
Chapter 4

The Future Demand for Food Supply Veterinarians in Beef Cattle Practice Careers

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Introduction

This study provides a systematic analysis of the likely future demand and potential shortages for food supply veterinary medicine (FSVM) professionals in Beef Cattle careers. Six inter-related questions are addressed:

- I. What are the issues and trends likely to drive the future demand for food supply veterinarians in beef cattle careers?
- II. Assuming a continuation of currently unfolding trends and the absence of major catastrophic events, what will be the demand for beef food supply veterinarians over the next several years?
- III. What are the specialized activities (e.g., roles, responsibilities, skill areas, clients served, etc.) that will have substantially higher or lower demand relative to the general pattern of demand in the beef cattle area?
- IV. What are the issues and trends likely to drive the future supply of food supply veterinarians entering beef cattle careers?
- V. Given the pattern of emerging trends and factors influencing supply and demand and assuming the absence of any major catastrophic events, what will be the likely surplus or shortage of food supply veterinarians in beef cattle careers over the next several years?
- VI. Given the answers to the first five questions, how can the FSVM profession take action now to create a better future?

This report provides a description of the research method used and then presents the answers to each of these six questions.

The Delphi Forecasting Technique

Food supply veterinarians live in a changing world. Predicting the future is never an easy task and the changing context of the FSVM profession makes the linear extrapolation of historical trends with econometric models, as was used in the KPMG Mega Study, more problematic. The Delphi forecasting process is an expert judgment forecasting method and is the main alternative to historical trend-based methods. It is the best method for identifying emerging trends and the likely patterns of future demand for FSVM professionals, and determining whether there will be shortages or surpluses of food supply veterinarians in the future.

The Delphi method works hand-in-hand with strategic planning processes in that it appreciates that the future is only partly a function of unfolding larger societal forces that cannot be easily managed or changed. It appreciates that the future is largely a function of trends that, if better understood now, can be acted upon before the future arrives. It is designed to identify leverage points that are important to planned change effort. Strategic action by thoughtful leaders taken now can change the pattern of future demand and shortages/surpluses that experts predict will occur if current trends continue and no catastrophic events occur.

In this study, 13 different sectors of the FSVM profession were identified and a Delphi forecasting process was used to evaluate each sector. The FSVM sectors evaluated are: Academe, Dairy, Swine, Poultry, Beef Cattle, State/Provincial Public Service, three sectors of US Federal Service (Public Health, Animal Health, and Food Safety & Security), Canadian Federal, Industrial Veterinarians in Pharmaceuticals, Small

Ruminants, and Mixed Food Animal Practitioners in Rural Settings. After identifying a sector, experts were identified who could best address the five questions noted above. In general, panels of 15-25 members for each sector were created.

The Delphi method gathers expert opinion and then provides a structured feedback process where experts have an opportunity to consider the views of other experts. The feedback process is structured so experts can change their predictions without any dysfunctional group dynamics that can plague interacting groups. It sets up a learning process where one expert has an opportunity to reconsider his or her judgment in the face of conflicting viewpoints from other experts. This should make the Delphi panel collectively smarter at the end of the process. The Delphi process used had three stages:

1. Panel members completed a first survey that included questions related to the first five questions noted above. We included items, identified from the FSVM literature and asked panel members to rate their influence on the future supply or demand for food supply veterinarians in their sector. We also included open-ended questions giving panel members an opportunity to suggest additional relevant issues not included in the initial listing. After getting panel members to think about the trends and issues driving future demand, we then asked them to forecast demand changes over various time periods between 2004 and 2016. Panel members then rated the influence of various supply related trends. This was designed to help them think about likely future labor supply flows and prepared them to forecast whether there will be shortages or surpluses of veterinarians over these same time periods.

2. The results of the first survey were incorporated into the second survey. New items were derived from a content analysis of the open-ended replies. Demand and supply influence items where there were higher levels of disagreement within the panel were repeated, and the average rating and middle 50% range (between the 25th and 75th percentile) information was presented with each one. A brief report explaining the general patterns in the data, including explanations for disagreement within the panel on future demand and shortage/surplus forecasts, accompanied the second survey. Thus, when panel member re-estimated future demand and shortages/surpluses they did this while considering panel information from the first survey.
3. The third survey followed a similar design strategy. Items with higher disagreement were repeated and the panel average and middle 50% range information were presented in this last survey. In addition, a brief report summarized the results of the second survey. Finally, items describing 18 different possible solutions to the projected shortage were added to this survey addressing the last question noted in the introduction.

Panel members came primarily from the US but experts focused on Canada were also included. Panel members identified whether they had focused on the Canadian versus the US context and additional analysis evaluated whether there seemed to be significant differences in the ratings of the US versus Canada sub-groups. While we see all panel members as having good expertise, we appreciate that some may be more expert than others. Panel members rated their own forecasting expertise and additional analyses contrasted those better than the median “expertise” score with those on the less-expert

side of the median. This analysis identified items where there was significant difference between those two sub-groups. Whenever Canada versus US and expert versus less-expert differences were found, they were noted in the feedback to the panel. With the expertise contrasts, there was a tendency for significant differences in the earlier survey to become less significant in the second or third survey.

