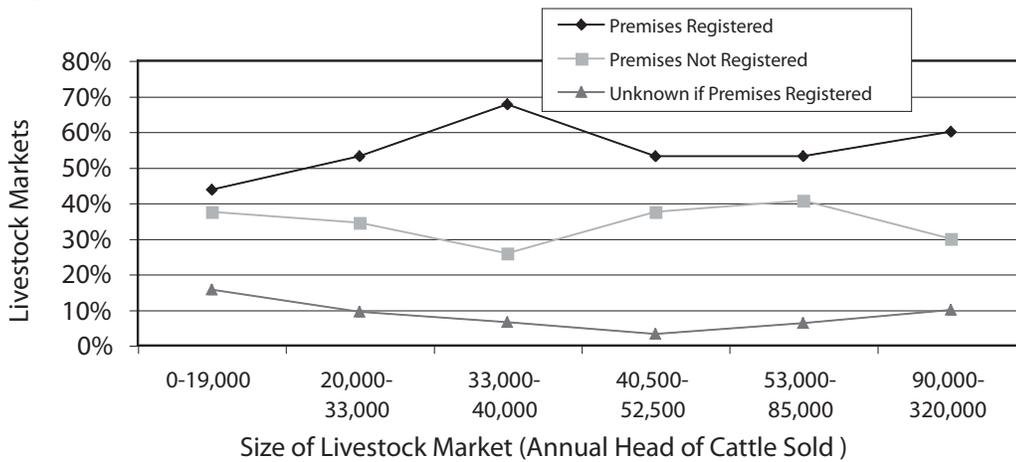


Figure 16. *Livestock Markets with Registered Premises Depending on Size, Among Survey Respondents.*



RFID Technology Adoption

Recently there has been growing interest in adopting electronic animal identification services at livestock markets. Livestock markets could benefit from electronic animal identification systems because these systems would allow individual animal identification tags (most likely RFID tags) to be read at the speed of commerce and be less likely to slow the speed of livestock market

sales. Only 14 percent of livestock market survey respondents had installed electronic animal identification systems, all of which were RFID tag reading systems.

Livestock markets that adopted RFID reader systems ranged in size from 13,000 to 275,000 head of cattle sold annually. Figure 17 shows livestock market survey respondents divided by size of facility that have and have not adopted RFID reader systems. There were 72 livestock market respondents that sold between 25,000 and 50,000 head of cattle annually, but only 10 (13.9 percent) of the facilities have adopted RFID technology. Only one survey respondent sold between 150,000 and 225,000 head of cattle annually and this facility has adopted RFID technology. Generally speaking, higher percentages of livestock markets have adopted RFID technology as annual cattle sales among livestock markets increase.

Figure 18 shows the percentage of livestock markets in each region that have adopted RFID reader systems. In the Midwest, 26 percent of livestock market respondents have adopted RFID technology; whereas fewer than 10 percent of respondents in the other regions have adopted RFID technology. Many of the livestock markets from the Midwest that had RFID readers installed were from Kansas and Michigan. All of the Kansas

Figure 17. Survey Respondents with RFID Reader Systems Installed by Size of Livestock Market.

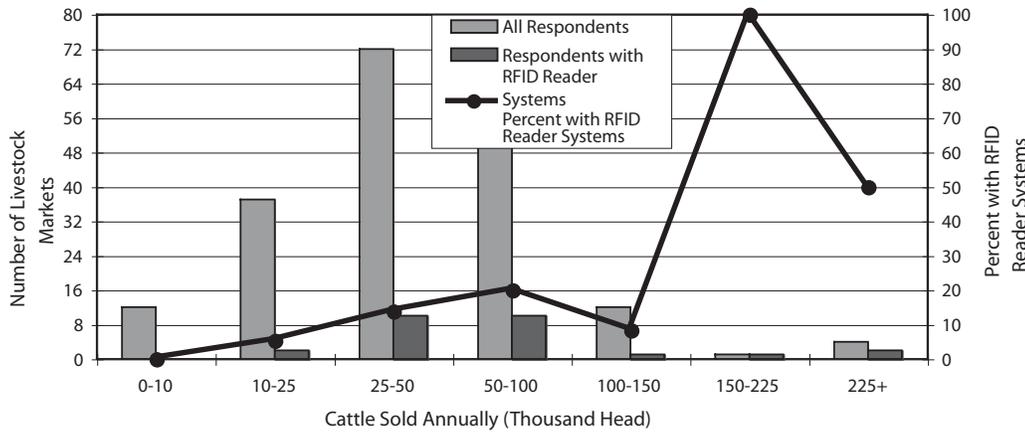
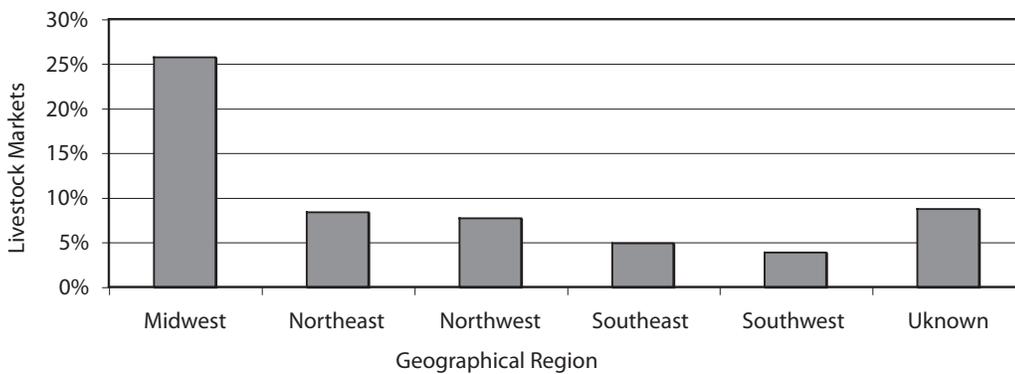


Figure 18. Percent of Respondents in Each Region That Have Adopted RFID Technology.



livestock markets with RFID readers installed participated in a pilot study, in which RFID readers were installed and evaluated in terms of cost and performance. Michigan livestock markets had RFID reader systems installed because the state has a mandatory animal identification program implemented to eradicate tuberculosis. Thus, the relatively high adoption rate in the Midwest somewhat overstates the actual adoption rate in the region as a whole, given the circumstances for Kansas and Michigan.

Among livestock markets that have adopted RFID reader systems, 46 percent also provide internet/video auction. This compares to only 18 percent of the livestock markets that had not installed RFID reader systems providing internet/video auction services. This may be because livestock markets that install RFID readers are more progressive technology adopters.

When asked for the reasons an electronic animal identification reader system was installed, 89 percent of respondents indicated it was for

research purposes. Only 41 percent claimed they installed a reader system to provide an added service for customers and 44 percent did so in anticipation of future regulations (Figure 19). Ninety-three percent of the livestock markets identified “other” reasons for why they installed a reader system. Common responses for “other” reasons included participation in a grant where part of the reader system was paid for, to increase the value of cattle, to couple with a Quality Systems Assessment (QSA) program, or because of a mandatory animal identification program in their state of origin. Almost three-fourths (73 percent) of

livestock markets that adopted this technology were participants in a grant that paid for part of the costs of adopting an electronic reader system. Perhaps early adopters of RFID technology did so because of the cost-share program.

Most facilities (88 percent) indicated 0 to 25 percent of cattle sold annually at the facility used the reader systems by being scanned and recorded (Figure 20). Four percent of the markets indicated using the reader system on 51 to 75 percent of cattle sales and 8 percent of livestock markets scanned and recorded 76 to 100 percent of annual cattle sales with the reader systems. Livestock markets located in Michigan had 76 to 100 percent of cattle sales using the reader systems because individual animal identification is mandatory in the state.

A binary logit model was used to determine factors affecting the probability that a livestock market had installed RFID reader equipment. The following equation was estimated to determine how individual factors affected the probability of a livestock market installing RFID reader equipment:

Figure 19. Reason for RFID Technology Installation Among Survey Respondents.

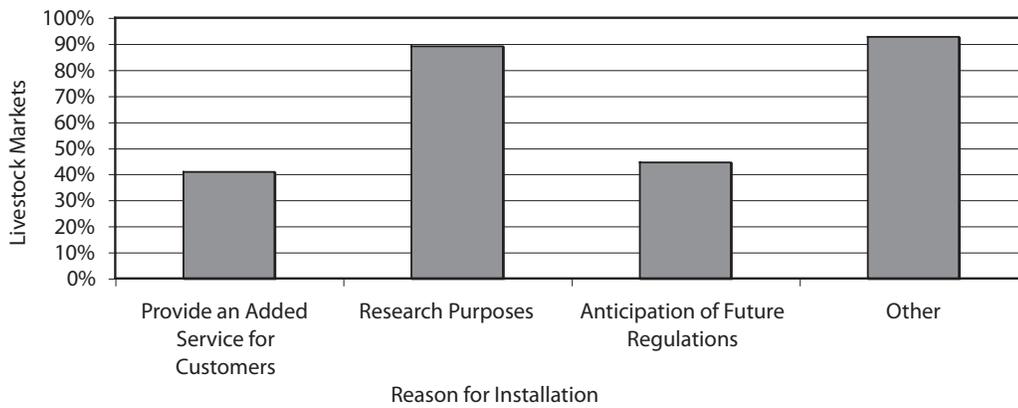
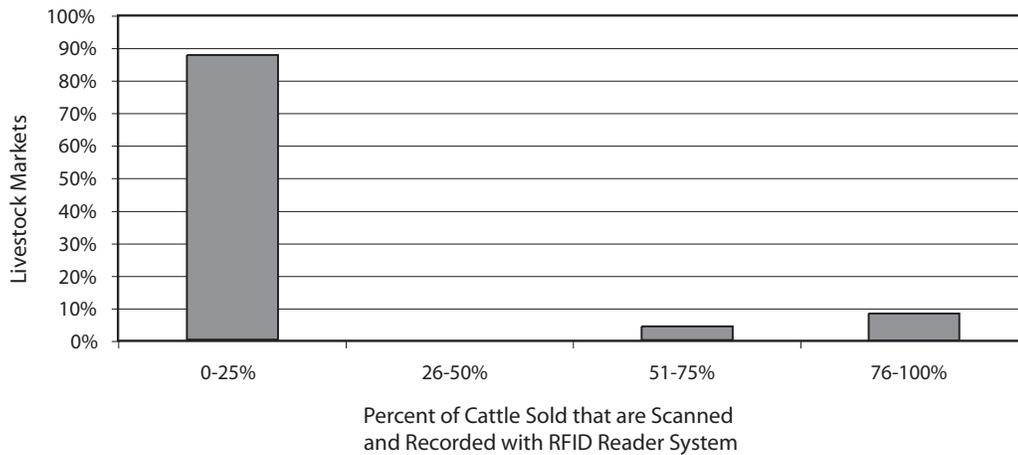


Figure 20. Percent of Cattle Using RFID Readers Among Survey Respondents.



