National Beef Quality Audit-2016: Phase 1, Face-to-face interviews

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ABSTRACT: The National Beef Quality Audit (NBQA) is conducted every 5 yr and was most recently again conducted in 2016. Face-to-face interviews gauged progress in quality associated with live cattle production using procedures first utilized in NBQA 2011. The 2016 NBQA was the first in which interviews concerning fed steers and heifers were combined with an audit of market cow and bull beef. Face-to-face interviews were designed to illicit definitions for beef quality, estimate willingness to pay (WTP) for quality attributes, establish relative importance rankings for important quality factors, and assess images, strengths, weaknesses, potential threats, and shifting trends in the beef industry since the 2011 audit. Individuals making purchasing decisions in 5 market sectors of the steer/heifer and cow/bull beef supply chain were interviewed, including packers (n = 36), retailers (including large and small supermarket companies and warehouse food sales companies; n = 35), food service operators (including quick-serve, full-service, and institutional establishments; n = 29), further processors (n = 64), and peripherally-related government and trade organizations (GTO; n = 30). Face-to-face interviews were conducted between January and November of 2016 using a designed dynamic routing system. Definitions (as described by interviewees) for 7 predetermined quality factors, including: (1) How and where the cattle were raised, (2) Lean, fat, and bone, (3) Weight and size, (4) Visual characteristics, (5) Food safety, (6) Eating satisfaction, and (7) Cattle genetics were recorded verbatim and categorized into similar responses for analysis. Compared to NBQA-2011, a higher percentage of companies were willing to pay premiums for guaranteed quality attributes, but overall were willing to pay lower average premiums than the companies interviewed in 2011. Food safety had the highest share of preference among all interviewees, generating a double-digit advantage over any other quality factor. The 2 beef industries have an overall positive image among interviewees, and despite lingering weaknesses, product quality continued to be at the forefront of the strengths category for both steer and heifer beef and market cow and bull beef.

Key words: beef, beef quality, best-worst scaling, market survey, willingness-to-pay

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INTRODUCTION

National Beef Quality Audits (NBQA) were initially conducted based on rationale derived from Total Quality Management principles of W. Edwards Deming. Those same principles leading to the original audit in 1991 hold true for today's beef industry. In NBQA-1991, authors stated that, "The U.S. cattle industry cannot expect improvements in prices for its products/byproducts when 'quality' doesn't warrant such a price increase". Deming described quality from 2 different perspectives. The first perspective

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was from a production stand point; identifying quality as "conformance to standards" through the prevention of problems. Deming understood that the correction of problems after the fact has nothing to do with quality. He described a second perspective as "meeting consumer wants and needs". Phase 1 of the NBQA historically focused on wants and needs of customers (as opposed to consumers) by interviewing employees that make purchasing decisions for companies that are positioned in the beef marketing chain.

Since 1991, and throughout the history of the audits, multiple areas of concern were identified. The objective of NBQA-2016 face-to-face interviews was to identify producer related beef quality shortfalls from the perspective of packers, retailers, food service, further processors, and government and trade organizations (GTO), and to ascertain willingness to pay (WTP) estimates, best/worst scaling, and views of the industry.

MATERIALS AND METHODS

No animals were used in this study, thus, no IACUC approval was needed.

Face-to-face interviews were administered across the U.S. from January through November 2016 using a designed, dynamic-routing software system. Interviews targeted individuals that make purchasing decisions, individuals very knowledgeable about purchasing requirements within U.S. beef companies, or technical personnel employed by peripherally related GTO. Five sectors of the U.S. beef supply chain for steers and heifers and market cows and bulls were interviewed: packers (n = 36), retailers (n = 35), food service (n = 29), further processors (n = 64), and peripherally related GTO (n = 30). Interviews accounted for approximately 92% of packers, > 55% of retailers, and > 25% of food service companies marketing beef in the U.S. while market share of further processors was unclear.

Computer-Assisted Interview Software

A dynamic-routing, computer-assisted interview program was developed using the Qualtrics software platform (Qualtrics 2016, Provo, UT). The computer program standardized administration of the interview such that the order of questions was "designed" to prevent the "leading" of interviewees to answers by those administering the interview. Additionally, the program allowed for routing of questions based on individual's responses and provided sliding scales to interpret a respondent's WTP once it was established that they were, in fact, willing to pay a premium for a given quality attribute. Subtle changes in contrast with NBQA-2011 (Igo et al., 2013) were adapted to improve the interview process.

Interview Overview

Interviews began with demographic questions designed to briefly characterize interviewee's companies or organizations. Demographic questions also allowed dynamic routing of subsequent questions. Sectors of the industry not associated with purchasing, such as GTO, were not asked to answer financial questions. Likewise, companies purchasing only steers and heifers or only cows and bulls were routed such that they answered questions only associated with that portion of the audit, while companies purchasing both types of beef answered questions from both perspectives.

Economic questions followed demographic questions closely. Respondents (except those in the GTO sector) were asked to list financial considerations affecting their purchasing decisions. The goal of including financial questions before asking quality questions was to separate the influence of such factors on purchasing from those associated with quality in the mind of respondents.

Willingness-to-pay (WTP) questions immediately followed, and were broken into 2 separate categories. To accurately determine a respondent's WTP for a quality attribute, it was key to first identify non-negotiable quality traits that a company "*must have*" before continuing with a business transaction. Respondents were asked to list all attributes of cattle or beef products that they absolutely *must have* before purchasing the product. Responses were categorized into 1 of the 7 predetermined quality factors by trained interviewers and were then asked: "if that trait could not be guaranteed, would you still purchase the product at a discounted price"? If the respondent agreed to purchase the product for a discount, then that quality trait was deemed not absolutely necessary as a prerequisite to purchase, and was therefore removed from the *must have* responses during analysis. For every quality factor that was not determined to truly be a *must have* requirement, a WTP a question was asked: "If your definition of the trait could be guaranteed, would you be willing to pay a premium"? If the respondent answered no, the interviewer moved to the next question. If the answer was yes, a follow up question was asked to determine the percentage premium that the respondent was willing to pay for a specific quality category.

Questions to determine best-worst scaling of quality factors followed questions associated with WTP. Eight questions were asked for each type of beef (fed steers/heifers vs. cows/bulls) such that 7 of the questions included a triad of quality factors, while the eighth question included all of 7 quality categories; this procedure was previously described by Louivere (Louviere, 2008). Respondents were asked to select the most important and least important quality factor during each round of ranking from a list of 7 pre-determined quality factors, including: (1) How and where

the cattle were raised, (2) Lean, fat, and bone, (3) Weight and size, (4) Visual characteristics, (5) Food safety, (6) Eating satisfaction, and (7) Cattle genetics.