Issues and Trends Driving Future Demand for Academic Food Supply Veterinarians

The panel responded to both panel-suggested demand-related items that are unique, as well as items drawn from the general FSVM literature. This later set of 25 items was included in the first surveys to all 13 panels included in this study. In addition to rating the 25 general items, panel members provided suggestions on additional issues influencing demand in the beef cattle FSVM sector. Ten additional items were derived from those open-ended comments for a total of 35 items. In the second survey, the 9 new items were asked and items from the original set of 25 were repeated when there was fair disagreement within the panel's ratings. Higher agreement on several items was reached in the second survey and the items with greater disagreement were repeated a final time in the third survey. The following are the survey items seen as *increasing* future demand (starting with the most influential issues and trends first):¹

Trends Increasing Demand

1. Public concerns over food safety (5.95 on a 7-point scale)²
2. Growing need to track animals entering the food chain (mean: 5.60)
Note that the Canada-focused panel members' mean of 5.0 is significantly lower than the US-focused sub-group mean of 5.67.
3. Animal tracking and identification requirements (mean: 5.52)
Note that the self-rated forecasting experts' sub-group mean of 5.77 was significantly higher than the less-expert sub-group mean of 5.13.

¹ Where significant differences exist between those focused on the Canadian context versus the US-focused sub-group mean, they are noted. Similarly, where significant differences between the ratings of the self-rated forecasting experts' sub-group versus the less-expert sub-group exist, those respective means are noted.

² The items were rated on a 7-point Likert-type scale and evaluated based on the expected influence on future demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase.

4. Public concerns over bio-terrorism (mean: 5.45)
5. Increasing need for cost-efficient animal production (mean: 5.45)
6. Increasing concern for animal health (mean: 5.41)
7. Availability of highly technical or specialized services (mean: 5.40)
8. Zoonotic disease-related human health concerns (mean: 5.39)
9. Client use of veterinary herd management services (mean: 5.33)
Note that the Canada-focused panel members mean of 3.67 is significantly lower than the US-focused sub-group mean of 5.17.
10. Expansion of food safety related regulations (mean: 5.30)
Note that the self-rated forecasting experts' sub-group mean of 5.08 was significantly lower than the less-expert sub-group mean of 5.71.
11. Large operations seeking practiced management and business advice (mean: 5.24)
12. Required third-party certification or verification of standards (mean: 5.24)
13. Increasing concern for animal wildlife (mean: 5.23)
14. Public concerns over bio-terrorism (mean: 5.19)
15. Demands for nutrition consulting (mean: 5.19)
16. Large operations needing production medicine consulting (mean: 5.19)
Note that the Canada-focused panel members' mean of 4.67 is significantly lower than the US-focused sub-group mean of 5.24.
17. More access to global markets for food exports (mean: 5.14)

Note that items with a mean rating of 4.0 and 5.0 (between the “4. No Influence and “5. Slight Increase” scale anchor points) are not presented. See Exhibit D for a listing of these items as well as the distributions and mean ratings of all items used in the 1st, 2nd, or 3rd wave surveys. The mean values noted for each of the above (and following) items are from the last survey in which that item appeared.

Items with means below 4.0 are seen as trends or issues leading to decreases in demand for beef cattle veterinarians. The survey items noted below are trends rated as *decreasing* future demand starting with the most influential factors first:

Trends Decreasing Demand

1. Producers becoming less dependent on services from DVMs (mean: 3.05)³
2. Lack of veterinarians practice management & business skill (mean: 3.10)
3. Slow adoption of new technologies by veterinarians (mean: 3.16)
4. Client concerns about veterinary service costs (mean: 3.62)
5. Curtailment of government support of veterinary services (mean: 3.64)
6. Decreasing demand for individual animal care (mean: 3.67)
7. Federal and/or State/Provincial budgetary constraints (mean: 3.86)
8. Continuing consolidation of large producer operations (mean: 3.95)⁴
Note that the Canada-focused panel members' mean of 3.0 is significantly lower than the US-focused sub-group mean of 4.29

The Planning Matrix

The ratings of these trends and issues are important to the extent that they can be used to understand and plan for the future. Some items noted above identify issues or trends that are more “actionable,” meaning that direct strategic actions can be taken by the profession *without extensive external resources or cooperation of external entities to*

³ The items were rated on a 7-point Likert-type scale and evaluated based on their influence on future demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence.

