

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 increased use of animal identification systems. Livestock markets are a primary industry sector where animal movement and identification information can be recorded.

This fact sheet summarizes a more comprehensive research report entitled “Electronic Animal Identification Systems at Livestock Auction Markets: Adoption Rates, Costs, Opportunities, and Perceptions.”<sup>1</sup> The objectives of the project were 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 2006/07. Results from the analysis of completed surveys, representing 189 livestock auction markets, are reported.

### Knowledge, Concerns, and Views of the NAIS

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 movement tracking systems are important to understand. If livestock market operators do not understand the NAIS or animal identification systems, information may be misconstrued. Identifying concerns that livestock market operators may have about electronic animal identification systems is important in designing programs to address these issues.

Livestock market operators tend to moderately understand the NAIS program standards, costs associated with adopting the NAIS, and how to adopt the NAIS practices. Forty-two percent of survey respondents indicated intermediate or less understanding of the NAIS program standards, 51 percent indicated they did not fully understand what would need to be done to adopt the NAIS practices, and 56 percent

did not understand costs involved with adopting the NAIS. More importantly, 50 percent of livestock market operators indicated that they view the NAIS as a *threat* to their business and only 20 percent view it as an *opportunity*. This illustrates the need for a study focusing on the benefits and costs of the NAIS and more information dissemination.

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 (number in parenthesis 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)

The greatest concerns about animal identification technology are related to costs, reliability, and impact on speed of sale. However, there are only small differences in the average rankings of the concerns listed and all are greater than moderate concern on average.

### Factors Related to Knowledge, Concerns, and Views of NAIS

Statistical analysis of the data were conducted to determine how individual characteristics of livestock markets relate to levels of knowledge, views, and concerns of the NAIS. The purpose of the analysis was to determine any systematic characteristics of auction markets that relate to specific survey responses. The systematic characteristics that affect perceptions can be used to better target information dissemination programs.

Results indicate that operators of livestock markets that currently have, or plan to add, an RFID tagging service are likely to have more knowledge of the NAIS program standards, more knowledge of how to adopt the NAIS practices, and higher understanding of the

<sup>1</sup> Bolte, K., K. Dhuyvetter, and T. Schroeder

probable costs involved with adoption of the NAIS. Also, 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. They also tend to be more knowledgeable about the NAIS program standards than operators of small-volume facilities. Finally, managers of facilities that have operating RFID reader systems tend to be more informed about how to adopt the NAIS practices and of costs associated with adopting the NAIS. This suggests operators of smaller auction markets are an important target for information dissemination, as well as facilities that do not plan to add an RFID tagging service in the future, or facilities that do not currently have operating RFID reader systems.

Given that NAIS is currently a voluntary program, as would be expected, 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 identification systems have been early adopters. Markets that have not adopted electronic animal identification information technology will likely not adopt such technology without a change in general perception.

Livestock market managers tend to be highly concerned about adoption of individual electronic animal identification systems adversely impacting sale speed. The more volume the auction sells, the greater the manager's concern about animal identification systems slowing speed of commerce. However, the impact on the speed of sale 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 this technology.

## Perceptions of Electronic Animal Identification

Livestock market respondents that have not adopted electronic animal identification systems tend to overestimate costs and needs of such systems. Tables 1 and 2 display the differences in perceived and actual changes needed to install electronic animal identification systems. Differences exist in what livestock market respondents expect would happen and what is realized when reader systems are installed.

Table 1. Comparison between Expected and Actual Changes when Adopting Electronic Animal Identification Systems in Livestock Auction Markets.<sup>1</sup>

	Expected by Those Without RFID Reader Systems	Actual by Those With RFID Systems
<b>Types of Readers</b>		
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 <sup>2</sup>	201	37
<b>Reader Locations</b>		
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 <sup>2</sup>	222	37
<b>Need to Buy a New Computer</b>		
Yes	46.0%	48.1%
No	16.8%	51.9%
Uncertain	37.3%	0.0%
Number of Observations	161	27
<b>Need New Software</b>		
Yes	70.8%	44.4%
No	4.3%	55.6%
Uncertain	24.8%	0.0%
Number of Observations	161	27

<sup>1</sup> 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.

<sup>2</sup> Survey Respondents had the option to choose more than one response.

Table 2. Comparison between Expected and Actual Changes when Adopting Electronic Animal Identification Systems in Livestock Auction Markets.<sup>1</sup>

	Expected Change by Those Without RFID Reader Systems				Actual Change by Those With RFID Systems			
	Response	Avg. <sup>2</sup>	Min <sup>3</sup>	Max <sup>3</sup>	Response	Avg. <sup>2</sup>	Min <sup>3</sup>	Max <sup>3</sup>
<b>Change in Speed of Sale</b>								
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			
<b>New Employees Hired</b>								
Yes	46%	4	1	15	25%	2	1	3
No	3%				75%			
Uncertain	51%				0%			
Total	100%				100%			
Number of Responses	156				24			

<sup>1</sup> 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.