Questions to elicit perceived definitions for quality factors followed. Questions were phrased as, "What does the [quality factor] mean to your company"? Interviewers recorded entire responses into blank textboxes or into checkboxes populated with common potential answers such as "tenderness" or "flavor". How an interviewee defined each quality factor was critical to extracting meaning from the WTP estimates and the relative importance responses administered in preceding questions.

Images, strengths, weaknesses, potential threats, and changes since the last NBQA-2011 audit were the last set of questions asked; all allowed open-ended responses. Entire responses were recorded verbatim into text boxes within survey software and were categorized into groups of similar responses for analyses.

Some interviewees offered multiple responses for each question. In cases of multiple responses from a single individual, each response was counted individually. For instance, if a respondent stated that weight and size meant, "how large the individual muscles were," and "how consistent they were in size," the analysis was conducted so that both statements were counted as 2 separate responses.

Data Collection

Research institutions involved in conducting face-to-face interviews included Colorado State University, Oklahoma State University, and Texas A&M University. Following previous NBQA precedent (Igo et al., 2013), teams of 2 trained interviewers conducted each face-to-face interview. One individual would conduct the interview and record responses into the Qualtrics dynamic routing pre-programed system, while the other individual would manually record responses on a written copy of the interview template for quality control. Interviews were conducted at company headquarters and trade meetings between January and November 2016.

Statistical Analysis

A binary logit model using the glimmix procedure of SAS (SAS Inst. Inc., Cary, NC) was used to estimate statistical probabilities that a respondent would select a quality factor as a *must have*, if the quality category was indeed a *must have*, and the WTP a premium for a guarantee that they would receive the desired quality category. Probabilities were calculated and means separated at $\alpha = 0.05$.

An ANOVA using the MIXED procedure of SAS, and which included market sector as a fixed effect, was used to estimate the average percentage premium that respondents were willing to pay for each quality category given that the category was not a *must have*. Least squares means were calculated and separated at $\alpha = 0.05$.

Best-worst scaling analytics were based on the methods utilized by Wolf (2013) to determine policy preferences within the U.S. Dairy industry. To calculate shares of preference for each category, each respondent's best-worst scaling survey results were estimated using a multinomial logit model (Greene, 2003) within SAS. After utilizing the multinomial logit model, estimated coefficients and variance-covariance terms were used to generate a multivariate normal distribution of each estimated parameter using a Monte Carlo procedure proposed by Krinsky and Robb (1991) within Simetar (Richardson and Outlaw, 2008). To calculate the share of preference for each category, procedures by Lusk and Briggeman (2009)were followed. To test whether shares of preference statistically differed from each other, pairwise combination tests were conducted for all categories (Poe et al., 2005). In this application, probabilities generated a cardinal ranking system of relative importance. Mean separations of the calculated shares of preference were compared via ANOVA using the MIXED model of SAS ($\alpha = 0.05$) with quality factor serving as the fixed effects of the model. This system can be used to identify magnitudinal differences between quality factors. For example, if a share has a value twice as large as another, one may conclude that one share is twice as important as the other.

Because the steer and heifer audit was conducted simultaneously in 2016 with the market cow and bull audit for the first time, it was essential to separate steer and heifer answers from cow and bull answers when possible. However, multiple companies participated in both markets. When a company participated in both markets, answers to perspective questions were analyzed separately as if the responses came from 2 individual firms.

RESULTS AND DISCUSSION

Demographics

Industry-wide, there appeared to be a substantial increase in numbers of dairy cattle harvested as a replacement for shortened supplies of native beef animals compared to 2011 (Igo et al., 2013). Additionally, the average number of brand-labeled beef items increased from 2011 (Igo et al., 2013) in the marketplace, coinciding with concerns expressed about size inconsistencies in beef boxes. Researchers also found that penetration of Beef Quality Assurance (BQA) in the market place was severely lacking. When companies were asked if they required their suppliers to

source cattle that were raised using live animal quality assurance programs, less than 5% of companies reported that they mandated BQA in their responses.

Packers

Relative importance of the 7 quality factors (established by the research team) was estimated using methods provided by Louviere (2008). "Food safety" (36.7% shares of preference; Table 1) was most important and was preferred more than twice as often as "Lean, fat, and bone" (13.7%; Table 1), which was the second most important. When asked to define what the term "food safety" meant to their company, 40% (Table 2) defined it as a "critical" part of business and when pressed further for a definition, 29% (Table 2) responded with "pathogen free". Thirty-one percent of packers identified "food safety" as a *must have*, and when they did not identify it as a *must have,* 71% were willing to pay an average premium of 11.13% (Table 3). "Lean, fat, and bone" was defined by packers as "yield" (36%; Table 2) and "lean to fat ratio" (26%; Table 2). Furthermore, 17% (Table 3) of packers required a guaranteed "lean, fat, and bone" before purchasing cattle.

The third most important factor for packers was "how and where the cattle were raised" (11.37%; Table 1), which they defined as "source location" (38%; Table 2; the geographic region the cattle were raised in) or "welfare/handling" (28%; Table 2). "How and where the cattle were raised" was tied ($P > 0.05$) with "food safety" as the most frequently ($P < 0.05$) identified as *must have* (31%; Table 3), but generated the second lowest premium (5.28%; Table 3). "Eating satisfaction" (11.17%; Table 1) was the fourth most important category. Curiously, "eating satisfaction" ranked much lower than the same trait had in the previous audit (Igo et al., 2013), which could potentially be linked directly to economic fluctuations in 2015 and 2016. Not a single packer listed "eating satisfaction" as a *must have*, but 55% were willing to pay an average premium of 10% (Table 3) to guarantee it, which they primarily described as "customer satisfaction" (29%; Table 2) driven by "tenderness" (17%; Table 2) and "flavor" (14%; Table 2). "Cattle genetics" (10.97%; Table 1), defined as "breeds", (39%; Table 2) was more important to packers than "weight and size" (9.3%; Table 1), defined as "cattle size", (40%; Table 2).

The quality category of least importance to steer and heifer packers was "visual characteristics" (6.8%; Table 1), which they defined primarily as "live cattle composition" (45% Table 2). One packer told of his experiences buying cattle primarily by visual characteristics, stating that "Anybody buying cattle knows that you want them to look good, but that you can never really tell what their carcass will look like when they're alive".