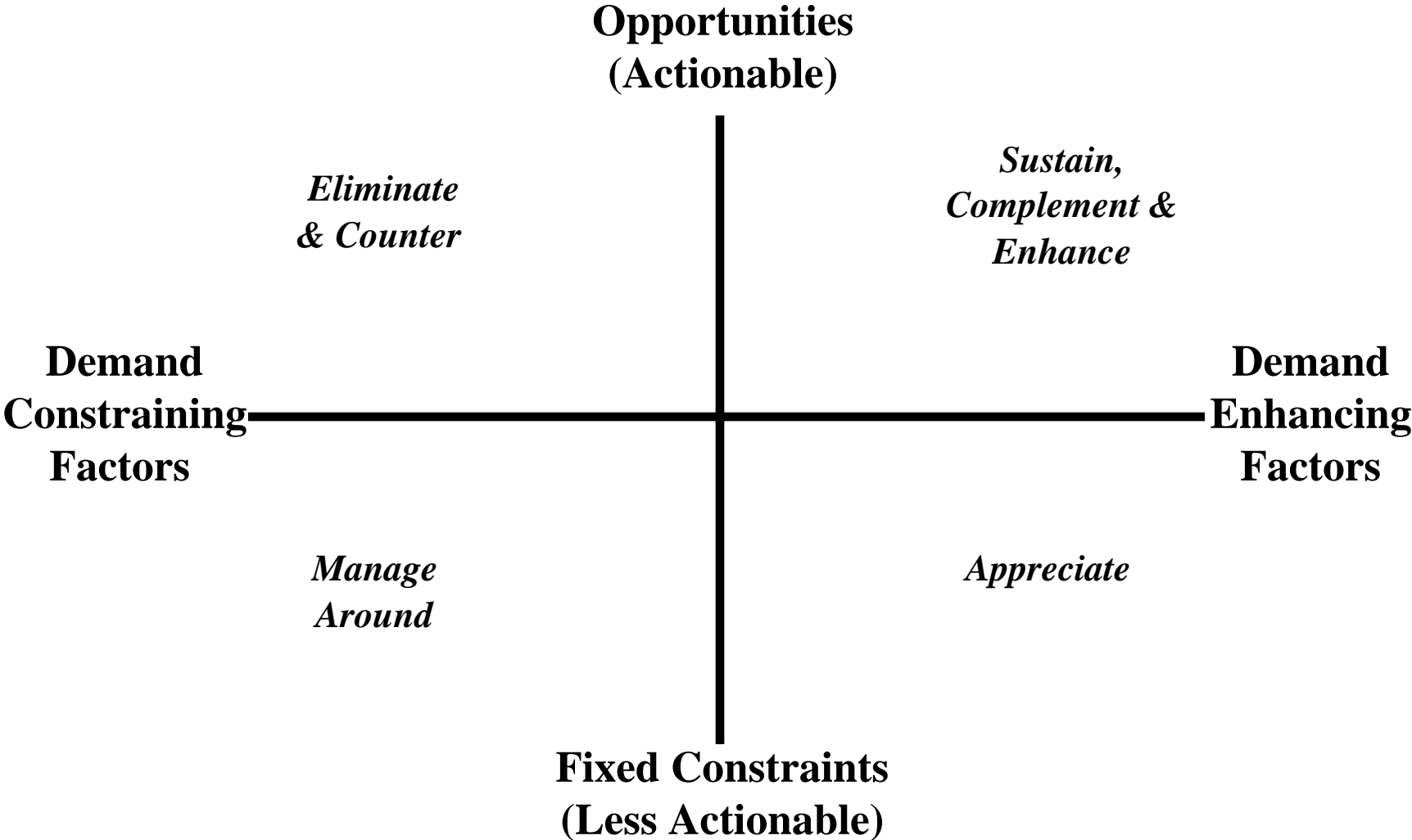
⁴ See Exhibit D for a listing of these items as well as the distributions and ratings of all items used in the 1st, 2nd, or 3rd surveys. Note that items with a mean rating of 4.0 to 5.0 (between the “4. No Influence and “5. Slight Increase” scale anchor points) are, with one exception, not presented. The mean values noted for each of the above (and following) items are from the last survey in which each appeared.

alter the expected pattern of influence suggested by the panel's mean score. Other items identify issues that are fairly fixed constraints and are much less actionable. These items represent general societal concerns where the cooperation of other entities beyond the FSVM profession, such as governments, is needed to change the expected pattern of influence on future demand.

Figure 1 presents a general planning matrix useful in organizing the results and guiding future strategic action. The best targets for strategic action are those in the "actionable" or top-half of that figure. In order to increase future demand, actionable demand-constraining factors (on the left-side of the figure) must be eliminated or countered in some fashion. The top, right-side quadrant represents actionable demand-enhancing opportunities that can be sustained, complemented, or enhanced in some way. The lower quadrants are less- manageable trends and factors. Any strategic responses to the challenges uncovered by this research need to be mindful of these constraints. They represent areas where the profession has less influence and may be areas that must be managed around rather than changed. This matrix will be used to interpret and draw strategic action implications for the panel's ratings.

This planning matrix can be used to organize the results of the analysis of the demand related issues and trends. The listing of the eight demand-decreasing items noted above fit on the left-side of Figure 1. The 17 demand-increasing items logically fit on the right-side of that figure. Figure 2 captures results from the above two listings. Two of the eight demand-decreasing items (items 5 and 7) relate to the *Government Budgetary Constraints* theme noted in Figure 2. These are the least actionable constraints on demand and fit on the lower-left quadrant of this figure. While there is some maneuvering room to