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

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

The most common type of electronic animal identification readers at livestock markets was an RFID stationary panel reader. This is also what livestock market managers anticipate using the most. Smaller-volume livestock markets (at least facilities that have small volumes of animals that may need to have an electronic identification tag read) may be able to use a handheld reader. However, livestock markets that sell larger volumes of livestock with electronic identification would probably require stationary panel readers to maintain speed of commerce.

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 advantage of placing the reader system after the sale ring is that a market transaction has taken place at this point, hence seller and buyer information, along with individual animal identification information, can be captured electronically at that point in the sale.

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 realizations 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 needed to purchase new software to use with their reader systems. This difference in responses between those that have and have not adopted electronic reader systems could be because livestock market operators that have installed readers are more progressive and already use software that would comply 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. For example, 63 percent of livestock markets that currently use 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. 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 have installed electronic animal identification systems, 79 percent of the operators indicated they have experienced no change in sale speed. Furthermore, for those that have experienced a change in sale speed, they reported only experiencing an average 13 percent per hour reduction. Across all livestock markets that have adopted RFID reader systems, on average livestock market operators experienced a speed of sale decrease of 3 percent per hour. None of the livestock markets experienced faster sales after installation of a reader system.

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, an additional half-time employee was hired. On average, employees at these facilities spent a total of 6.5 hours per week managing the RFID reader system. The maximum amount of hours spent per week managing the RFID reader system reported was 60 and the minimum was zero.

### **Premises Registration**

Premises registration is an important foundation of the NAIS because it allows a rapid, accurate, and cost effective method of tracking a disease outbreak.<sup>2</sup> Livestock markets are considered useful sites to be registered with the NAIS because they are livestock commingling sites. At the time of the survey in late 2006, 56 percent of livestock market operators who responded to the survey had registered their premises with the NAIS. Livestock market operators' views of the NAIS are related to whether the market has registered its premises. 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*.

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

### **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 sale at livestock markets.

Only 14 percent of livestock market respondents had adopted RFID reader systems. Most of the livestock markets that had 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.

Facilities where premises are registered are more likely to adopt RFID technology than facilities that have not registered premises. Large-volume markets are more likely to adopt RFID technology than small-volume markets. Also, 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 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. 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 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 important to livestock markets. Investment matters because it represents capital outlay required and annual cost is relevant because it represents how profits might be impacted with the adoption of this technology.

Items that reflected one-time expenditures are classified as investments in this analysis, this included RFID components (e.g., readers), labor for installation and facility modifications, materials, and training. Items considered annual expenses included equipment rental, annual technology fees, and operating labor. Other costs of RFID, such as potential slowing the speed of sale, could not be estimated with the data available.

Total investments ranged from \$5,250 to \$64,000 and annual cattle sales ranged from 12,000 to 275,000 head among the livestock market survey respondents that installed RFID reader systems. Annualized costs

Figure 1. Livestock Market Annualized Costs Based on 25% of Annual Cattle Sales (8% return).