Table 1. Shares of preference (± SE) for relative importance of quality factors for steer and heifer beef

Quality category	Packer	Retailer	Food service	Further processor	GTO
How and where cattle were raised	11.4[c] (0.05)[1]	6.3[d] (0.03)	6.1[e] (0.03)	5.3[f] (0.02)	12.2[c] (0.05)
Lean, fat, and bone	13.7[b] (0.06)	4.7[f] (0.03)	9.3[c] (0.05)	9.2[d] (0.03)	10.7[d] (0.05)
Weight and size	9.3[f] (0.04)	6.1[e] (0.09)	9.0[d] (0.04)	10.2[c] (0.03)	8.9[e] (0.04)
Visual characteristics	6.8[g] (0.03)	9.3[c] (0.03)	5.7[f] (0.03)	7.4[e] (0.02)	11.3[d] (0.05)
Food safety	36.7[a] (0.13)	44.0[a] (0.04)	46.3[a] (0.15)	46.5[a] (0.10)	30.2[a] (0.12)
Eating satisfaction	11.2[d] (0.05)	23.6[b] (0.14)	18.5[b] (0.08)	16.0[b] (0.05)	17.6[b] (0.07)
Cattle genetics	11.0[e] (0.05)	6.0[e] (0.02)	5.1[g] (0.03)	5.4[f] (0.02)	9.1[e] (0.04)

[a–c]Percentages within each column without a common superscript differ ($P < 0.05$).

[1]Standard Error of the Mean.

Packers identified a larger number of quality factors as *must haves* and were more willing to pay a premium for quality guarantees, but were willing to pay less for those guarantees than in NBQA-2011 (Igo et al., 2013). Best-worst rankings for market cow and bull packers are presented in Table 4. "Food safety" again dominated relative importance rankings at 56.3%, with the second most important factor of "lean, fat, and bone" at 13.4%. Following the 2 most important quality factors of "food safety" and "lean, fat and bone", the remaining quality factors had comparatively low shares of preferences when compared to the steer and heifer packers.

Retailers

For retailers, "food safety" (44.0%; Table 1) was the most important quality category, which, similarly to NBQA-2011, retailers primarily defined as being "produced within a safe environment" (25%; Table 2). Food safety also was described as "critical to business" and as "an obligation to consumers" (23% and 18%, respectively; Table 2). Twenty-four percent of retailers determined that "food safety" was a *must have,* but of the companies not describing "food safety" as *must have,* 46% said they were willing to pay an average premium of 9.36% (Table 3).

"Eating satisfaction", primarily defined as "customer satisfaction" (Table 2), was the second most important factor ($P < 0.05$; 23.6%; Table 1) and was more than twice as important as "visual characteristics" (Table 1). When describing "eating satisfaction", one retailer stated that "It is very important, if it [the product] doesn't taste good and isn't tender, people won't come back and buy it". "Customer satisfaction" was

Table 2. Categorized responses from interviewed companies for explaining what the pre-identified quality categories mean to their company as it relates to all beef products

	Packer		Retailer		Food service		Further processors		GTO	
Quality factor	Most frequent[1]	Definition	Most frequent	Definition	Most frequent	Definition	Most frequent	Definition	Most frequent	Definition
How and where the cattle were raised	38%	Source location	47%	Geography	27%	Animal welfare	29%	Geography	32%	Production practices
	28%	Welfare/handling	18%	Animal well-being	22%	Local/COOL	19%	Production practices	20%	Geography
	13%	Feed	16%	Other	14%	Feed	10%	Welfare	10%	Marketing
Cattle genetics	39%	Breeds	37%	Breed	43%	Breeds	48%	Breeds	26%	Breeds
	27%	Quality	26%	Quality	17%	Ability to guarantee quality	20%	Unimportant	19%	Improvements
	11%	Nothing*	13%	Bloodline	17%	Product improvements	17%	Quality improvement	16%	Eating quality
Weight and size	40%	Cattle size	27%	Uniformity in cuts	46%	Cut sizes	25%	Cut sizes	33%	Carcass weights
	29%	Cut sizes	24%	Cut sizes	20%	Yield	21%	Size of the subprimal	15%	Dosage size
	22%	Carcass weight	18%	Subprimal weights	12%	Unimportant	10%	Consistency	15%	Cut sizes
Visual characteristics	45%	Live cattle composition	34%	Color	32%	Quality of the product	23%	Appropriate product color	27%	Live animal
	17%	Other	18%	Marbling	18%	Eye appeal	16%	Lean/trimmed product	20%	Other
	13%	Animal health	15%	Eye appeal	16%	Nothing	12%	Marbling	17%	Hide color
							11%	Unimportant		
Food safety	40%	Critical	25%	Produced in a safe environment	19%	Top priority	32%	Critically important	19%	Obligation to consumer
	29%	Pathogen free	23%	Critical to business	19%	Wholesomeness	19%	Produced in a safe environment	14%	Trade
	13%	Obligation to consumer	18%	Obligation to consumer	19%	Pathogen testing	9%	Free of pathogens	12%	Residues
					9%	Brand protection	9%	Compliance	12%	Critical to business
					9%	Supplier insurance			12%	Pathogen free
Lean, fat, and bone	36%	Yield	27%	Yield	33%	Lean to fat ratio	21%	Lean to fat ratio	27%	Yields
	26%	Lean to fat ratio	22%	Lean to fat ratio	18%	Yield	20%	Boneless	17%	Drug administration
	13%	Fat thickness	14%	Lean to bone	13%	Bones	14%	Yields	17%	Lean to fat ratio
							13%	Specifications		
Eating satisfaction	29%	Customer satisfaction	23%	Customer satisfaction	26%	Customer satisfaction	35%	Customer satisfaction	16%	Customer satisfaction
	17%	Tenderness	20%	Tenderness	18%	Flavor	13%	Tenderness	16%	Experiences
	14%	Flavor	13%	Flavor	11%	Tenderness	10%	Flavor	12%	Flavor
					11%	Quality	6%	Quality	12%	Tenderness
									9%	Returning customers

[1]Most frequent = Top 3 most frequent and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 3. Least Squares Means (Confidence Limits) for probabilities of "must haves", paying premiums, and the average values (%) of paying premiums