Facilities that have registered their premises are 27 percent probable of RFID adoption; those that have not registered their premises are 0 percent probable of RFID adoption. Also, at livestock markets where more cattle are sold with any type of ear tag, the probability of those livestock markets adopting RFID technology increases. In fact, livestock markets that sell 0 to 25 percent of cattle with any type of identification tag are 27 percent probable of adopting RFID technology; whereas, livestock markets that sell 76 to 100 percent of cattle with any type of identification tag are 56 percent probable of RFID adoption.

$$(6) \text{ RFID} = \beta_0 + \beta_1 \text{herfin} + \beta_2 \text{cattid} + \beta_3 \ln(\text{lvstk}) + \beta_4 \text{tagging} + \beta_5 \text{premises} + \beta_6 \text{NE} + \beta_7 \text{SE} + \beta_8 \text{SW} + \beta_9 \text{NW} + e$$

where all variables are defined in Table 3 and summarized in Table 4. The explanatory variables were included because they were hypothesized to have an effect on the dependent variable (i.e., whether or not RFID equipment had been installed).

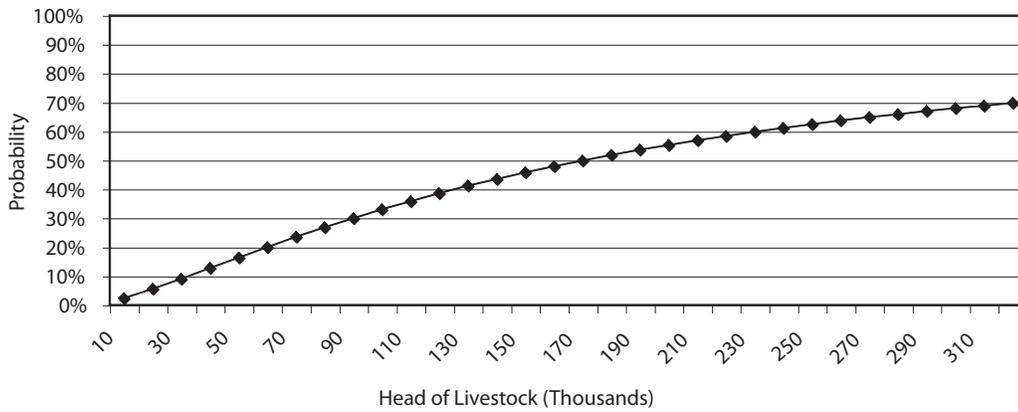
Marginal probabilities were calculated based on the average or most common survey respondent responses with respect to a one unit change in each explanatory variable. Binary variables in the model do not have marginal probabilities, because they only take on values of one or zero, so the probabilities as binary variables change from 0 to 1 are presented in Table 12. The probabilities associated with changes in the binary variables were calculated by holding all other variables at their average values if a continuous variable or most common response if a binary variable.

As livestock markets increase in size, the probability of RFID adoption also increases. Figure 21 shows that the probability of a livestock market operator adopting RFID technology increases, at a decreasing rate, as livestock market size, as measured by livestock sold annually, increases. A facility that sells 320,000 head of livestock annually has an 83 percent probability of adopting RFID technology; however, a facility that sells only 10,000 head of livestock annually has only a 5 percent probability of technology adoption. Other items, such as species concentration and geographical region were found to not influence RFID technology adoption among livestock market operators.

RFID Tagging Service Addition

Based on conversations with livestock market managers, some are concerned that producers will not participate in the NAIS or marketing programs that use RFID technology if they were to install reader systems. As such, these managers deem the purchase of RFID equipment as an unnecessary

Figure 21. *Probability of a Livestock Market Adopting a RFID Reader System.*



expense. Also, some livestock market operators are concerned that producers will expect livestock markets to offer tagging services if RFID equipment is available for use. Consequently, 55 percent of livestock auction market managers stated they would provide an RFID tagging service for customers if the NAIS were fully implemented (Figure 22). When the survey was constructed, the authors envisioned the statement of the NAIS being “fully implemented” in the survey instrument to refer to mandatory NAIS at the federal level. However, during the time the surveys were mailed to the livestock market operators, USDA announced that the NAIS would remain voluntary (at the federal level). Therefore, some livestock market survey respondents may have perceived the NAIS being “fully implemented” as a federally mandatory program, while others may have

perceived “fully implemented” as a voluntary NAIS. Therefore, in this report the term “fully implemented” could have been interpreted by livestock market respondents differently.

There was variation in the responses pertaining to adding a tagging service based on region. Table 13 shows that most live-

stock market respondents from the Northeast and Northwest plan to add a tagging service at their facilities if the NAIS were fully implemented. These two regions also exhibited the least “uncertain” responses. In the Midwest, Southeast, Southwest, and Unknown regions about half of livestock market respondents would add a tagging service at their locations if the NAIS were fully implemented.

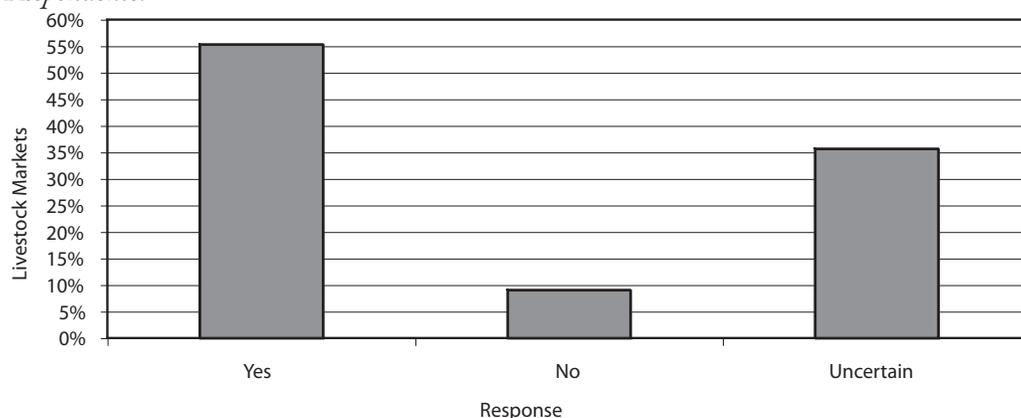
In regions where fewer cattle were sold with ear tags (e.g., number tag, RFID tag, etc.) more livestock markets would be expected to offer tagging services. This was expected because if producers currently do not tag their cattle, then most likely they would not be capable or want to RFID tag their livestock if the NAIS became fully implemented. Thus, if participation through RFID tagging occurred, the livestock market could step

Table 12. *Binary Logit Estimates for the Probability of RFID Reader Equipment Adoption for a Livestock Market. (1 = RFID Adoption, 0 = No RFID Adoption).*

Variable	Parameter Estimate	P-Value	0	1
Intercept	-43.461	<.0001	Probabilities	
tagging = 1	1.182	0.055		
tagging = 0	Default		0.899	0.101
premises = 1	27.026	<.0001	0.732	0.27
premises = 0	Default		1.000	0.00
NE	-0.734	0.557	0.851	0.149
SE	-1.414	0.135	0.918	0.082
SW	-1.859	0.109	0.946	0.054
NW	-1.152	0.359	0.896	0.104
Midwest/Unknown	Default		0.732	0.268
Marginal Probability				
herfin	-0.003	0.980	-0.001	
cattid	0.417	0.140	0.082	
ln(lvstk)	1.299	0.005	0.255	

Log-Likelihood Function = -43.54311 Number of Observations = 185

Figure 22. Livestock Markets that Plan to Provide a Tagging Service, Among Survey Respondents.



in and offer tagging services. Table 14 shows the percentage of cattle sold with any type of ear tag by region. In the Northeast and Northwest usually greater than 25 percent of cattle are sold with some sort of ear tag; whereas, in the other regions usually less than 26 percent of cattle are sold with ear tags. The relationship between cattle sold with ear tags and tagging service addition is illustrated in Figure 23. Livestock markets in regions where fewer cattle currently are tagged at the time of sale (Midwest, Southeast, Southwest, Unknown) are less likely to add a tagging service than livestock markets in regions where more cattle are sold that are tagged at the time of sale (Northeast and Northwest). This finding is contradictory to what was expected and points to a possible barrier to adoption (i.e., producers do not currently tag cattle and livestock

markets do not plan on adding a tagging service).

Among livestock markets that plan to add a tagging service if the NAIS were implemented, 85 percent plan to charge additional fees for this service. None of the livestock market respondents surveyed specifically indicated they would not charge an

added fee for this additional service, but 15 percent of the livestock market respondents were uncertain as to whether or not they would charge added fees. Of those reporting they would charge an additional fee for tagging cattle, the average expected fee reported was \$3.34 per head. The maximum a livestock market anticipated charging was \$20.00 per head and the minimum was \$1.00 per head.

A concern of livestock market operators when adding a tagging service is who would carry out this service, if it were added. Many livestock market managers have difficulty finding employees and were concerned about being able to find employees to perform this service. Eighty-three percent of livestock market operators would plan to use facility employees, 12 percent would use a third party to implement the service, and 5 percent were

Table 13. Tagging Service Addition Based on Geographical Region Among Survey Respondents.

	Geographical Region					
	Midwest	Northeast	Northwest	Southeast	Southwest	Unknown
Would add a tagging service	45.3%	91.7%	84.6%	59.0%	53.9%	47.8%
Would not add a tagging service	8.0%	0.0%	0.0%	10.3%	15.4%	13.0%
Uncertain	46.7%	8.3%	15.4%	30.8%	30.8%	39.1%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 14. Percent of Cattle Sold with Ear Tags by Geographical Region Among Survey Respondents.