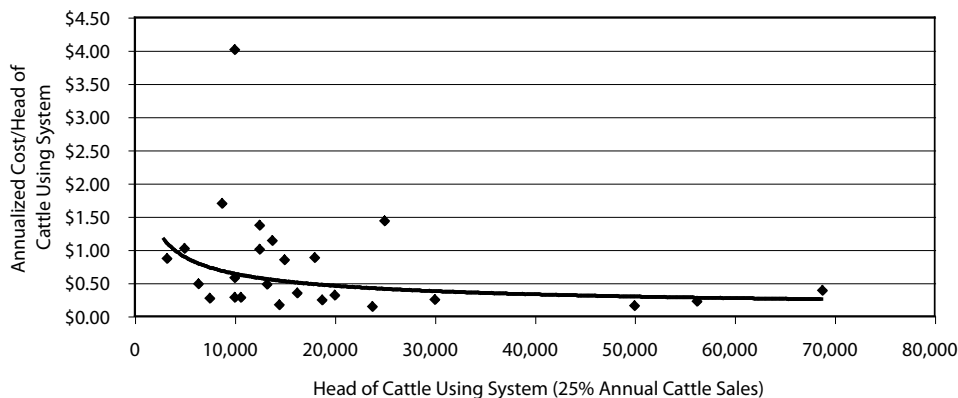
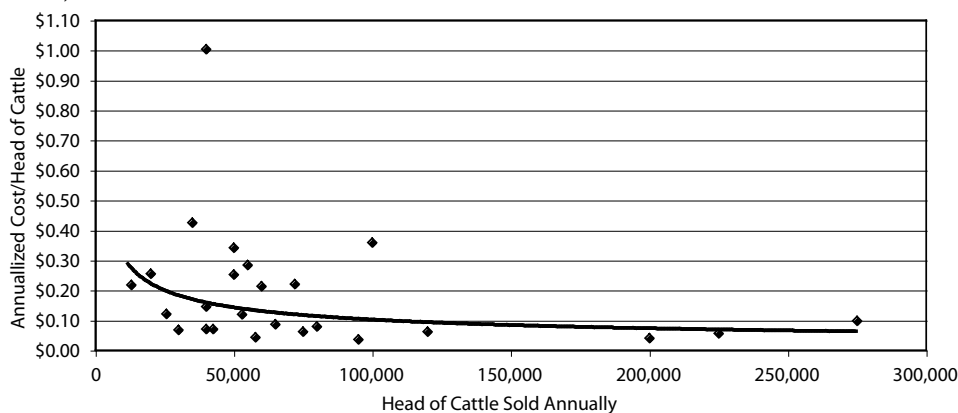


Figure 2. Livestock Market Annualized Costs Based on 100% of Annual Cattle Sales (8% return).



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. Interest was calculated on operating costs, assuming they were borrowed for 15 days each month. An 8 percent rate was used to reflect the cost of an operating loan. 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. At the end of the useful life the assumed salvage value was zero on all of the investment categories (i.e., they were completely depreciated out from an economic standpoint).

Figure 1 shows the annualized cost per head of cattle using the reader system assuming that 25 percent of the cattle sold annually were using the RFID reader system. This was chosen to simulate what may occur if the NAIS remains voluntary. The average annualized cost per head of cattle using the system was \$0.76, the maximum was \$4.02, and the minimum was \$0.14. The annualized cost per head of cattle using the system could be used as an estimate of the expected fee

charged, given our assumptions, to owners of cattle that use the RFID reader system at a livestock market.

Figure 2 shows the annualized cost per head of cattle sold, where the costs are allocated over 100 percent of cattle marketed annually. This is a scenario 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 government regulations or market demands caused 100 percent of animals sold through the livestock market to use the RFID system. The average annualized cost per head of cattle sold was \$0.19 with maximum and minimum values of \$1.01 and \$0.04 per head, respectively.

Based on estimated annual costs, economies of scale exist in RFID system adoption, i.e., larger-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 annually, with large-volume markets having annual costs less than \$0.11 per head of cattle sold annually.

Figure 3 shows expected annualized costs of RFID reader systems of four hypothetical livestock markets based on varying level of cattle using the system. This figure shows economies of size are related to intensity of RFID reader system use. That is, smaller-volume livestock markets that use an electronic reader system intensively (i.e., on a high percentage of cattle sold annually) can compete with larger-volume markets that use their reader system on a small percentage of cattle.

### RFID Tagging Service Addition

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

equipment as an unnecessary 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.

Most livestock market survey respondents from the Northeast (92 percent) and Northwest (85 percent) regions of the United States would plan to add a tagging service if NAIS were fully implemented. Livestock market survey respondents from the Southwest expect the highest percentage (75 percent) of annual livestock sales to use an RFID tagging service, which is not surprising given that this region has one of the lowest percentages of cattle currently being identified with some type of tag. On average, livestock market respondents expect 45 percent of livestock to use an RFID tagging service annually at their facility. Eighty-five percent of livestock market respondents plan to charge a fee for RFID tagging; however, a number of managers were uncertain at this time of the rate they will charge. The average amount a livestock market operator expects to charge is \$3.34 per head for RFID tagging, excluding the cost of the RFID tag.

### RFID Tagging Service Investments

Annualized costs of RFID tagging services were calculated by amortizing the required investment over a 10-year period at an 8 percent interest rate. 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. The 8 percent interest rate was used to reflect the cost of borrowing money for an operating loan. Other important costs of an RFID tagging service, such as cost of animal shrink, animal injury, and employee injury, could not be estimated with the data available.

Figure 3. Four Hypothetical Livestock Market's Expected Annualized Costs of RFID Reader Systems Based on Varying Levels of Cattle Using the System (8% return).