Sector	WTP[1]	How and where cattle were raised	Lean, fat, and bone	Weight and size	Visual characteristics	Food safety	Eating satisfaction	Cattle genetics
Packers	Must Have[1]	0.31[a]	0.17[ab]	0.09[b]	0.11[b]	0.31[a]	None[4]	0.11[b]
		(0.18–0.49)	(0.08–0.33)	(0.03–0.23)	(0.04–0.27)	(0.18–0.49)		(0.04–0.27)
	Premium[2]	0.42[ab]	0.65[ab]	0.47[ab]	0.39[b]	0.71[a]	0.55[ab]	0.45[ab]
		(0.23–0.64)	(0.44–0.82)	(0.30–0.64)	(0.23–0.57)	(0.50–0.85)	(0.38–0.71)	(0.28–0.63)
	Premium %[3]	5.28	7.43	10.77	5.17	11.13	10.06	9.85
Retailers	Must Have	0.30[a]	0.18[ab]	0.06[b]	0.09[b]	0.24[a]	0.36[a]	0.18[ab]
		(0.17–0.48)	(0.08–0.35)	(0.02–0.21)	(0.03–0.25)	(0.12–0.42)	(0.22–0.54)	(0.08–0.35)
	Premium	0.38[b]	0.54[b]	0.65[ab]	0.61[ab]	0.46[b]	0.84[a]	0.59[ab]
		(0.20–0.60)	(0.35–0.73)	(0.47–0.79)	(0.42–0.77)	(0.27–0.65)	(0.61–0.95)	(0.38–0.77)
	Premium %	3.30	6.50	6.5	6.71	9.36	12.59	10.15
Food service	Must Have	0.08[bc]	0.19[abc]	0.11[bc]	0.15[bc]	0.42[a]	0.35[ab]	None
		(0.02–0.26)	(0.08–0.39)	(0.04–0.30)	(0.06–0.35)	(0.25–0.62)	(0.19–0.55)	
	Premium	0.45[a]	0.39[ab]	0.55[a]	0.15[b]	0.50[a]	0.56[a]	0.29[ab]
		(0.26–0.66)	(0.20–0.62)	(0.34–0.74)	0.05–0.38	(0.26–0.74)	(0.32–0.78)	(0.15–0.50)
	Premium %	11.78[a]	3.3[b]	7.5[a]	6.67[ab]	3.3[b]	8.75[a]	7.29[a]
Further processors	Must Have	0.09[b]	0.32[a]	0.11[b]	0.08[b]	0.33[a]	0.14[b]	0.06[b]
		(0.04–0.19)	(0.22–0.45)	(0.05–0.21)	(0.03–0.17)	(0.23–0.47)	(0.07–0.25)	(0.02–0.15)
	Premium	0.47[b]	0.46[b]	0.67[a]	0.36[b]	0.41[b]	0.57[ab]	0.39[b]
		(0.35–0.60)	(0.30–0.62)	(0.53–0.78)	(0.24–0.49)	(0.28–0.57)	(0.44–0.69)	(0.27–0.52)
	Premium %	6.17	8.14	7.03	7.26	10.0	5.55	6.90

[a–c]Means within a row for each sector without a common superscript differ ($P < 0.05$).

[1]*Must have* = odds of a category identified as a *must have*.

[2]Premium = odds a sector would be willing-to-pay a premium WTP for guarantee of their definition of each quality factor.

[3]Premium % = average percent premium respondents were willing to pay for guarantee of their definition of each quality factor.

[4]No probabilities were calculated for the sector with 0 observations for this attribute.

Table 4. Shares of preference (± SE) for relative importance of quality factors in cow and bull beef market

Quality category	Packer	Retailer	Food service	Further processor	GTO
How and where cattle were raised	7.8[d] (0.05)[1]	1.5[e] (0.06)	2.9[f] (0.04)	4.4[f] (0.03)	10.6[d] (0.07)
Lean, fat, and bone	13.4[b] (0.08)	6.1[d] (0.23)	11.1[b] (0.12)	11.7[b] (0.07)	14.0[b] (0.08)
Weight and size	8.4[c] (0.05)	1.8[e] (0.07)	4.9[d] (0.06)	5.3[d] (0.04)	7.1[f] (0.04)
Visual characteristics	4.5[f] (0.03)	21.2[b] (0.74)	4.2[e] (0.05)	4.9[e] (0.03)	9.2[e] (0.06)
Food safety	56.3[a] (0.20)	52.3[a] (1.58)	66.4[a] (0.29)	62.7[a] (0.18)	39.0[a] (0.20)
Eating satisfaction	5.4[e] (0.04)	15.9[c] (0.57)	8.4[c] (0.09)	8.2[c] (0.05)	13.0[c] (0.08)
Cattle genetics	4.1[g] (0.03)	1.1[e] (0.05)	2.1[g] (0.03)	2.7[g] (0.02)	7.2[f] (0.05)

[a–c]Percentages within each column without a common superscript differ ($P < 0.05$).

[1]Standard Error of Mean.

the primary definition of "eating satisfaction" followed by "tenderness" and "flavor" (20 and 13%, respectively; Table 2). During the interviews, it was apparent that retailers fundamentally understand their consumers' purchasing patterns and complaints. Similar to studies performed by Platter et al. (2005)and Huffman et al. (1996), retailers were very aware of the impact that "eating satisfaction" has on maintaining repeat customers, as 36% of retailers required guaranteed "eating satisfaction" as a *must have* (Table 3). Of retailers not requiring "eating satisfaction" as a *must have*, 84% were willing to pay an average premium of 12.6% (Table 3) for guaranteed "eating satisfaction".

"Visual characteristics," primarily described as "color" by 34% of respondents (Table 2), was another category related to customer purchasing. Despite the knowledge that color does not necessarily affect eating satisfaction (Carpenter et al., 2001), color is a primary driver for beef purchases (Smith et al., 2000; Font-i-Furnols and Guerrero, 2014; Holman et al., 2016). Retailers know how important color is to their bottom line, and although only 9% require "visual characteristics" as a *must have,* 61% were willing to pay an average premium of 6.7% to guarantee it (Table 3). Following the 3 most important factors, differences between quality categories narrowed considerably with "lean, fat, and bone" identified as "yield" and "lean to fat ratio" (27% and 22%, respectively; Table 2) rating as the least important factor to retailers. Tighter

windows on company-specific cutting specifications could be the reason that "lean, fat, and bone" guarantees ranked so lowly in importance, as there are already mechanisms in place to control this quality category.

Very few retailers claimed to participate in the market cow and bull industry, with only 7 of the 35 companies interviewed stating that they purchase beef from market cows and bulls. Nevertheless, the cardinal ranking of quality factor importance can be found in Table 4. It should be noted that, of retailers stating that they purchased beef from market cows and bulls, they answered the majority of questions from the perspective of ground beef. "Food safety" (52.3%), followed by "visual characteristics" (21.2%) and "eating satisfaction" (15.9%), were the quality categories that dominated best-worst rankings with "cattle genetics" (1.1%; Table 4) as the least important quality factor ($P < 0.05$). Retailers were the only market sector that did not rank "visual characteristics" toward the bottom of the best-worst ranking system. Considering business models for the marketing sectors, this discrepancy fit expectations. Retail meat purchasing decisions are influenced by color more than any other quality factor because consumers most often associate color with freshness (Mancini and Hunt, 2005).