Percent of Cattle sold with ear tags	Geographical Region					
	Midwest	Northeast	Northwest	Southeast	Southwest	Unknown
0-25%	52.7%	8.3%	23.1%	84.6%	69.2%	73.9%
26-50%	23.0%	33.3%	30.8%	10.3%	19.2%	0.0%
51-75%	13.5%	33.3%	23.1%	2.6%	3.9%	13.0%
76-100%	10.8%	25.0%	23.1%	2.6%	7.7%	13.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Figure 23. *Percent of Livestock Markets Planning to Provide a Tagging Service, Among Survey Respondents.*

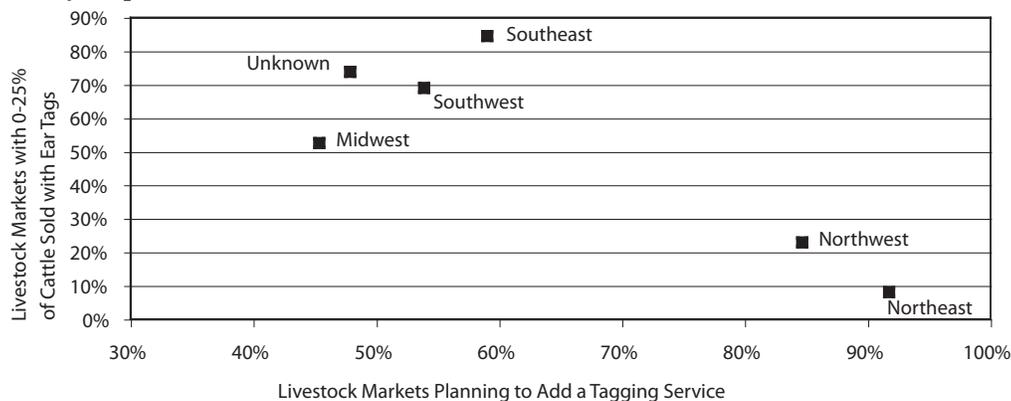
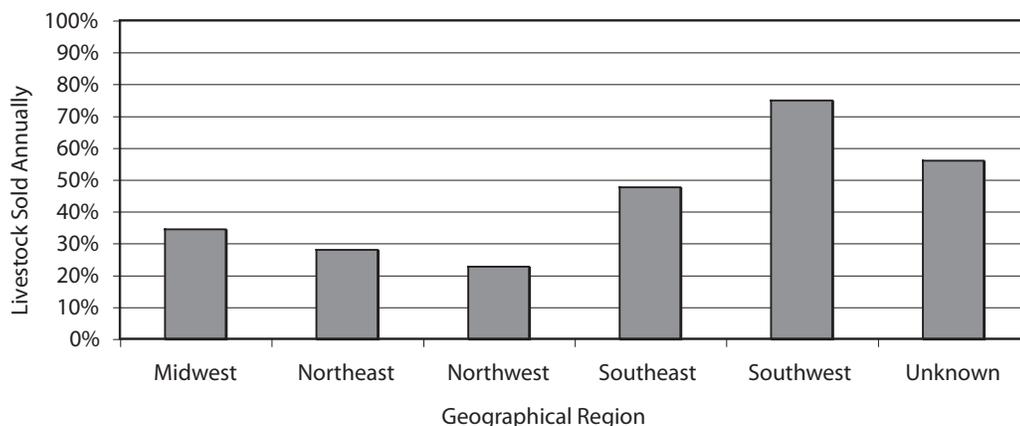


Figure 24. *Percent of Livestock Sold that are Expected to Use the Tagging Service by Region, Among Survey Respondents.*



uncertain. A possible third party choice could be a local veterinarian, or this could be an opportunity for startup businesses to provide custom tagging services.

Livestock market respondents were asked to estimate the number of livestock they expected would use an RFID tagging service if the NAIS were fully implemented. Figure 24 depicts the responses in terms of the percentage of livestock sold annually that would be expected to use a tagging service offered by livestock markets by region. Livestock markets in the Southwest expect the highest percent of livestock sold would use a tagging service. The lowest expectations for using a tagging service were in the Northwest and the Northeast where only 23 percent and 28 percent, respectively, of the cattle were expected to use the service. The Northwest and Northeast regions are where most livestock market managers planned to add a tagging service, even though only 23 percent and 28 percent of livestock would use the service.

One reason for the lower expected use is because a higher percentage of the cattle currently are already being tagged in these regions.

RFID Investments

Many livestock market operators are concerned about the investment required to adopt an electronic animal identification system and how this investment would affect their businesses. All of the livestock markets surveyed that adopted electronic animal identification systems used RFID technology. This section examines investment and estimated annual expenses associated with adopting electronic animal identification systems in

livestock auction markets.

The total dollars required to get an RFID system in place does not represent the cost of the technology, but rather reflects the investment required. The annual expenses of the technology are for those items that occur on a regular basis and when combined with the annualized investment equals the annual cost. Both investment and annual cost values are relevant to livestock markets. Investment, because it represents capital outlay required, and annual cost because it represents how profits might be impacted with the adoption of this technology.

Twenty-seven survey respondents had installed electronic animal identification systems; data used in this section are from those respondents. Items that reflected one-time expenditures are classified as investments in this analysis, this included labor for installation and facility modification, materials, and training.⁵ Items considered annual expenses

⁵ Investment is conditional on the time of purchase. For example, livestock markets that purchased the RFID equipment 5 years

Figure 25. *Livestock Market Total Investments in RFID Reader Systems Based on Annual Livestock Sales.*

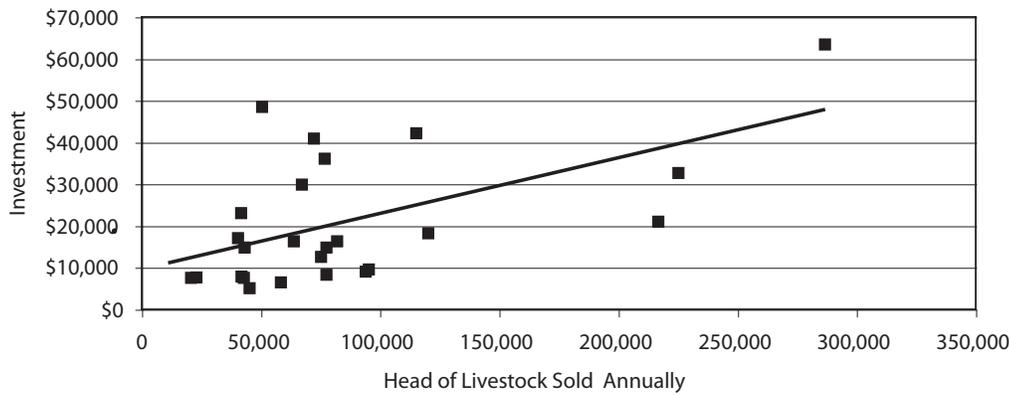
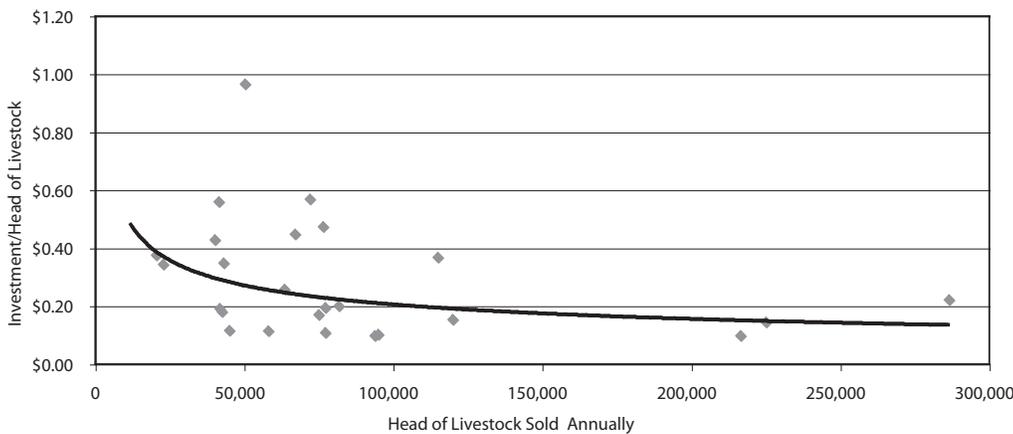


Figure 26. *Livestock Market per Head Investments in RFID Reader Systems Based on Annual Livestock Sales.*



included equipment rental, annual technology fees, and operating labor.⁶ Thus labor, materials, and training costs associated with purchasing and installing an RFID reader system made up the total investment. The equipment rental fees, annual technology fees, and operating labor costs were used as annual expenses of an RFID reader system. Other costs of RFID, such as the cost of slowing down the speed of a sale, could not be estimated with the data available.

Labor costs include the cost of labor (both livestock market employees and contractors) for facility modifications and installation of the electronic reader system. When the labor cost per hour for facility modification and installation was not

ago may have paid more than livestock markets that adopted RFID technology 1 year ago because the price of the technology may have decreased over time.

⁶ *Annual expenses reported are conditional on the number of RFID tagged livestock using the reader system. For example, operating labor costs may increase as RFID tagged cattle sales increase at a livestock market, because more time may be required to read more cattle.*

provided, the average labor cost, \$17.50 per hour, among livestock market managers that responded was used. Material costs included the cost of general materials, materials used by a contractor, RFID technology (total amount charged by company providing RFID technology), software upgrades, computer purchases, and software purchases. Five livestock markets did not include the total cost of the RFID technology in their survey response. In these cases, average costs of livestock markets with similar systems and RFID companies were used.

Training costs were the costs of training employees to use the new RFID system. Equipment rental costs only applied to the two livestock markets that rented an RFID reader system. This rental fee was based on a fee per month and a fee per RFID tag reading. The annual technology fee only applied to three livestock markets. This fee was in response to an increase in the annual technology support fees charged to the livestock markets by their respective clerking software companies. This increase in technology support fees was due to the installation of an RFID system. Operating labor expenses accounted for the additional labor needed to run an RFID reader system.