Figure 1 Planning Matrix

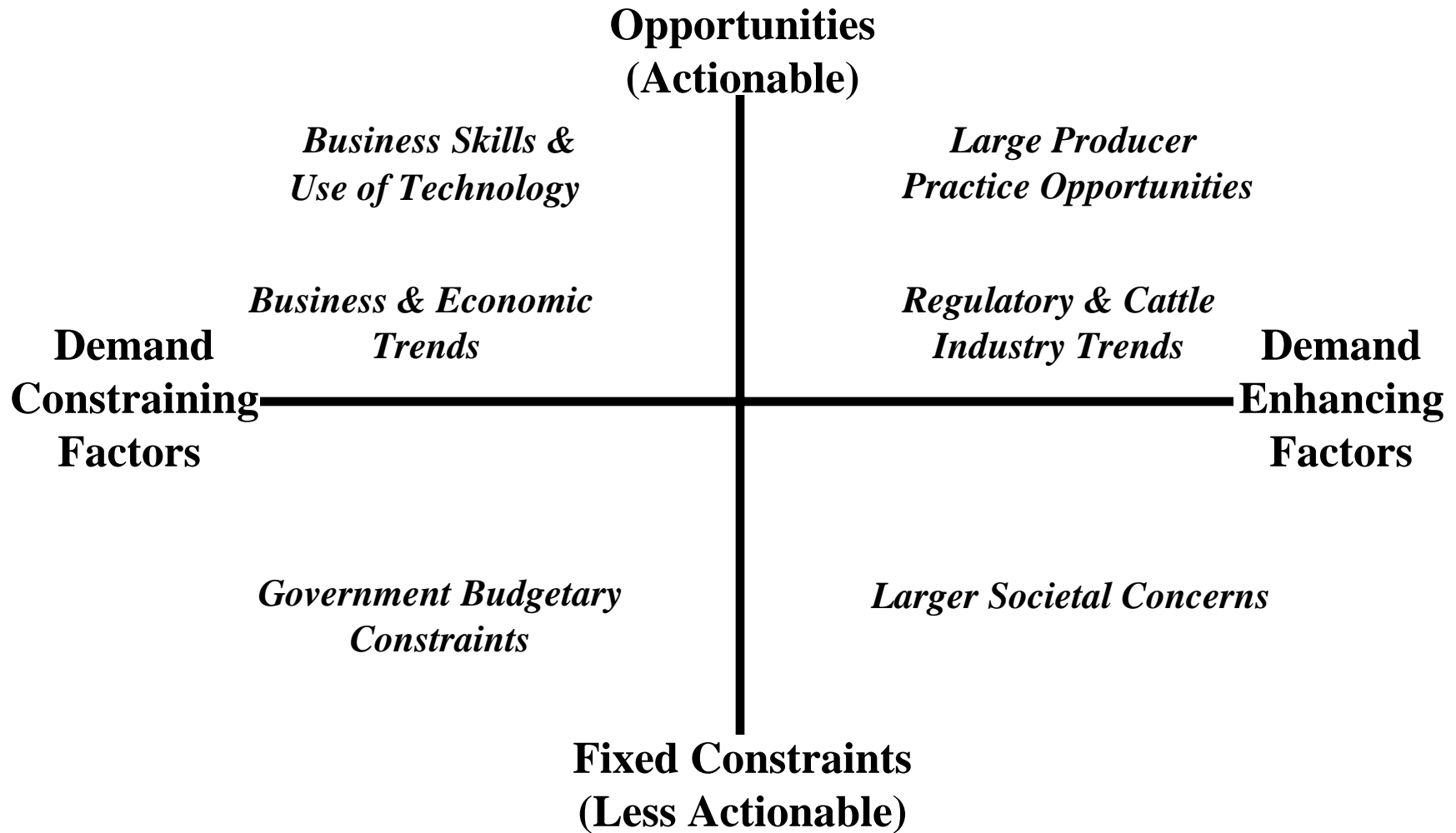


help insure that animal agriculture allocations are hurt less, the reality of large deficits represents a fairly fixed constraint that the profession must manage around. In contrast, two highly ranked issues, items 2 and 3, refer to practice management skills and resistance to new technology. These are self-imposed constraints on demand that can be acted upon and lessened. With educational initiatives, veterinarians can be better prepared and the negative influence that this trend has on demand can be changed. This issue is captured by the *Business Skill and Use of Technology* theme noted on the upper-right quadrant of Figure 2. The remaining items are related to industry consolidation, cost concerns, and changing client needs (items 1, 4, 6 and 8). While these *Business and Economic Trends* partially based in global economic forces and consolidation in the cattle industry, which are not going to be changed, the profession can respond to these general constraints and better prepare veterinarians to deal with this trend. For this reason, this theme is placed near the middle line, but is included in the upper-left quadrant of Figure 2.

The items ranked at the top of the list of demand-increasing trends and issues noted above are frequently *larger societal concerns* and cannot be directly changed. For this reason, that theme has been placed in the lower-right quadrant of Figure 2. These issues need to be understood and appreciated in the strategic planning process. For example, item 1 (food safety concerns), item 4 (bio-terrorism concerns), item 6 (animal health concerns), item 8 (zoonotic disease concerns), and item 13 (wildlife) all touch on larger societal concerns that benefit the profession by encouraging demand. These are not going to be changed by direct strategic action.

Figure 2

Demand Diminishing & Enhancing Issues in the Beef Sector



In contrast, item 7 (specialized services), item 9 (herd management services), item 11 (practice management advice for large producers), item 14 (nutrition consulting), item 15 (production medicine consulting) represent different *large producer practice opportunities* that are very actionable and has been placed in the upper-right quadrant. While some items (7 and 14) are practice opportunities that can be used with smaller beef cattle operations, many of these items explicitly identify practice opportunities involving large operations. The favorable influence of these demand-increasing issues is very actionable and can be further leveraged to increase demand.

The remaining items are related to *regulatory and cattle industry trends*. Items 2, 3, & 12 involve animal tracking and other third-party certifications. These are emerging regulatory requirements. Item 5 (cost-efficient production) and item 17 (global market access) are beef cattle industry trends. These relate to larger economic and social trends which cannot be directly managed; however, the profession's responses to these emerging issues represent a strategic opportunity. Strategic responses to these opportunities are actionable and, for this reason, the theme has been placed in the upper-right quadrant but near the middle line. For example, while the reasons for the emerging need to identify and track animals entering the food chain are not directly manageable, the profession has great latitude in developing strategic responses to such requirements. These responses can improve the demand for beef cattle veterinary services.