Food Service

"Food safety", "eating satisfaction", and "lean, fat, and bone" (46.3, 18.5, and 9.3%, respectively; Table 1) were the 3 most important quality factors to food service providers with "cattle genetics" (5.1%) ranked the least important ($P < 0.05$). According to food service companies, the term "food safety" was described equally as the "top priority", "wholesome", or "pathogen free" 19% of the time (Table 2). "Food safety" was more than twice as important ($P < 0.05$) as "eating satisfaction" and, before 2011, had never even been listed as a top 10 quality concern (Smith et al., 1992; Smith et al., 1995; Smith et al., 2006). Forty-two percent of food service respondents cited "food safety" as a *must have* category, and 50% of companies not listing it as a *must have* category were willing to pay an average of 3.3% (Table 3) premium for "food safety" guarantees.

Food service providers defined "eating satisfaction" as "customer satisfaction" 29% of the time, 18% described the term as "flavor", and 11% as "tenderness" (Table 2). Food service providers required "eating satisfaction" 35% of the time while 56% of remaining companies were willing to pay an average premium of 8.8% (Table 3) for guaranteed "eating satisfaction". "Eating satisfaction" was tied with "food safety" ($P > 0.05$) for the most likely quality factor to be required before purchasing and ($P > 0.05$) as the trait companies were most willing to pay a premium for (Table 3). Following previous consumer research (Boleman, 1997; Miller et al., 2001; Platter et al., 2003), it is widely known that consumers are willing to pay a premium for positive eating experiences and can differentiate multiple levels of known sensory differences within steaks. An ability to provide a consistent, positive eating experience generates more exposure for the restaurant to new customers and increases rates of returning customers. It was apparent during interviews how passionate restauranteurs were about "eating satisfaction" and the impact it could have on their business. One operator stated "Customer satisfaction: it's all about eating satisfaction and the consumer telling their friend about their experience".

"Lean to fat ratio" was used to define the "lean, fat, and bone" quality category by 33% of the respondents (Table 2) with 18% of respondents defining it as "yield" and 13% referring to the presence of "bones" within the product. CattleFax estimated that ground beef consumption today has grown to between 55 and 60% of total beef consumption. Therefore, it is logical that foodservice companies would place emphasis on a specific "lean to fat ratio" within their ground beef blends. Although companies have tight specifications already in place for "lean, fat, and bone" percentages, 34% of companies were willing to pay an additional 7.6% (Table 3) premium for increased guarantees of agreed on lean percentages. One restauranteur mentioned "Ensuring proper ratios will entice more business between a supplier and customer, and will also play key roles in the guests' experience and if they would be willing to repeat the purchase of that menu item". Food service companies stated that 43.5% of their beef purchases were subprimals to be cut in the back of the stores; "yield" and the amount of trimming required to reach serving specifications was critical because there is rarely an outlet for trimmings in large food service companies and it is widely considered waste. "Cattle genetics", predominantly defined as "breed" by 43% (Table 2) of respondents, ranked last ($P < 0.05$) in relative importance and none (Table 3) of the companies considered "cattle genetics" a *must have* for purchase. Additionally, more than half (55.2%, Table 5) believed the steer and heifer industry elicits a positive image.

Of the 29 food service companies, 10 claimed to participate in the market cow and bull market and best-worst rankings for quality categories can be found in (Table 6). "Food safety" dominated rankings with 6 times the shares of preferences (66.4%) than the second most important quality category "lean, fat, and bone" (11.1%). Again, like retailers, most companies only focused on beef from the cow and bull market as trimmings or ground beef and, for the clear majority, were not answering questions from the perspective of whole muscle cuts.

Table 5. Categorized responses from interviewed companies describing their belief of the image of steer and heifer beef industry

Packer		Retail		Food service		Further processing		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
33.0%	Good image	75.0%	Positive	55.2%	Positive image	39.1%	Positive image	51.5%	Positive image
12.5%	Unknown	9.4%	Improving image	10.3%	Uneducated customers	27.5%	Negative	27.3%	Negative
12.5%	Improving image	9.4%	Negative	10.3%	Improving image	13.0%	Improving image	6.1%	No opinion
12.5%	Negative			10.3%	No position			6.1%	Family farms and old west

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 6. Categorized responses from interviewed companies describing their belief of the image of market cow and bull beef industry

Packer		Retail		Food service		Further processing		GTO	
Most frequent[1]	Responses	Most frequent	Responses	Most frequent	Responses	Most frequent	Responses	Most frequent	Responses
26.1%	Negative	50.0%	Positive image	25.0%	Unknown	33.3%	Positive	35.7%	Positive image
26.1%	Positive	25.0%	Same as fed	16.6%	Good image	13.3%	Negative	35.7%	Negative
21.7%	Improving image	12.5%	Negative	16.6%	Unknown to consumers	13.3%	No Image	21.4%	No Image
		12.5%	Improving image	16.6%	Decreasing in competition	6.7%	Unknown to consumers		

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Further Processors

Companies classified as "further processors" consisted of grinding operations, purveyors, cookers, and distributors and represented a much broader perspective than other, more narrowly focused sectors. Nevertheless, "food safety" ranked the highest ($P < 0.05$) of the 7 quality categories, generating 46.5% of the shares of preference (Table 1). "Food safety" was most frequently described as "critically important" (32%) or as products being "produced in a safe environment" (19%) and "pathogen free" (9%; Table 2). Additionally, 33% (Table 3) of companies required a guarantee of "food safety" before completing the purchase. Of the companies not identifying "food safety" as a *must have* category, 41% were prepared to pay a premium of 10.0% (Table 3). The level of attention paid to food safety from the further processing sector was made very clear by the clear majority of the respondents, "Food safety is what the industry is based on. Number 1 factor in our production and for consumers buying our product".

Similar to all other sectors dealing directly with end consumers, "eating satisfaction" ranked second ($P < 0.05$) to "food safety", with 15.96% of the shares of preference (Table 1). "Eating satisfaction" again was defined as "customer satisfaction" by 35% of companies interviewed, with "tenderness" and "flavor" reflecting 13 and 10% of how this category was defined, respectively (Table 2). Fourteen percent of further processors required guaranteed "eating satisfaction", but more than half (57%) were willing to pay a 5.6% (Table 3) premium for guaranteed "eating satisfaction".

"Weight and size" was the third most important quality category for further processors and was defined as "cut sizes" (25%), "subprimal size" (21%), "consistency" (10%) and "unimportant" (10%). With so many further processors buying steaks and roasts, increasing cattle sizes are causing issues with respect to meeting customer specifications for thicknesses and weights. Therefore, it was not surprising that 67% (Table 3) of further processors would be willing to pay a premium for a guaranteed weight and size. While discussing a customer, one steak purveyor said: "White table cloths want smaller subprimals to control the portion and thickness of steaks". Other companies simply want the products they purchase to be more consistently sorted before reaching their facility, and other companies only grind, so weight and size of raw trimmings they buy do not matter to them or were "unimportant".