There was one large outlier in the data set that was removed from the following analyses. This livestock market estimated their RFID system investment at \$2.22 per head of cattle sold annually. This facility's largest capital outlays were associated with computer and software purchases. The entire expense for computer and software purchases should not be completely charged to the RFID reader system if this livestock market integrated

Figure 27. *Livestock Market Investments in RFID Reader Systems Based on Annual Cattle Sales.*

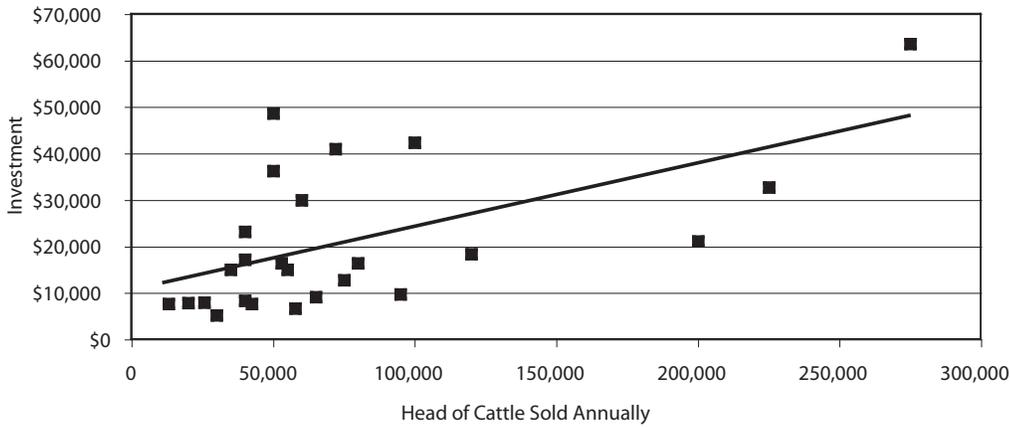
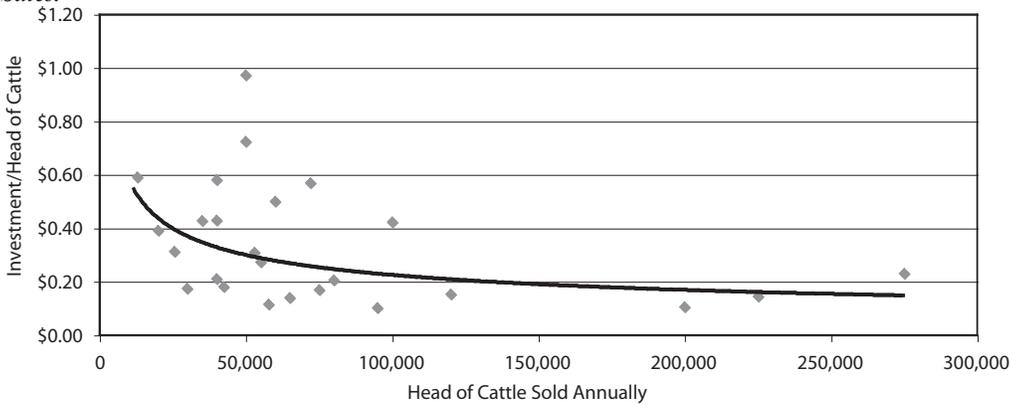


Figure 28. *Livestock Market Investments in RFID Reader Systems Based on Annual Cattle Sales.*



the new software and computer into their entire business, and not only the RFID reader system. Therefore, this reported RFID investment value was believed to be over-estimated and hence was removed from the following analyses.

Total investments ranged from \$5,250 to \$64,000 and annual cattle sales ranged from 13,000 to 275,000 head among the livestock markets that installed RFID reader systems. Figure 25 shows the total investment made by each livestock market that had installed RFID reader systems based on annual livestock sales. Figure 26 illustrates the total investment per head of livestock sold annually for livestock markets. The smallest investment per head of livestock sold annually was \$0.10 per head. Figure 27 shows the total investment made by each livestock market to purchase an RFID reader system based on annual cattle sales. Figure 28 shows the total investment per head of cattle sold annually (as opposed to sales of all livestock as was depicted in Figure 25). The smallest investment per head of cattle sold annually was \$0.10 per head.

Both figures 25 and 27 and figures 26 and 28 are very similar, so from this point forward only the “per cattle” analysis will be used. Most of the estimated investment amounts are less than \$0.50 per head of cattle or livestock sold annually at the livestock markets.

Total investment increased among livestock markets as the size of livestock markets increased. For each 1,000 head increase in annual cattle sales, the total investment increased by roughly \$137, as shown by the “Total Investment” trend line in Figure 27. However, economies of size are displayed by the “Investment/Head of Cattle” trend line in Figure 28. That is,

as livestock market size increases, the investment per head of cattle decreases at a declining rate and flattens out at about 150,000 head. Consequently, larger livestock markets have a lower RFID system investment per head relative to smaller livestock markets.

Annualized costs of RFID reader systems were calculated by annualizing the total investment, given an interest rate and number of years the system was expected to be used along with the annual expenses. Two rates of return were used, 8 percent and 15 percent. The 8 percent return was used to reflect the cost of borrowing money for an operating loan, and the 15 percent rate was used to reflect a higher desired rate of return to account for risk. The RFID reader system was assumed to have a useful life of 3 years, the facility modifications a life of 6 years, and the computer investments (computer and software) a life of 3 years. Interest was calculated on operating costs, assuming they were borrowed for 15 days each month. It was assumed that, at the end of the useful life, there was no salvage value on any of the three

Figure 29. *Livestock Market Annualized Costs Based on 25% of Annual Cattle Sales (8% Return).*

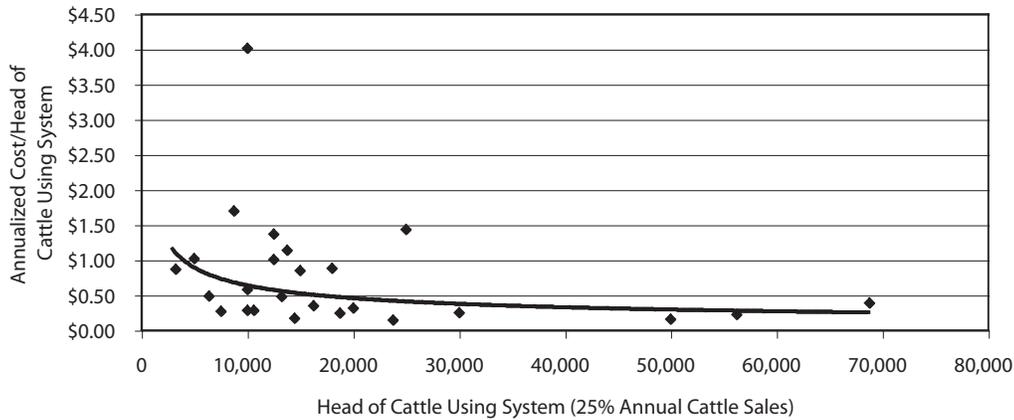
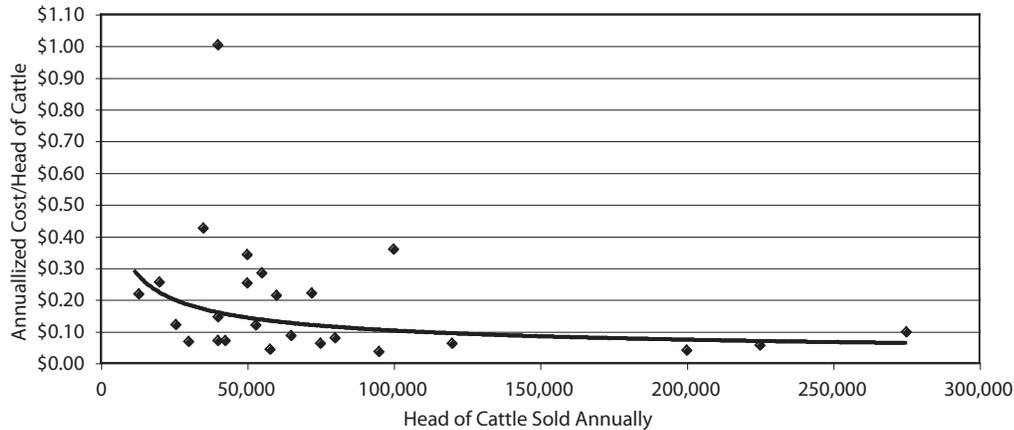


Figure 30. *Livestock Market Annualized Costs Based on 100% of Annual Cattle Sales (8% Return).*



investment categories (i.e., they were completely depreciated out from an economic standpoint).

The annualized cost of RFID reader systems is depicted in figures 29 and 30 at an 8 percent return rate for different livestock markets. Figure 29 shows the annualized cost per head of cattle using the RFID reader system, assuming that 25 percent of the cattle sold annually were using the RFID reader system. The 25 percent of annual cattle sales was chosen to simulate what may occur if the NAIS remains voluntary. Use of the system had an average annualized cost per head of cattle of \$0.76, the maximum was \$4.02, and the minimum was \$0.14. The annualized cost per head of cattle could be used as an estimate of the expected fee charged, given our assumptions, to owners of cattle who use the RFID reader system at a livestock market.

Figure 30 shows the annualized cost per head of cattle sold annually, where costs are allocated over 100 percent of cattle marketed annually. This scenario is useful to livestock market operators who

may choose to increase commission fees for all cattle sold at their facility after installing a reader system. This scenario also depicts what the cost might be if market demands or government regulations caused 100 percent of animals sold to use the RFID system. The average annualized cost per head of cattle sold was \$0.19, the maximum was \$1.01, and the minimum was \$0.04. For most livestock markets, the values in Figure 30 are one-fourth the values depicted in Figure 29, because the annual cost was allocated over four times as many animals in this example. The exception to this was the two livestock markets that were renting equipment and paying a fee per

scan. Therefore, for most livestock markets the cost of owning and operating an RFID reader system is fixed and the more head of livestock sold lowers the cost per head. Figure 30 it shows that most of the annualized costs per head of cattle sold fall below \$0.30 per head.