The Future Demand for Beef Cattle Veterinarians

The Delphi process provides panel members an opportunity to make initial estimates of future demand over several time periods in the first survey. The second survey and the feedback report that summarized the general patterns seen in the first survey provided an opportunity to re-estimate future demand. The Delphi methodology encourages panelists to re-consider their estimates in light of the views of other panel members. The third survey and accompanying report on the second survey results was a second opportunity to re-consider and make final projections of future demand.

Demand estimates were grouped into three time periods: Short-Term (fall of 2004 to fall of 2007), Medium-Term (fall of 2007 to fall of 2010) and Long-Term (fall of 2010 to fall of 2016). Demand estimates were stated in the form of the expected percentage increase or decrease from the start to the end of these time periods. Both range and point estimates are provided. The range estimates identify the middle 50% of panel members (i.e., the estimates between the 25th percentile and 75th percentile of the distribution, or inter-quartile range), and the point estimates include both the arithmetic mean and the median (or estimate at the 50th percentile) of the distribution of estimates. Figures 3 through 5 presents the results of each time period. The pattern of estimates indicates continuing disagreement within the panel on the nature of future demand. While the means and median values are always positive and indicate between 2% to 4% increases in demand, the middle 50% range (those between the 25th and 75th percentile of the distribution) include a wide range of estimates particularly in the long-term (2010-16) period.

Frequently, negative numbers indicating forecasts of decreasing demand are noted but on the whole the ranges include many positive values indicating increasing demand.

Figure 6 presents a summary of the forecasts from the final survey.

In spite of the usual tendency in the Delphi process to reach greater consensus (or narrower ranges ratings) at each successive survey, we see a pattern of continuing disagreement on the expected pattern of future demand even at the last survey. Further analysis that combined panel members' forecasts over all three periods indicates that just over one-third of the panel see zero or decreasing demand while the remaining panel members are forecasting demand increases. The median forecast over all periods for the "demand-is-decreasing" sub-group is -3.00% and the median estimate for the "demand-is-increasing" sub-group is +7.33%. This presents strikingly different views of what the future holds for the profession!

Figure 3

Short-Term Demand Change (2004-07)

2nd Survey Results:

- Mid-50% = +3.0% to +8.0%
- Mean = +4.1% (■)
- Median = +5.0% (▲)

3rd Survey Results:

- Mid-50% = 0% to +7.0%
- Mean = +3.8% (■)
- Median = +3.0% (▲)

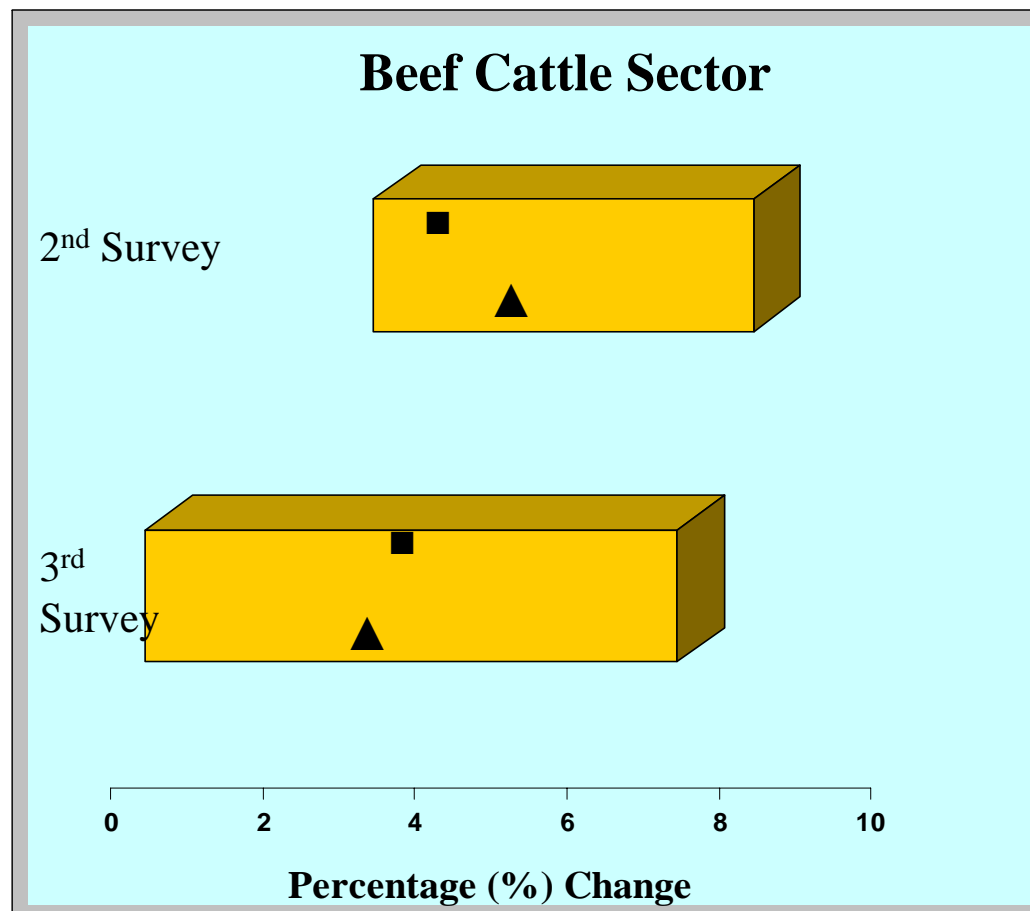


Figure 4

Medium-Term Demand Change (2007-10)