Best-worst rankings by companies participating in the market cow and bull beef industry can be found in (Table 4). Rankings of further processors for market cows and bulls very closely mirrored rankings of food service

providers. As with all rankings, "food safety" was most important ($P < 0.05$), garnering 62.7% of the shares of preference, while "lean, fat, and bone" represented 11.7% as the second most important quality category (Table 4).

Government and Trade Organizations

Although GTO's do not purchase beef and were not subjected to WTP questions of the interview, it was important to understand their perspective on the industry and to provide guidance as to the issues that are likely to be discussed in future policy, trade, and developing sciences. All GTO's were asked questions pertaining to both the fed cattle and market cow and bull portions of the beef industry. Best-worst rankings for each sector differed except in relation to the ranking for "food safety", which was most important for both industries (Tables 1, 4). "Food safety" was defined by GTO's as "obligation to consumers" by 19%, "trade impacts" by 14%, "residues" by 12%, "crucial to business" by 12%, and 12% reported "food safety" as meaning "pathogen free" (Table 2). One GTO respondent said: "(It's the) baseline for being in the meat business. Without food safety, nothing else matters".

Government and trade organizations ranked "eating satisfaction" as the second most important quality category ($P < 0.05$; Table 1) for steers and heifers and described it as "customer satisfaction" 16%, "customer experiences" 16%, "flavor" 12%, and "tenderness" 12%. For market cows and bulls, the second most important factor was "lean, fat, and bone" ($P < 0.05$; Table 4) with 27% of interviewees defining that category as "yield" (Table 2), with the addition of multiple references to actual yield grades. The second most offered response included the impact that particular "drug administration" can have on the specific tissues (17%; Table 2). Third, ($P < 0.05$) was the "Lean to fat ratio" presented within the product, primarily from the perspective of trimmings produced by market cows and bulls.

For GTO, "How and where the cattle were raised" was the third most important fed beef quality category ($P < 0.05$; Table 1), with the predominant definition described as "production practices" (32%; Table 2), followed by "geography" (20%) and "marketing" (10%). When discussing "production practices," respondents were primarily concerned about marketing claims and how to classify the animals produced under the premise of potential branding opportunities. "Geography" meant the location within the country that animals were raised, while "marketing" definitions primarily pertained to the ability to sell products within certain markets, e.g., exports or local vs. non-local. "Eating satisfaction" was listed as the third most important factor ($P < 0.05$) for market cows and bulls (Table 4).

Images, Strengths, Weaknesses, Potential Threats, and Changes from Previous Audits

Open-ended questions regarding the image, strengths, weaknesses, potential threats, and changes from the previous audits for the beef industry were asked. The question "what does your company/organization believe the image of the steer and heifer industry/market cow and bull industry is?" generated polarizing opinions. Companies predominately purchasing steer and heifer beef suggested that the image is mostly positive; however, respondents suggesting a negative image were represented in every sector except food service (Table 5). The image of the beef industry to those predominately purchasing market cow and bull beef was less "positive" when compared to that reported for the steer and heifer beef industry (Table 6). About 25% of retailers and 16.6% of food service companies believed that the image of the market cow and bull sector was either the "same as fed" or "unknown to customers", revealing the lack of consumer knowledge relative to sources of beef items in the marketplace.

When asked about the strengths of the 2 industries it, was obvious that companies involved in the industry are proud of the products being produced. The "product quality" was reported as a strength of the steer and heifer industry by all market sectors (Table 7). Market cow and bull packers, as well as further processors, believed that "product quality" was the biggest strength, while many retailers and GTO focused on the "value" and the positive "economics" of the products. Furthermore, 30.8% of food service companies said they import most of their market cow and bull product (Table 8).

Retailers and food service companies reported that "marketing" was the greatest weakness within the steer and heifer industry, with "consumer communication" as the second most frequently reported weakness among packers (Table 9). Multiple quotes from retailers and food service companies suggested that the beef industry has lacked progress toward addressing consumers' wants and needs with respect to specific production practices and process transparency. Weaknesses identified by the market cow and bull industry focused more on the "animal welfare" perspective than did the steer and heifer industry. Twenty-five percent of cow and bull packers believed the "producers" were the largest weakness, with special attention directed at the timeliness of marketing their animals. Food service, further processors, and GTO all cited "animal welfare" either first or second as the largest weakness of the market cow and bull sector (Table 10). Management of slaughter endpoints and timeliness of culling seemed to be the root of animal welfare concerns from companies that seemingly understood that older, less mobile animals were the primary targets of animal welfare complaints.

Table 7. Categorized responses from interviewed companies describing their belief of the strengths of the steer and heifer beef industry

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
28.5%	Quality	26.9%	Product quality	39.6%	Product quality	28.6%	Product quality	28.3%	Product quality
11.9%	Taste	13.5%	Nutrition	14.6%	Food safety	18.1%	Food safety	19.6%	Production practices
11.9%	Story	11.5%	Sustainability	8.3%	Supply	8.6%	Supply	15.2%	Marketing
11.9%	Food safety	9.6%	Food safety	8.3%	Market	6.7%	Animal welfare		
						6.7%	Consistency		

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 8. Categorized responses from interviewed companies explaining describing their belief of the strengths of the market cow and bull beef industry

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
37.0%	Product quality	33.3%	Value	30.8%	Don't buy U.S.	31.3%	Product Quality	30.0%	Economics
18.5%	Source	22.2%	Product	15.4%	Sustainability	18.8%	Supply	30.0%	Value
18.5%	Value	11.1%	Taste	15.4%	Food safety	12.5%	Food safety	10.0%	Tradition
								10.0%	Product production
								10.0%	cost

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 9. Categorized responses from interviewed companies describing their belief of the weaknesses of the steer and heifer beef industry

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
29.4%	Market	18.6%	Poor marketing	21.2%	Marketing	19.7%	Economics	23.5%	Production practices
17.6%	Consumer communication	11.6%	Supply	18.2%	Production practices	15.5%	Cut sizes	20.6%	Marketing
14.7%	Consistency	11.6%	Size	18.2%	Economics	9.9%	Supply	14.7%	Product quality
		9.3%	Food safety	12.1%	Too fragmented	8.5%	Too few companies	8.8%	Public perception
		9.3%	Environment	12.1%	Supply	7.0%	Too fragmented	8.8%	Traceability

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 10. Categorized responses from interviewed companies describing their belief of the weaknesses of the market cow and bull beef industry