The annualized cost per head of an RFID reader system changes if a different rate of return is used. Figures 31 and 32 show the annualized cost of an RFID reader system by size of market, given an interest rate of 15 percent. Figure 31 shows the annualized cost per head of cattle, assuming the system was used on 25 percent of cattle sold annually (i.e., the NAIS remains voluntary – comparable to Figure 29). On average, the annualized cost was \$0.83 per head of cattle using the system, the maximum was \$4.15 per head, and the minimum was \$0.16 per head. If the annualized cost of the RFID reader system was divided by all of the cattle sold annually, the average annualized cost per head of cattle sold decreased to \$0.21, with maximum

Figure 31. *Livestock Market Annualized Costs Based on 25% of Annual Cattle Sales (15% Return).*

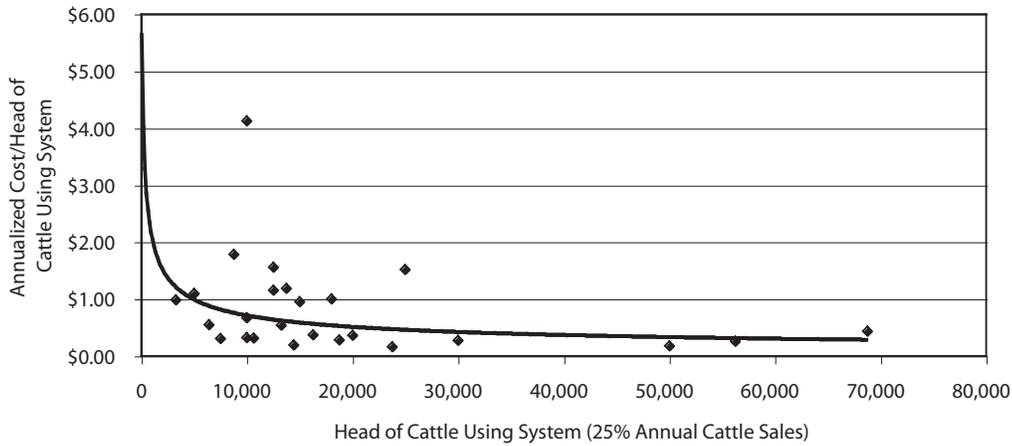
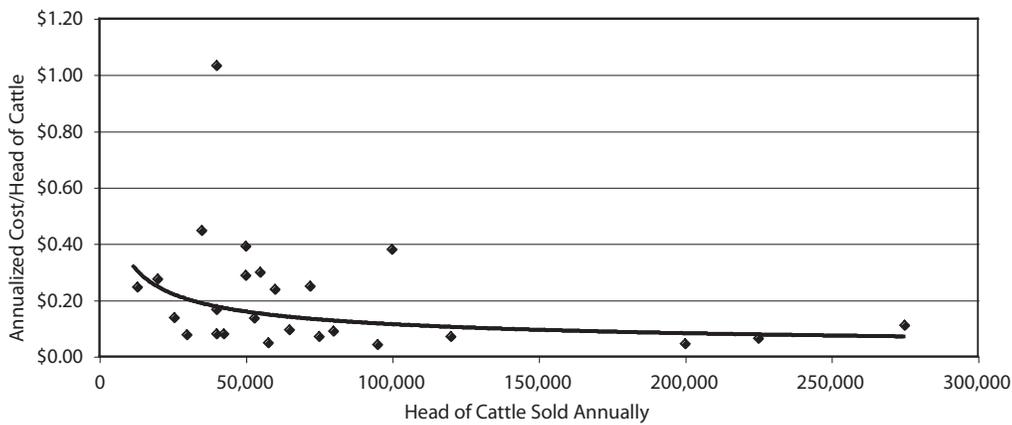


Figure 32. *Livestock Market Annualized Costs Based on 100% of Annual Cattle Sales.*



and minimum values of \$1.04 and \$0.04 per head, respectively (Figure 32 – comparable to Figure 30). As before, the values in Figure 32 are one-fourth the values of the annualized cost per head of cattle in Figure 31 because four times as many cattle are being evaluated. Once again, this indicates the economic benefit of allocating the costs over as many head as possible, because most of the costs of the RFID system are fixed.

Cost estimates provided in figures 29 through 32 show that economies of scale associated with RFID adoption exist. Annualized costs per head decrease as the size of livestock market increases. This shows that larger livestock markets have a cost advantage relative to smaller livestock markets. These annualized costs can help livestock markets decide if they are going to charge an extra commission to all cattle sold, or only to those cattle that use the RFID reader system.

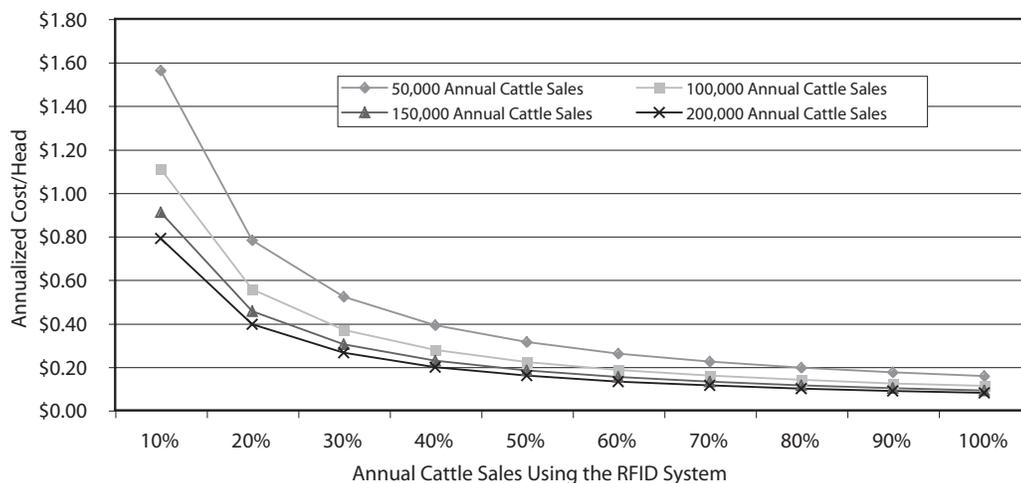
Figure 33 shows the annualized cost per head of cattle for four different sized hypothetical livestock

markets when an RFID reader system is used on varying levels of cattle. The four hypothetical livestock markets' annualized costs per head were found by using the equation for the trend line in Figure 32. Based on a livestock market that sells 50,000 head of cattle annually, expected annualized costs would be \$1.56 per head when 10 percent of cattle are using the reader system and \$0.16 per head when 100 percent of cattle are using the system. A livestock market that sells 100,000 head of cattle annually could expect annualized costs of \$1.11 per head when 10 percent of cattle are using the system and \$0.11 per head when 100 percent of cattle are using the system. When

the annualized costs between these two livestock markets are compared, a livestock market that sells 50,000 head of cattle annually has an expected annualized cost per head 41 percent higher than a livestock market that sells 100,000 head of cattle, across all levels of cattle usage.

A livestock market that sells 150,000 head of cattle annually can expect annualized costs of \$0.91 per head when 10 percent of cattle are using the system and \$0.09 per head when 100 percent of cattle are using the system. A livestock market that sells 200,000 head of cattle annually can expect annualized costs of \$0.79 per head when 10 percent of cattle are using the system and \$0.08 per head when 100 percent of cattle are using the system. Expected annual costs for a facility that sells 150,000 head of cattle annually are 15 percent higher than expected annual costs for a facility that sells 200,000 head of cattle annually, across all levels of cattle usage.

Figure 33. *Four Hypothetical Livestock Market's Expected Annualized Costs of RFID Reader Systems Based on Varying Levels of Cattle Using the System (15% Return).*



There are large differences in expected annualized costs per head when comparing different sized livestock markets; however, it is clear that expected annualized costs per head gradually decrease as more cattle use the system for each livestock market size. This means economies of size exist in this relationship; as more cattle use the RFID reader system annualized costs per head decrease. Since economies of size exists, smaller livestock markets that use a reader system intensively (i.e., higher percentage of cattle sold annually) can compete with larger livestock markets that use their reader system on a smaller percent of total cattle sales. The largest decrease in expected annualized cost per head appears to be realized when at least 45 percent of cattle use the system for all four livestock markets. This shows that livestock markets wishing to invest in an RFID reader system should strive to have a minimum of 45 percent of cattle sales using the RFID reader system to substantially decrease expected annualized costs per head of cattle using the system.

Benefits of Electronic Animal Identification Systems

Electronic animal identification systems may benefit livestock markets that choose to install them. For example, livestock markets may find more customers (buyers and sellers) attracted to their facility or premiums associated with RFID tagged cattle. Premiums associated with RFID-tagged cattle could result in higher valued animals sold or even an elevated reputation for a livestock market. Electronic animal identification systems

must provide benefits to livestock markets that decide to install them; otherwise, it is unlikely that these businesses will adopt the services.

As demand for cattle individually identified with electronic tags increases, livestock markets that offer electronic animal identification reader systems will be able to attract more buyers and sellers. Livestock markets

would probably need to advertise this service. They could even offer meetings to buyers and sellers explaining what the livestock market has to offer concerning electronic animal identification and how the reader system can benefit them. If livestock market customers are unable to reap the benefits of individual electronic identification of their cattle, then it is highly unlikely that RFID reader systems installed by livestock markets will be widely used by their customers.

Livestock market customers may even experience premiums associated with cattle that are RFID tagged and preconditioned. Cattle transaction data were collected at three livestock market sales in Kansas during late 2006 and early 2007 where preconditioned, RFID-tagged cattle were sold. Preconditioned cattle, in this sense, refers to cattle that were third-party verified as preconditioned. The three livestock market sales where data were collected contained cattle that participated in different preconditioning programs.

Ordinary least squares (OLS) regression analysis was used to analyze transaction price data for each of the three livestock markets. Preconditioned and RFID-tagged cattle brought a statistically significant and economically important premium at only one of the livestock markets. Preconditioned and RFID-tagged cattle at the first livestock market brought a premium of \$1.45 per hundredweight when compared to cattle that were preconditioned but not RFID tagged, but the premium was not statistically significant. At the second livestock market, preconditioned and RFID-tagged cattle brought a premium of \$1.15 per hundredweight

Table 15. *Summary of Tagging Service Costs, Usage, and Fees.*

	Average	Minimum	Maximum
Annual Livestock Use (head)	23,130	200	128,930
Investment Expense	\$43,651	\$0	\$500,000
Annual Expense	\$28,138	\$0	\$200,000
Expected Fee, \$/head (excluding tag cost)	\$3.34	\$1.00	\$20.00

when compared to cattle that were not preconditioned or RFID tagged; however, the premium was not significantly different from zero. The third livestock market sold preconditioned and RFID-tagged cattle that brought a \$2.96 per hundredweight premium that was statistically significant when compared to cattle that were not preconditioned or RFID tagged.