2nd Survey Results:

- Mid-50% = -1.8% to +5.8%
- Mean = +2.8% (■)
- Median = +3.5% (▲)

3rd Survey Results:

- Mid-50% = -1.0% to +5.0%
- Mean = +2.1% (■)
- Median = +3.0 (▲)

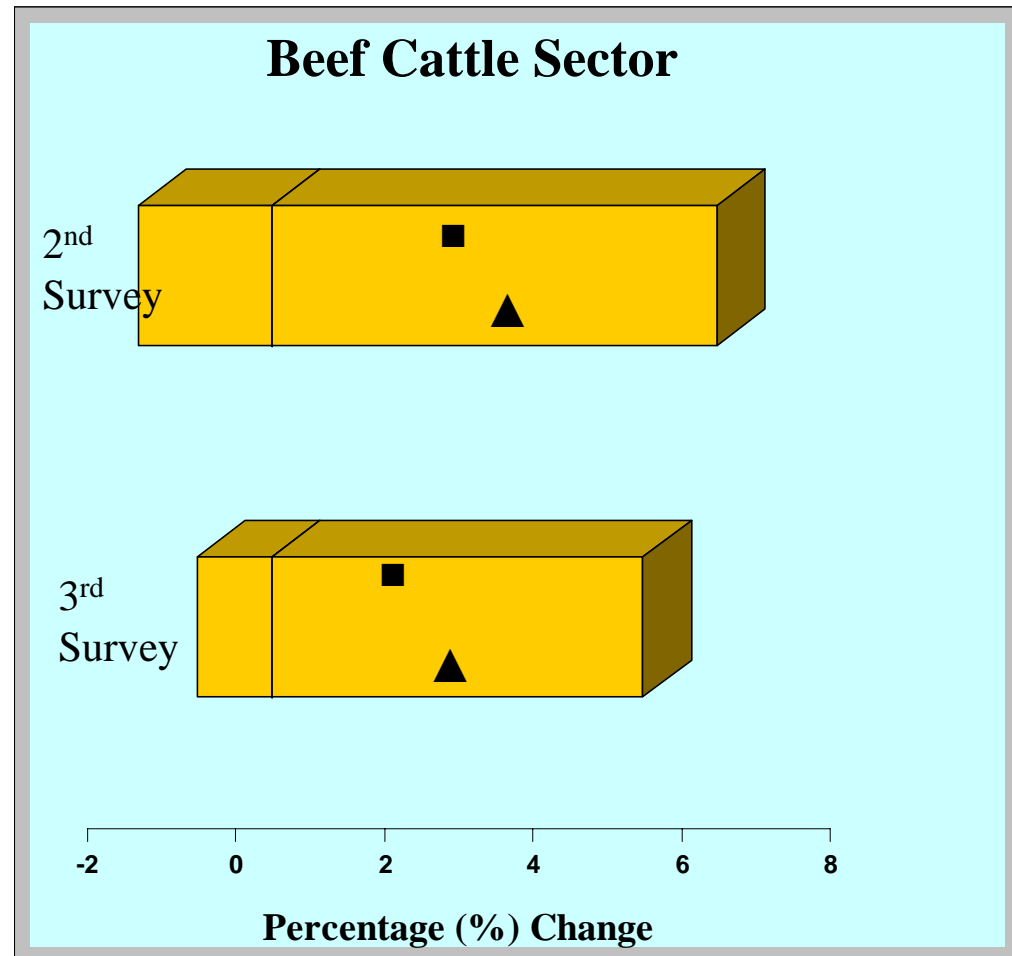


Figure 5

Long-Term Demand Change (2010-16)

2nd Survey Results:

- Mid-50% = +.5% to +10.8%
- Mean = +6.5% (■)
- Median = +6.0% (▲)

3rd Survey Results:

- Mid-50% = -3.5% to +8.5%
- Mean = +2.5% (■)
- Median = +6.0 (▲)