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
25.0%	Producers	20.0%	Product	19.0%	Animal welfare	21.4%	Supply	22.2%	Animal welfare
22.2%	Supply	20.0%	Food safety	14.3%	Too fragmented	14.3%	Product quality	16.7%	Residues
13.9%	Cost	20.0%	Media	14.3%	Residues	14.3%	Economics	16.7%	Traceability
				14.3%	Controversies	14.3%	Animal welfare	16.7%	Quality
								16.7%	Supply

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Potential threats reported within the steer and heifer industry were closely related to the weaknesses, as "poor marketing" has evidently translated into "public perception" being the most cited potential threat by retailers, food service, and further processing companies (Table 11). "Animal Disease" was another concern that was consistently expressed across all sectors of the industry except GTO and, with the memories of Porcine Epidemic Diarrhea Virus and Avian Influenza, companies expressed concern that they did not believe the beef industry could survive similar outbreaks. Multiple government agencies discussed discrepancies between beef, pork, and poultry relative to the development of vaccine banks for known viral and bacterial zoonotic pathogens, and the concern that they had for the beef industry if more resources were not allocated to developing a vaccine bank. Respondents from the market cow and bull beef industry listed a multitude of factors as potential threats, with "residues" and "food safety" as the only truly common themes throughout the sectors (Table 12).

When asked about changes that companies had witnessed since the NBQA-2011, more than 30% of food service and further processors stated "nothing" had changed, while packers cited "grading" and "business expansion" as the primary changes. Retailers responded with "economics" and "nothing", while 13.7% of GTO said they had seen an "improvement" in the industry and another 13.7% said that "trade" has increased (Table 13). When asked what had changed since the National Market Cow and Bull Beef Quality Audit-2007, 50% of retailers and 44.4% of further processors said that "nothing" had changed (Table 14). Packers believed that "supply" (19.5%) had decreased, but "animal welfare" (19.5%) had improved, while 23.1% of food service companies believed that "Food safety" had improved and 35.7% of GTO stated that there was a better "understanding of production" (Table 14).

Conclusions

Companies across all sectors of both industries ranked "food safety" as the highest priority ($P < 0.05$), often garnering more than twice as many shares of preference as the second most important factor (Table

Table 11. Categorized responses from interviewed companies describing their belief of the potential threats for the steer and heifer beef industry

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
22.0%	Market	21.1%	Public perception	17.8%	Public relations	15.7%	Public perceptions	20.4%	Activist groups
15.9%	Animal rights activists	19.3%	Food safety	16.1%	Animal diseases	15.7%	Food safety	14.3%	Regulations
13.6%	Animal disease	12.3%	Media	16.1%	Economics	10.2%	Animal disease	12.2%	Uninformed consumer
13.6%	Food safety	12.3%	Animal Disease	16.1%	Production practices	9.3%	Economics	12.2%	Exports
13.6%	Resources					8.3%	Activist groups	10.2%	Media

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 12. Categorized responses from interviewed companies describing their belief of the potential threats of the market cow and bull beef industry

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
22.2%	Business	41.7%	Food safety	17.6%	Animal welfare	18.9%	Animal disease	18.8%	Trade issues
16.7%	Residues	16.7%	Public perception	17.6%	Meat from alternative sources	10.8%	Activist groups	18.8%	Policy
13.8%	Uneducated consumers	8.3%	Activist groups	11.8%	Media	10.8%	Economics	12.5%	Cost
11.1%	Animal disease	8.3%	Animal welfare	11.8%	Food safety	10.8%	Food safety	12.5%	Residues
				5.9%	Animal rights activists	8.1%	Federal regulations		
				5.9%	Cost	8.1%	Nature		
				5.9%	Too fragmented				
				5.9%	Environmental				

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 13. Categorized responses from interviewed companies explaining what they believed has changed since the 2011 NBQA

Packer		Retail		Food service		Further processor		GTO	
Most frequent[1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
17.5%	Grading	22.4%	Economics	31.4%	Nothing	36.5%	Nothing	13.7%	Improvement
17.5%	Business expansion	18.4%	Nothing	22.9%	Economics	15.9%	Products	13.7%	Trade
12.5%	Supply	14.3%	Improved quality	11.4%	Consumer demands/ perceptions	12.7%	Increased food safety initiatives	11.8%	Cattle size
12.5%	Nothing	8.1%	Consumer awareness					7.8%	Competition
								7.8%	Nothing
								5.9%	Antibiotics
								5.9%	Alignment
								5.9%	Increased food safety initiatives

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

Table 14. Categorized responses from interviewed companies explaining what they believed has changed since the 2007 National Market Cow and Bull Beef Quality Audit

Packer		Retail		Food service		Further processor		GTO	
Most frequent [1]	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response	Most frequent	Response
19.5%	Supply	50.0%	Nothing	23.1%	Increased food safety initiatives	44.4%	Nothing	35.7%	Understanding production
19.5%	Animal welfare	25.0%	Supply	15.4%	Marketing	18.5%	Increased food safety initiatives	28.6%	Antibiotics
12.2%	Costs	12.5%	Improvements	15.4%	Improvement in quality	11.1%	Economics	14.3%	Supply
12.2%	Food safety	12.5%	Increased food safety initiatives	7.7%	Animal welfare				

[1]Most frequent = Top 3 most frequent responses and ties. Response data were evaluated as the number of times that interviewees in each market sector identified the attribute as a definition or description of the given category divided by the total number of responses.

1). "Eating satisfaction" (Table 1), described primarily as "customer satisfaction" (Table 2), was the second most important factor ($P < 0.05$) to all steer and heifer industry sectors except for packers. Therefore, producing a safe product that meets consumer demands for eating quality are the primary factors that companies involved in the steer and heifer industry are concerned with. When companies were asked about the market cow and bull industry, they were primarily answering questions related to beef trimmings generated from those products and not whole muscle cuts. Partially due to the perspective in which the companies were answering the questions, "lean, fat, and bone" was the second ($P < 0.05$) most important factor, and was described as "lean to fat ratio" by multiple sectors, except for retailers, who stated "visual characteristics" was the second ($P < 0.05$) most important quality factor (Table 4). When compared to NBQA-2011, more companies required guarantees of "food safety" across the board and 50% of food service companies stated they required some guarantee of "food safety" before conducting business. Responses also showed that more companies were willing to pay premiums for guaranteed quality factors than in 2011, but that they were willing to pay less for those guarantees, on average (Table 3; Igo et al., 2013). Companies believed that the image of the steer and heifer industry is polarizing, with the majority believing beef is still viewed as "positive" (Table 5) with the primary strength being "product quality" (Table 7). Nevertheless, multiple companies believe the image is "negative" with one of the largest weaknesses as "marketing" (Table 9) and one of the largest threats "public perception". The market cow and bull sector is a less visible and less popular industry compared to the steer and heifer industry. Additionally, the market cow and bull indus-

try is often misunderstood by the general consumer. Furthermore, purchasing agents within the retail and food service industry were often unfamiliar with the sources of trimmings or grinds they are buying. The market cow and bull beef industry is viewed as a high "value", high "quality" (Table 8) product that delivers beef as a more economical alternative to steers and heifers. One of the largest weaknesses that continues to plague the industry are "animal welfare" (Table 10) concerns linked to producers holding cows and bulls past their optimal culling period. The largest potential threats to the industry varied across sectors with "animal welfare", "food safety", and "animal activists" rising as common themes throughout the responses (Table 12). "Nothing" was most often cited as the change from the 2007 NMCBBQA with "increased food safety initiatives" also mentioned (Table 14).