Other studies have found premiums to exist for third-party verified preconditioned cattle. A survey conducted by the Livestock Marketing Association and Global Animal Management⁷ found that livestock market operators have seen premiums up to \$5.37 per hundredweight for cattle that were age verified, source verified, and third-party verified as preconditioned. Analyzing LMA-VACC and regular auction sales at the Holton Livestock Exchange, Dhuyvetter et al. found premiums of \$4.50 to \$5.50 per hundredweight for LMA-VACC preconditioned calves sold in the fall, relative to cattle that were not preconditioned, over a 5-year period. Analysis by King and Seeger in the Superior Livestock Video Auctions from 1995 to 2004 found that cattle that were in the Superior promoted VAC-45 preconditioning program brought premiums on average of \$4.37 per hundredweight over the 10-year period. The study also found that premiums paid for VAC-45 calves in 2004 were higher than previous periods. Premiums have increased each of the last 5 years.

Price premiums associated with RFID-tagged and preconditioned cattle and the prospects of a larger customer base are two benefits that may be achieved by livestock markets that provide electronic animal identification reader systems to their customers. Another benefit that may be realized is reduced clerking costs for livestock markets as clerking becomes more automated. This added service may set apart a livestock market from other facilities by offering additional services to their customers.

Tagging Service Investments

Many livestock market operators said they believe their customers will expect them to offer an RFID-tagging service if the NAIS were fully implemented. Other livestock market managers feel as though they would have to offer tagging services if they invest in an RFID reader system, to ensure that it is used. These facility operators are concerned about extra investment requirements, costs, and risks this may bring upon their businesses. This section reviews capital outlays (investments) and annual expenses livestock market respondents expect to incur if they were to offer tagging services to their customers.

As stated earlier, 55 percent of livestock market respondents believed they would offer a tagging service to customers if the NAIS were fully implemented. Currently, only a few livestock markets offer RFID-tagging services. Livestock market respondents indicating they would provide tagging services were asked to estimate the required investment, annual expenses, and expected use of the service. The investment is a “one-time” capital outlay that included things such as a squeeze chute, new pens, etc. The additional annual expenses included things such as operating labor. Expected use is the number of livestock expected to use the new tagging service annually. In a few cases, expected use was not provided by the livestock market respondent, so 45 percent of annual livestock sales was used. This was the average of what other livestock market operators reported. Livestock market respondents were also asked how much they would charge for such a service. Other important costs of an RFID-tagging service, such as the cost of animal shrink, animal injury, and employee injury, could not be calculated with the available data.

On average, livestock market operators surveyed expected 23,130 head of livestock sold would use a tagging service annually (Table 15). However, the responses ranged from 200 to 128,930 head annually. On average, livestock markets expect to

⁷ Rutherford, Burt

Figure 34. *Total Investment per Head of Livestock Using Tagging Service.*

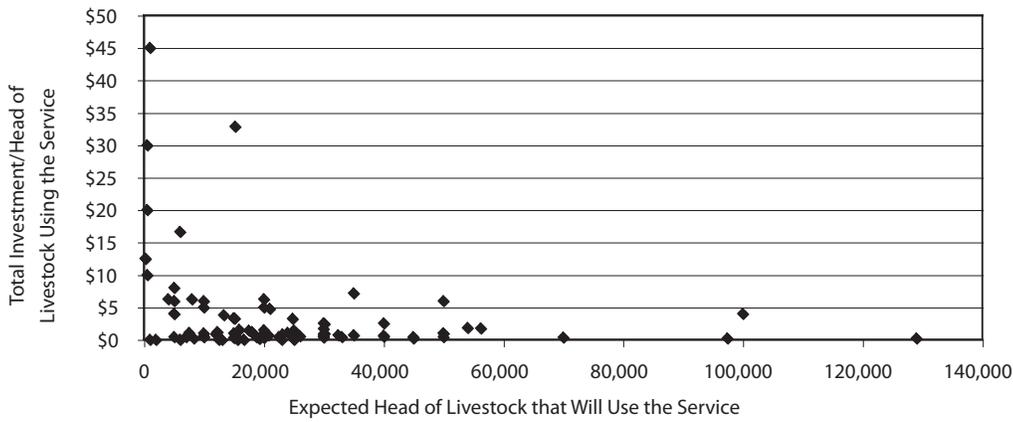
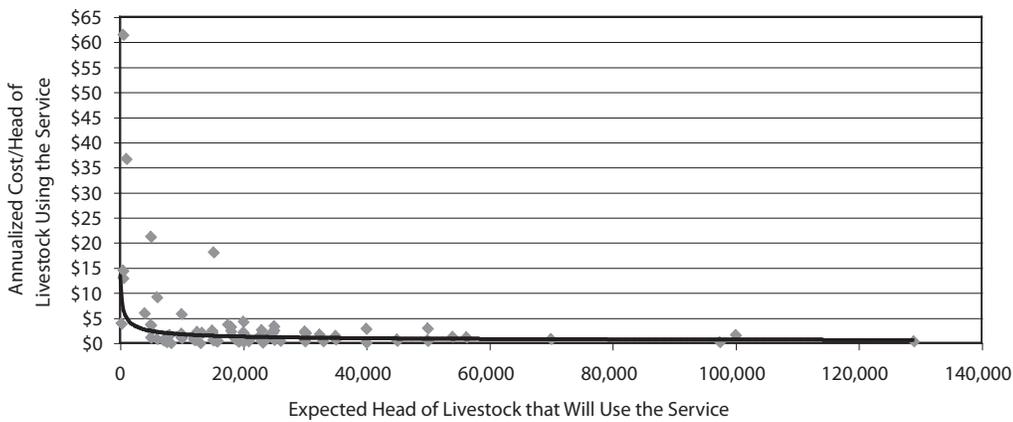


Figure 35. *Annualized Cost per Head of Livestock Using the Tagging Service (8% Return).*



invest \$43,651 to set-up a tagging service and incur \$28,138 in annual expenses. There was a wide range in responses among livestock market respondents when asked how much they would charge for this added service. Thirty-two livestock markets estimated they would charge on average \$3.34 per head (this excludes the cost of RFID tags), one planned to charge \$20 per head. Sixty-one operators did not know how much they would charge for RFID tagging.

Most livestock markets expect the investment in a tagging service to be less than \$10 per head of livestock that would use the service (Figure 34). Six of the livestock market respondents expected the investment to be more than \$10 per head. One livestock market operator estimated a tagging service addition at their facility would cost \$325 per head of livestock using the system. This market estimated that only 200 head of livestock would use a tagging service, but they would need to invest \$65,000 to set up a tagging service. The investment for this livestock market was deemed unrealistic and considered

to be an outlier, thus it was excluded from Figure 34 and removed from the analysis.

Annualized costs of RFID-tagging services were calculated by amortizing the required investment over a 10-year period at interest rates of 8 percent and 15 percent. The annual expenses of adding a tagging service were added to this amortized value to arrive at an annual cost associated with adding a tagging service. An 8 percent interest rate was used to reflect the cost of borrowing money for an operating loan. The 15 percent interest rate was used to reflect the cost of borrowing money for an operating loan plus the cost of

making a risky investment.

The annualized costs using the 8 percent interest rate averaged \$3.21 per head of livestock expected to use the service and ranged from \$0.00 to \$61.49 per head (Figure 35). The annualized costs using the 15 percent rate averaged \$3.39 per head and ranged from \$0 to \$61.99 per head. Annual costs changed very little with interest rates because the annual expense (i.e., operating labor) represents a much larger portion of the annual cost than does the annualized investment amount. In Figure 35, economies of size are shown by a rapid decrease and flattening in annualized costs as the number of livestock using the service increases. This means that livestock markets with larger volumes of livestock using the tagging service will have a competitive advantage over livestock markets with fewer livestock using the service. Based on the estimated model (i.e., line in Figure 35), the annual cost per head decreases, up to 12,000 head of livestock using the service, and then the cost per head remains constant at \$1.51. However, it can also

Figure 36. Annualized Cost per Head of Livestock Using the Tagging Service.

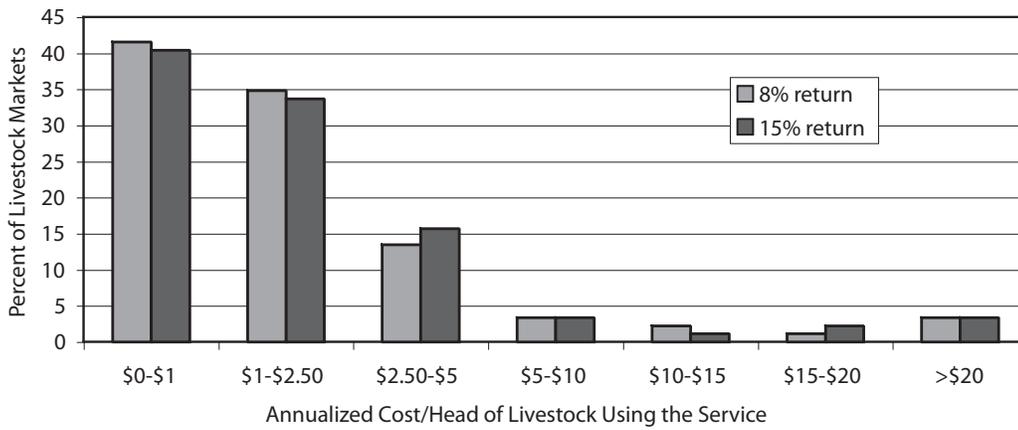
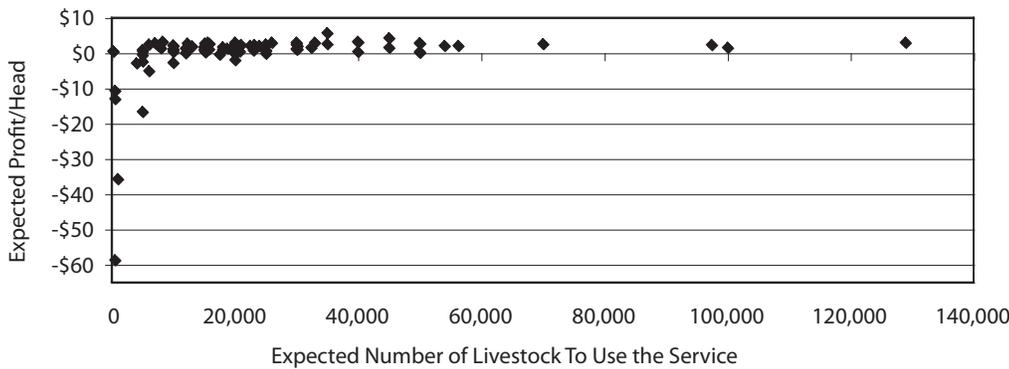


Figure 37. Expected Profit per Head of Livestock Using the Service (15% Return).



be seen that many of the livestock markets using the tagging service on fewer than 20,000 head also had costs below \$5 per head indicating that smaller livestock markets can compete economically with a tagging service. The expected annualized cost per head was less than \$5.00 per head for most (90 percent) livestock markets (Figure 36).