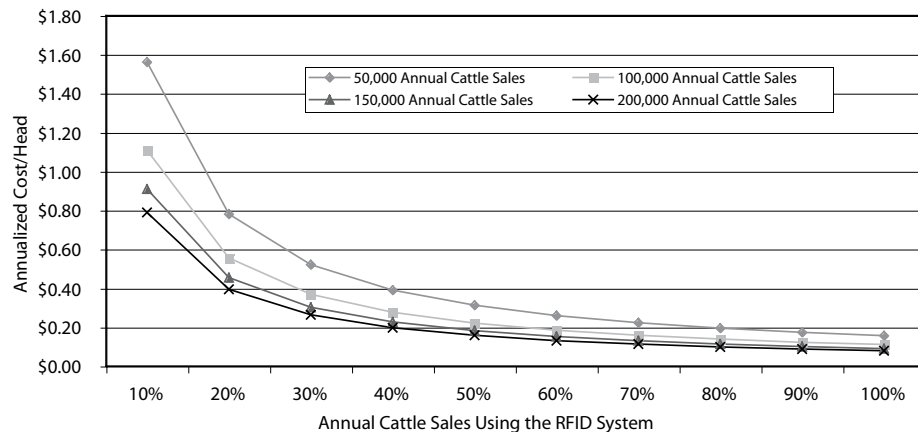
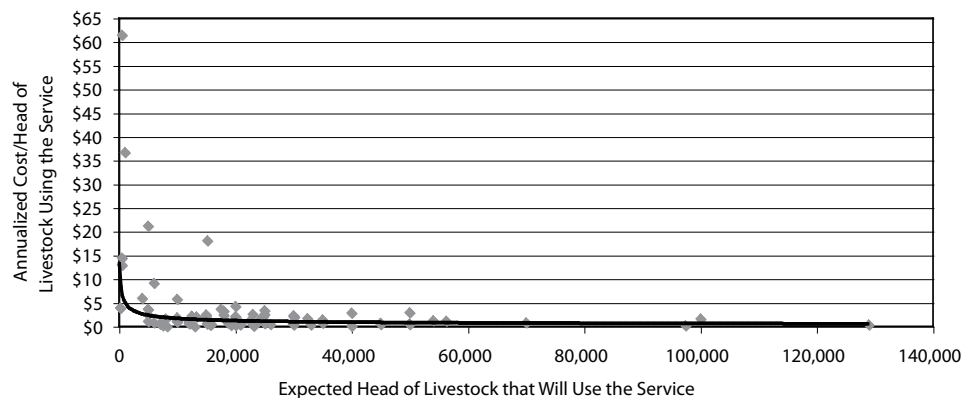


Figure 4. Annualized Cost per Head of Livestock Using the Tagging Service (8% return).



In Figure 4, the annualized cost per head of livestock using the tagging service averaged \$3.21 per head and ranged from \$0.00 to \$61.49 per head. 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) experienced annualized costs of less than \$5.00 per head for an RFID tagging service. Based on the estimated model (i.e., line in Figure 4), the annual cost per head decreases up to approximately 12,000 head of livestock using the service and then the cost per head remains constant at \$1.51.

### 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 attracted to their facility or even 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.

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 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.

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 upon buyer demand and competition for such cattle at any particular market venue.

### Implications

- Livestock market operators need additional and on-going information regarding the NAIS standards, adoption requirements, benefits, and costs. Such information will affect adoption rates of individual animal identification and tracking technology.
- Some misperceptions about what is necessary for a livestock market to adopt individual animal identification and recording technology and what is needed to operate these systems are present. As such, on-going efforts to provide current and reliable data on investment costs, operating costs, reliability of technology, and impacts of animal

identification systems adoption on speed of commerce will be critical to industry adoption of such systems.

- The voluntary nature of the NAIS makes it so those livestock markets that can find value opportunities in adoption of animal identification tracking that exceed costs will be more likely to adopt these practices. Markets will not likely make such investments where costs exceed value opportunities associated with adoption. As such, more specialization and differentiation is likely across auction markets over time than if the marketplace or regulations do not require all animals to be identified with RFID tags.
- Large-volume livestock markets and those that will send a higher percentage of cattle through such a system are much more likely adopters of individual animal identification technology than small-volume markets and/or those that would not heavily use the system. This will add to increased differences in the types of customers and types of cattle that will tend to frequent different auction markets. For example, cattle that are under certification programs that require individual animal identification, source, and/or age verification will find auction markets with electronic readers and recording systems as more attractive markets than those without these systems.

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**Kati Bolte**  
former Graduate Research Assistant  
Department of Agricultural Economics  
Kansas State University

**Kevin Dhuyvetter**  
Professor  
Department of Agricultural Economics  
Kansas State University

**Ted Schroeder**  
Professor  
Department of Agricultural Economics  
Kansas State University

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