As consumer demands change, it is paramount for the U.S. beef industry to also change to maintain viability. "The U.S. cattle industry cannot expect improvements in prices for its products/byproducts when 'quality' doesn't warrant such increases (Smith et al., 1992)". Identification of the relative importance of quality factors and estimation of the industries WTP for those quality factors has provided targets of improvement to increased profitability within the beef industry. In general, companies are willing to pay for additional quality guarantees, providing the industry and opportunity to increase value to each of the marketing sectors.

LITERATURE CITED

Boleman, S. J. 1997. Consumer evaluation of beef of known categories of tenderness. J. Anim. Sci. 75:1521–1524. doi:10.2527/1997.7561521x

Carpenter, C. E., D. P. Cornforth, and D. Whittier. 2001. Consumer preferences for beef color and packaging did not affect eating satisfaction. Meat Sci. 57:359–363. doi:10.1016/S0309-1740(00)00111-X

Font-i-Furnols, M., and L. Guerrero. 2014. Consumer preference, behavior and perception about meat and meat products: An overview. Meat Sci. 98:361–371. doi:10.1016/j.meatsci.2014.06.025

Greene, W. H. 2003. A latent class model for discrete choice analysis: Contrasts with mixed logit. Transp. Res., Part E Logist. Trans. Rev. 37:681.

Holman, B. W. B., Y. Mao, C. E. O. Coombs, R. J. van de Ven, and D. L. Hopkins. 2016. Relationship between colorimetric (instrumental) evaluation and consumer-defined beef colour acceptability. Meat Sci. 121:104–106. doi:10.1016/j.meatsci.2016.05.002

Huffman, K., M. Miller, L. Hoover, C. Wu, H. Brittin, and C. Ramsey. 1996. Effect of beef tenderness on consumer satisfaction with steaks consumed in the home and restaurant. J. Anim. Sci. 74:91–97. doi:10.2527/1996.74191x

Igo, J. L., D. L. VanOverbeke, D. R. Woerner, J. D. Tatum, D. L. Pendell, L. L. Vedral, G. G. Mafi, M. C. Moore, R. O. McKeith, G. D. Gray, D. B. Griffin, D. S. Hale, J. W. Savell, and K. E. Belk. 2013. Phase I of The National Beef Quality Audit-2011: Quantifying willingness-to-pay, best-worst scaling, and current status of quality characteristics in different beef industry marketing sectors1. J. Anim. Sci. 91:1907–1919. doi:10.2527/jas.2012-5815

Krinsky, I., and A. L. Robb. 1991. Three methods for calculating the statistical properties of elasticities: A comparison. Empir. Econ. 16:199–209. doi:10.1007/BF01193491

Louviere, J. J. 2008. A comparison of importance weights and willingness-to-pay measures derived from choice-based conjoint, constant sum scales and best–worst scaling. J. Bus. Res. 61:903. doi:10.1016/j.jbusres.2006.11.010

Lusk, J. L., and B. C. Briggeman. 2009. Food Values. Am. J. Agric. Econ. 91:184–196. doi:10.1111/j.1467-8276.2008.01175.x

Mancini, R., and M. Hunt. 2005. Current research in meat color. Meat Sci. 71:100–121. doi:10.1016/j.meatsci.2005.03.003

Miller, M., M. Carr, C. Ramsey, K. Crockett, and L. Hoover. 2001. Consumer thresholds for establishing the value of beef tenderness. J. Anim. Sci. 79:3062–3068. doi:10.2527/2001.79123062x

Platter, W. J., J. D. Tatum, K. E. Belk, S. R. Koontz, P. L. Chapman, and G. C. Smith. 2005. Effects of marbling and shear force on consumers' willingness to pay for beef strip loin steaks. J. Anim. Sci. 83:890–899. doi:10.2527/2005.834890x

Platter, W. J., J. D. Tatum, K. E. Belk, J. A. Scanga, and G. C. Smith. 2003. Effects of repetitive use of hormonal implants on beef carcass quality, tenderness, and consumer ratings of beef palatability12. J. Anim. Sci. 81:984–996. doi:10.2527/2003.814984x

Poe, G. L., K. L. Giraud, and J. B. Loomis. 2005. Computational methods for measuring the difference of empirical distributions. Am. J. Agric. Econ. 87:353–365. doi:10.1111/j.1467-8276.2005.00727.x

Richardson, J. W., and J. L. Outlaw. 2008. Ranking risky alternatives: Innovations in subjective utility analysis. WIT Transactions on Information and Communication 39:213–224.

Smith, G., J. Savell, R. Clayton, T. Field, D. Griffin, D. Hale, M. Miller, T. Montgomery, J. Morgan, and J. Tatum. 1992. Improving the consistency and competitiveness of beef—A blueprint for total quality management in the fed-beef industry. The final report of the National Beef Quality Audit—1991, conducted by Colorado State University and Texas A&M University, for the National Cattlemen's Association on behalf of the Cattlemen's Beef Promotion and Research Board.

Smith, G., J. Savell, H. Dolezal, T. Field, D. Gill, D. Griffin, D. Hale, J. Morgan, S. Northcutt, and J. Tatum. 1995. Improving the quality, consistency, competitiveness and market-share of beef. National Beef Quality Audit National Cattlemen's Beef Association, Englewood, CO.

Smith, G. C., K. Belk, J. Sofos, J. Tatum, and S. Williams. 2000. Economic impiications of improved coior stability in beef. Antioxidants in muscle foods: Nutritional strategies to improve quality. John Wiley & Sons, New York., NY: 397-426.

Smith, G. C., J. Savell, J. Morgan, and T. Lawrence. 2006. Report of the June-September, 2005 National Beef Quality Audit: A new benchmark for the US beef industry. In: Proceedings Beef Improvement Federation 38th Annual Research Symposium and Annual Meeting. p. 6-11.

Wolf, C. A. 2013. Dairy farmer policy preferences. J. Agric. Resour. Econ. 38:220.