The annualized costs per head could be the fee livestock markets charge customers for a tagging service. When livestock market respondents were asked how much they would charge for a tagging service, the average response was \$3.34 per head. This is almost exactly equal to the average annual costs, indicating livestock market managers would simply pass the cost of the additional service on to

the customers rather than trying to make this a profit center. However, if livestock markets only charge \$3 to \$5 per head for RFID tagging when it cost them more (10 percent had costs greater than \$5 per head), they would be losing money on this service.

When comparing the annualized cost per head using the 15 percent interest rate to what the livestock markets reported they would charge for the service, 15 percent of livestock markets surveyed would lose money on this service (Figure 37), assuming the service did not increase volume by attracting new customers

to the auction market. On average livestock markets would be losing \$0.05 per head, including five livestock markets that would be losing more than \$10 per head. If a livestock market indicated that they did not know how much they would charge for a tagging service, the average \$3.34 per head was used to figure profits or losses. Livestock markets that choose to provide a tagging service for their customers should consider the annualized costs associated with the service when determining how much to charge for the service. They should also consider the possible increase in customers due to a new service being offered.



Kansas State University Livestock Auction Market Survey

Economic Impact of Individual Animal
Identification Systems at Livestock Markets



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Kansas State University Livestock Auction Market Survey

Economic Impact of Individual Animal Identification Systems at Livestock Markets

Thank you for taking time to participate in this study. By collecting data from your operation and others, we are quantifying the economic impact of individual animal identification scanning and recording on U.S. Livestock Auction Markets. All information you provide will be strictly confidential. The analysis and report generated from this study will be done in a manner in which no individual Livestock Auction Market is associated with specific data. Please report information as accurately as possible, if you are unsure of an answer, please provide your best estimate. We will send you a copy of our report findings after they are compiled. Your assistance is greatly appreciated!

I. Description of Livestock Market Environment

A. What is the average annual number typically sold at this location, for each of the following species?

Cattle (Dairy and Beef) _____ head
Hogs _____ head
Sheep _____ head
Horses _____ head
Goats _____ head
Other: _____ head

B. What is the approximate breakdown of cattle typically sold? (Enter percent for each category)

Calves, Yearlings, and Replacement Heifers _____ %
Cows and Bulls _____ %
Total 100%

C. What is the current, one-time, holding pen capacity of this facility?

_____ head of cattle

D. Do you have the ability to expand pen capacity? (Check One)

____ Yes ____ No

Questions E-I pertain to peak versus non-peak cattle sale days. Peak sale days refer to times of the year when you have “bigger runs” than normal (e.g. fall weaning) and non-peak sale days refer to all other times. These differences are important for identifying potential constraints or bottlenecks that might occur at certain times of the year.

E. How many cattle are typically sold on a peak volume day at this livestock market?

_____ head

F. What month(s) of the year would peak volume sale days occur? **(Check all that apply)**

- January April July October
 February May August November
 March June September December

G. On average, how long are sales during a peak day? **(Check One)**

- Less than 2 hours
 2-4 hours
 4-8 hours
 8-12 hours
 Over 12 hours

H. How many cattle are typically sold, on a non-peak sale day at this livestock market?

_____ head

I. On average, how long are sale days during a non-peak day? **(Check One)**

- Less than 2 hours
 2-4 hours
 4-8 hours
 8-12 hours
 Over 12 hours

J. On average, how many cattle sales are conducted per year? **(Check One)**

- Less than 25
 25-49
 50-99
 Over 100

K. What percent of cattle currently marketed through this barn have some type of identification tag (not including market back tags) (e.g., number tag, RFID tag, etc.)? **(Check One)**

- 0-25%
 26-50%
 51-75%
 76-100%

L. What is the distribution of lot sizes of the following livestock sold through the sale ring of this facility annually? **(Enter percent for each category)**

	Calves/Yearlings/ Replacement Heifers	Cows/Bulls	Swine	Goats/Sheep
	Percent of lots (rows a-d should add to 100)			
a. Single head lots				
b. 2-10 head lots				
c. 11-50 head lots				
d. Lots with more than 50 head				
Total	100%	100%	100%	100%

M. What is the approximate market value of the auction facility (e.g., land, buildings, and stationary equipment (e.g., auction arena, chutes, corrals, etc.))? **(Check One)**

- Less than \$250,000
- \$250,000-\$499,999
- \$500,000-\$1,499,999
- \$1,500,000-\$2,499,999
- \$2,500,000-\$4,999,999
- \$5,000,000-\$7,499,999
- \$7,500,000 or more

N. What is the approximate market value of rolling equipment in this business (e.g., pickups, trucks, tractors, trailers)? **(Check One)**

- Less than \$75,000
- \$75,000-\$149,999
- \$150,000-\$249,999
- \$250,000-\$499,999
- \$500,000 or more

O. What is the approximate total annual cost for each of the following at this livestock market?

- A. Salaried labor \$ _____
- B. Hourly labor \$ _____
- C. Fuel and hired trucking \$ _____
- D. Repairs and maintenance \$ _____
- E. Utilities \$ _____
- F. Other _____ \$ _____

P. If you utilize a computer system, what is the name of the software used to clerk each livestock sale?
(Write "none" if no software or computer is utilized)

Q. Is an internet/video auction utilized during sales? **(Check One)**

- Yes
- No

II. Added Services with the National Animal Identification System

A. When the National Animal Identification System becomes fully implemented will this facility provide a tagging service for customers, providing them an alternative to tagging on their farm/ranch? **(Check one)**

- Yes
- No, **skip to question B, in the middle of page 4**
- I do not know, **skip to question B, in the middle of page 4**

1. Will the facility charge an added fee for this tagging service? **(Check one)**

- Yes
- No
- I do not know

2. If yes, how much do you plan to charge per head, excluding the cost of the tag?
 _____\$/head _____ Not sure at this time
3. Would the tagging service be completed by an employee of the facility or contracted out to a third party (e.g., a local veterinarian)? **(Check one)**
 _____ Facility employee(s)
 _____ Outside third party
4. How many head of livestock do you estimate would use this service annually?
 _____ head
5. Provide an estimate of additional costs the livestock market will incur from the addition of a tagging service.
 \$_____ Additional annual costs (i.e. labor)
 \$_____ One-time investment expense (i.e. squeeze chute, new pens, etc.)

- B. Do you envision offering any other new service(s) to your customers when the National Animal Identification System becomes fully implemented (e.g., age/source verification, record keeping, data analysis, etc.)?
 _____ Yes _____ No

1. If yes, please list the type(s) of services you plan to offer your customers?

III. Knowledge and Concerns with the National Animal Identification System

- A. Rate your knowledge of the National Animal Identification System (NAIS), regarding the program standards. **(Use a scale of 1-9, where 1 reflects having no knowledge of the NAIS and 9 indicates you are extremely knowledgeable of the NAIS.)**

No								Extremely
Knowledge								Knowledgeable
1	2	3	4	5	6	7	8	9

- B. Rate your level of understanding of what this facility needs to do to comply with the National Animal Identification System. **(Use a scale of 1-9, where 1 reflects you have no understanding and 9 indicates you completely understand.)**

Do Not								Completely
Understand								Understand
1	2	3	4	5	6	7	8	9

- C. Rate your level of understanding of costs you will incur to comply with the National Animal Identification System within this facility. **(Use a scale of 1-9, where 1 reflects you have no understanding and 9 indicates you completely understand.)**

Do Not								Completely
Understand								Understand
1	2	3	4	5	6	7	8	9

D. Please indicate your level of concern about each of the following as they relate to the adoption of the National Animal Identification System. **(Circle one level for each item)**

	Level of Concern
	Low-Moderate-High
1. Speed of sale adversely impacted	1 - 2 - 3 - 4 - 5
2. Additional technology expertise needed	1 - 2 - 3 - 4 - 5
3. Reliability of electronic animal I.D. equipment	1 - 2 - 3 - 4 - 5
4. Cost of technology (e.g., readers, computers)	1 - 2 - 3 - 4 - 5
5. Cost of operating the system (e.g., labor)	1 - 2 - 3 - 4 - 5
6. Cost of renovation/facility modification	1 - 2 - 3 - 4 - 5
7. Confidentiality of NAIS	1 - 2 - 3 - 4 - 5
8. Other (specify _____)	1 - 2 - 3 - 4 - 5
9. Other (specify _____)	1 - 2 - 3 - 4 - 5

E. Do you view the National Animal Identification System as a threat or opportunity to this business?
(Check all that apply)

- Threat
 Opportunity
 Neither a threat, nor opportunity

F. Please list any other thoughts you have relating to the adoption of the National Animal Identification System and how it will impact your business (opportunities, threats, etc.).

IV. Individual Animal Identification

A. Does the livestock market currently have any sales that are specifically targeted toward animals with RFID (Radio Frequency Identification) tags? **(Check One)**

- No Yes

B. Has this livestock market registered for a premise identification number? **(Check One)**

- Yes No I do not know

C. Does this livestock market currently utilize an individual animal identification scanning and recording system to identify cattle, such as a RFID reader system? **(Check One)**

- No, **please answer the questions in Section V, beginning on page 5**
 Yes, **please skip to the questions in Section VI, beginning on page 6**

V. If you answered “No” to question C, please answer the following questions: (If you answered “Yes” to question C, answer the questions beginning in Section VI, on page 6)

A. When the National Animal Identification System is fully implemented what type of individual animal identification reader do you think would be most useful in this facility? **(Check all that apply)**

- Hand-held reader
 Stationary panel reader
 Other, please specify: _____
 I do not know

- B. If an individual animal identification scanning system was installed in your facility would you need to buy a new computer(s) in order to utilize this new system? **(Check One)**
 Yes No I do not know
- C. Would the facility need to purchase new software or have the current software upgraded if an individual animal identification system was installed? **(Check one)**
 Yes No I do not know
- D. Where is the optimal location for an individual animal identification reader system within the facility? **(Check all that apply)**
 Unloading area
 Load-out area
 Sorting area
 Immediately before the sale ring
 Immediately after the sale ring
 Other, please specify: _____
 I do not know
- E. If an individual animal identification system was installed in this sale barn how many new employees do you anticipate would need to be hired to manage the new system?
 _____ Employees I do not know
- F. Would the speed of the sale change if an individual animal identification system was installed in your facility? **(Check one and fill in the blank if applicable)**
 No
 Yes, the speed of sale will decrease by _____% cattle per day
 Yes, the speed of sale will increase by _____% cattle per day



Thank you for your cooperation in completing this survey!