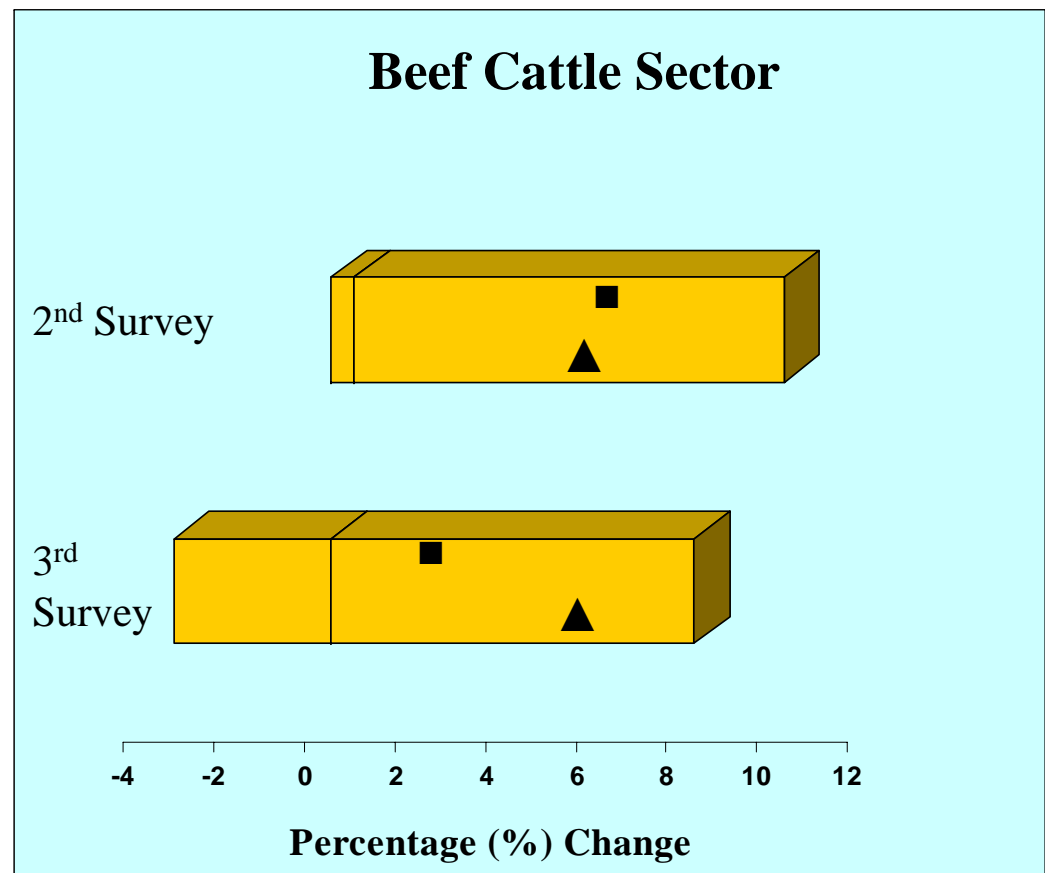


Figure 6

Future Demand Summary

Short-Term:

Mid-50% = 0% to +7.0%

Mean = +3.8% (■)

Median = +3.0 (▲)

Medium-Term:

Mid-50% = -1.0% to +5.0%

Mean = +2.1% (■)

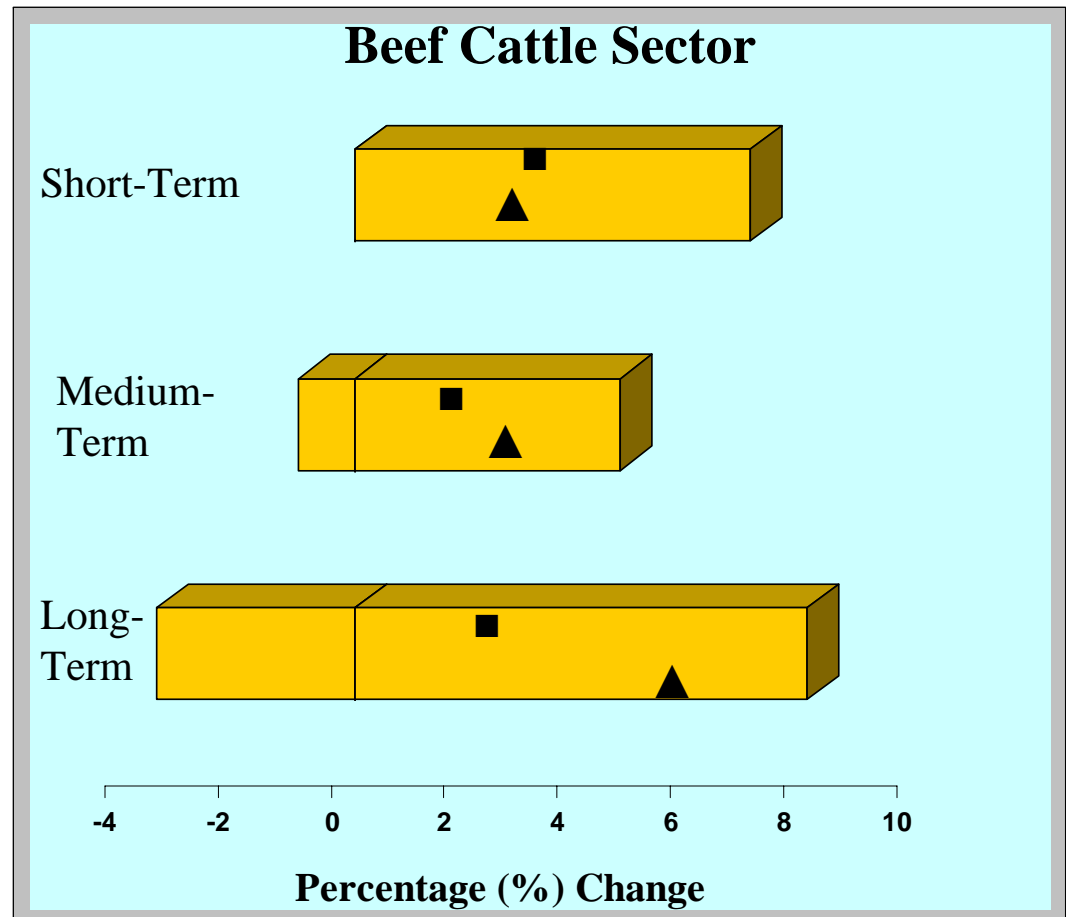
Median = +3.0 (▲)

Long-Term:

Mid-50% = -3.5% to +8.5%

Mean = +2.5% (■)

Median = +6.0 (▲)



Growing or Declining Demand

To more fully understand the wide range of future demand projections, analyses that contrasted the perceptions of those forecasting demand decreases versus those projecting increases in demand. Several significant differences between the demand-is-decreasing and the demand-is-increasing sub-groups' ratings on the demand-influencing trends (summarized above) present a clear explanation for the pattern of disagreement seen in this panel.