VI. If you answered “Yes” to question C (on page 5), please answer the following: (If you answered “No” to question C (on page 5), you have completed the survey.)

- A. For what reason was the individual animal identification scanning and recording system installed? **(Check all that apply)**
 Provide an added service to customers
 For research purposes
 Anticipation of regulations requiring an individual animal identification system
 Other, please indicate: _____
- B. From what company were the individual animal identification readers purchased?
 _____ (e.g., Allflex, Destron Fearing...)
- C. What type of individual animal identification is being utilized? **(Check all that apply)**
 RFID technology
 Retinal Scan technology
 Bar Code technology
 Other, please specify: _____

D. What type of reader is being utilized? **(Check all that apply)**

- Hand-held reader
 Stationary panel reader
 Other, please specify: _____

E. How much did each reader cost this facility?

Type of reader	Quantity purchased	Cost of one reader
_____	_____	\$ _____
_____	_____	\$ _____
_____	_____	\$ _____

F. What was the total amount charged to this facility by the company that installed the electronic animal identification system? **(Please record the total cost including the cost of the above listed readers and any other charges.)**

\$ _____

G. How many hours of labor were required to install the reader(s) by your employees? **(Do not include hours required to modify your facility)**

_____ hours

H. What was the labor cost per hour of your employees, used installing the reader(s)?

_____ \$/hour

I. Did a new computer(s) have to be purchased in order to utilize this new system? **(Check One)**

Yes No

J. If yes, how much was spent on a new computer(s)? (Be sure this cost only reflects the added expense due to the new technology) **(Check One)**

- Less than \$1,000
 \$1,000-\$1,999
 \$2,000-\$2,999
 \$3,000-\$3,999
 \$4,000-\$4,999
 \$5,000 or more

K. Did the facility have to purchase new software to comply with the new technology? **(Check One)**

Yes No

L. If yes, how much was spent on the new software? (Be sure this cost only reflects the added expense due to the new technology) **(Check One)**

- Less than \$5,000
 \$5,000-\$9,999
 \$10,000-\$14,999
 \$15,000-\$19,999
 \$20,000-\$24,999
 \$25,000 or more

M. Did a software company help the livestock market upgrade to using the new technology with your current software? **(Check One)**

Yes No

- N. If yes, how much did the upgrade in software cost? (Please include the entire cost of the software upgrade, including labor and software)
 \$ _____
- O. Is the facility being charged additional "technology support" fees annually from the software provider because of the new technology? (**Check one**)
 _____ Yes, \$ _____ is charged additionally annually _____ No
- P. Please describe, in detail, the changes made to the facility in order for the new technology to be installed (e.g., redesigning alleys, modifying chutes, constructing new pens).

Q. What material costs were incurred to modify the facility? (**Please list major items and the costs of each**)

Material	Estimated Cost
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____

- R. What is the location of the reader system within the facility? (**Check all that apply**)
- _____ Unloading area
 _____ Load-out area
 _____ Sorting area
 _____ Immediately before the sale ring
 _____ Immediately after the sale ring
 _____ Other, please specify: _____

- S. Was a contractor hired to complete any of the facility modifications needed to install the reader system? (**Check One**)
 _____ Yes _____ No

- T. If yes, what was the cost of this service in terms of materials and labor?
 Materials \$ _____ Labor \$ _____

- U. Approximately, how many hours of labor did employees spend modifying the facility to prepare it for the installment of readers? (Do not include hours required to install the reader system)
 _____ hours

- V. How many new employees were hired to manage the new system?
 _____ Employees

- W. How many employees were no longer needed because of the new system?
 _____ Employees

X. How many hours per week do employees work with the reader system (total for all employees)?
_____ hours/week

Y. What is the average cost per hour of employees working with the reader system?
_____ \$/hour

Z. In order for the reader system to be fully functional, were any of your employees trained? (**Check One**)
___ Yes ___ No

AA. If yes, how many employees were trained and how much did the training cost per person?
_____ Number of employees trained
_____ Cost of training per person (\$)

AB. Has the speed of the sale changed due to the system? (**Check one and fill in the blank if applicable**)
___ No
___ Yes, the speed of sale has decreased by _____ % cattle per day
___ Yes, the speed of sale has increased by _____ % cattle per day

AC. What percent of livestock sold through the facility currently utilize the reader system by being scanned and recorded? (**Check one**)
___ 0-25%
___ 26-50%
___ 51-75%
___ 76-100%

Thank you for your cooperation in completing this survey!



November, 2006

Dear Fellow Livestock Marketer:

The enclosed survey, being conducted by Kansas State University, of the potential costs of implementing an electronic national animal identification system in livestock markets **is so important that LMA has agreed to send it to you, on K-State's behalf, with our full endorsement.**

Very little is currently known of the potential costs to U.S. livestock marketing businesses of implementing the U.S. Department of Agriculture's proposed National Animal Identification System (NAIS). With your participation in this survey, we hope to learn much more about the marketing sector's cost of collecting (reading) the ID information, retrofitting market facilities to accommodate an electronic ID system, transferring the ID information to private databases, etc. and possibly even tagging animals. **Once this information is in hand**, we anticipate having the necessary information to better assess the cost/benefits of a national animal ID system, determine if cost barriers to implementation of an electronic ID system exist at livestock markets, identify needed resources to implement the NAIS requirements at livestock marketing businesses and determine market infrastructure needs to operate a fully functional national animal ID system.

Protecting your interest and concerns relative to NAIS before the U.S. Congress and State legislatures, federal and state animal health officials and with other livestock industry groups and interests **is LMA's principal consideration in supporting the enclosed cost survey.** Thus, **we urge you in the strongest possible terms** to take 20-30 minutes out of your busy schedule **to answer the survey and return it to the K-State researchers** in the enclosed self-addressed, stamped envelope **as soon as possible.** Please contact LMA Vice President Nancy Robinson at 1-800-821-2048 or K-State Graduate Research Assistant Kati Bolte at 785-532-6702 if you have any questions about the survey.

Thank you for taking part in this most important livestock auction market survey!

Sincerely,

Jim Santomaso
LMA President

P.S. **To assure the most complete survey results, please consider providing your name and contact information on the enclosed card** to allow the researchers to contact you should any questions about your individual survey responses occur. **You can be assured that your individual responses to the survey will be kept strictly confidential.**

Over 50 years of dedicated service to the Livestock Industry

10510 NW Ambassador Drive • Kansas City, MO 64153-1278 • 816-891-0502 • 1-800-821-2048 • Fax 816-891-7926



National Livestock Producers Association

November, 2006

Dear NLPA Livestock Market Managers:

The enclosed survey, being conducted by Kansas State University, of the potential costs of implementing an electronic national animal identification system in livestock markets **is so important that NLPA has agreed to send it to you, on K-State's behalf, with our full endorsement.**

Very little is currently known of the potential costs to U. S. livestock marketing businesses of implementing the U.S. Department of Agriculture's proposed National Animal Identification System (NAIS). With your participation in this survey, we hope to learn much more about the marketing sector's cost of tagging animals, collecting (reading) the ID information, retrofitting market facilities to accommodate an electronic ID system, and transferring the ID information to private databases, etc. **Once this information is in hand**, we anticipate having the necessary information to better assess the cost/benefits of a national animal ID system, determine cost barriers to implementation of an electronic ID system at livestock markets, identify needed resources to implement the NAIS requirements at livestock marketing businesses, and determine market infrastructure needs to operate a fully functional national animal ID system.

Protecting your interest and concerns relative to NAIS before the U.S. Congress and State legislatures, federal and state animal health officials and with other livestock industry groups and interests **is NLPA's principal consideration in supporting the enclosed cost survey.** Thus, **we urge you in the strongest possible terms** to take 15-20 minutes out of your busy schedule **to answer the survey and return it to the K-State researchers** in the enclosed self-addressed, stamped envelope as soon as possible. Please contact NLPA Assistant Director of Member Services, Stacy Loutzenhiser at 1-800-237-7293 or K-State Graduate Research Assistant Kati Bolte at 785-532-6702 if you have any questions about the survey.

Thank you for taking part in this most important livestock auction market survey!

Sincerely,

A handwritten signature in cursive script that reads "Scott Stuart".

Scott Stuart
NLPA President and CEO

P.S. **To assure the most complete survey results, please consider providing your name and contact information on the enclosed card** to allow the researchers to contact you should any questions about your individual survey responses occur. **You can be assured that your individual responses to the survey will be kept strictly confidential.**

660 Southpointe Court - Suite 314 - Colorado Springs, Colorado 80906 - 719-538-8843 - Fax 719-538-8847 - Internet: www.nlpa.org

Appendix C

Table C1. *States represented by Regions*

Region	State
Midwest	Illinois
	Indiana
	Iowa
	Kansas
	Michigan
	Minnesota
	Missouri
	Nebraska
	North Dakota
	Ohio
	South Dakota
Wisconsin	
Northeast	New York
	Pennsylvania
Northwest	California
	Colorado
	Montana
	Utah
	Wyoming
Southeast	Oregon
	Alabama
	Arkansas
	Florida
	Georgia
	Kentucky
	Louisiana
	Mississippi
	North Carolina
	South Carolina
Tennessee	
Virginia	
Southwest	New Mexico
	Oklahoma
	Texas

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In each case, credit Kati Bolte et al., *Electronic Animal Identification Systems at Livestock Auction Markets: Adoption Rates, Costs, Opportunities, and Perceptions*, Kansas State University, February 2008.