The following *demand-increasing* influences had statistically significantly *higher* ratings by the sub-group projecting increasing (versus decreasing) future demand:⁵

- Large operations seeking practice management and business advice (mean equals 5.69 on a 7-point scale in the demand-is-increasing sub-group versus a mean of 4.50 in the demand-is-decreasing sub-group)
- Large operations needing production medicine consulting (mean equals 5.69 in the demand-is-increasing sub-group versus a mean of 4.50 in the demand-is-decreasing sub-group)

Those seeing increasing demand compared to those seeing decreasing demand also made significantly *higher* ratings on the following *demand-decreasing* factors:

- Continued consolidation of larger producer operations (mean equals 4.85 in the demand-is-increasing sub-group versus 3.13 in the demand-is-decreasing sub-group)
- Decreasing demand for individual animal care (mean equals 4.08 in the demand-is-increasing sub-group versus 3.00 in the demand-is-decreasing sub-group)

The consolidation of smaller producers into large beef cattle operations is a dominant reality in this industry. Those seeing increasing future demand see opportunities in this trend. The demand-influencing trend of “Move to larger sized producer operations” has a

⁵ The scale introduced earlier should be used in interpreting these mean values: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase

mean 4.85 in the demand-is-increasing sub-group. This is above the “4. No Influence” and while not high it approaches the “5. Slight Increase” anchor point. The demand-is-decreasing sub-group was significantly lower at 3.63 into the decreasing demand side of the scale. The four other significant differences noted above provide additional details that support this same theme. For the demand-is-increasing sub-group, providing specialized services to large producers, including practice management and business advice and production medicine consulting, are seen as leading to more demand for veterinary services that more than compensate for any losses in demand associated with this trend, such as demand for individual animal care. Those seeing decreasing demand see the demand decreases in the individual animal services as more extreme and see less opportunity in the consolidation trend. This result reinforces an earlier conclusion noted in Figure 2. Serving the needs of large producers and finding ways to add incremental value (beyond the cost of services) to those operations is the path to prosperity and increasing demand for veterinary service. Not making that transition to serving the needs of these clients places beef cattle veterinarians in a precarious position marked by decreasing demand for services.

Specialized Activities Increasing or Decreasing in Demand

Open-ended questions in the first survey invited panel members to identify activity areas (e.g., roles, responsibilities, skill areas, clients served, etc.) where there will be a substantial future increases or decreases in demand compared to the general pattern of demand for beef cattle veterinary services. These suggestions were content analyzed and 13 areas received multiple mentions and were used to form items that panel members rated in the second survey. The activity areas rated as having *higher* future demand (starting with the highest demand areas) are:

1. Production management data analysis (5.81 on a 7-point scale)⁶
2. Developing health management systems (mean: 5.71)
3. Training staff at large operations (mean: 5.71)
4. Management and business consulting (mean: 5.57)
5. Animal identification and source verification (mean: 5.57)
6. Using research skills (mean: 5.43)
7. Regulatory requirements (mean: 5.19)
8. Using genetics expertise (mean: 5.14)
9. Using immunology expertise (mean: 5.05)
Note that the Canada-focused panel member mean of 3.67 is significantly higher than the US-focused sub-group mean of 5.29.

The activity areas rated as facing *lower* future demand than the general pattern food supply veterinary services (starting with the most extreme low demand areas) are:

⁶ The items were rated on a 7-point Likert-type scale and evaluated based on forecasted increase in demand relative to the expected general pattern of demand. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 4. No Difference, 5. Slight Increase, 6. Increase, 7. Strong Increase.

1. Doing vaccinations (mean: 2.55 on a 7-point scale)⁷
2. Obstetrics (mean: 3.29)
3. Treating individual animals (mean: 3.38)
4. Surgery (mean: 3.67)

These results shed further light on the conflicting views (increasing demand vs. decreasing demand) seen in the panel's future demand projections. Many of these nine "higher demand" activities assume a large producer operation context. For example, the highest rated items, item 1 (production management data analysis), item 2 (health management systems), and item 3 (training staff in large operations), are most relevant in serving the needs of large producers. Similarly, from the listing of four areas facing lower demand, three of the four involve treating individual animals (items 2, 3, and 4). Items 5 and 7 in the listing of activities facing higher demand are related to regulatory trends also noted in Figure 2. Items 4 (business consulting), 6 (research skills), item 8 (genetics expertise), and item 9 (immunology expertise) all related to specialized technical skills that will be increasingly useful in delivering high value adding expertise to both large and small producer operations.

⁷ The mean rating for areas seen as decreasing in demand are noted in parentheses and the following scale anchor points will aid interpretation: 4. No Difference, 3. Slight Decrease, 2. Decrease, 1. Strong Decrease.

Trends and Issues Driving the Future Supply of Beef Cattle

Veterinarians

The panel responded to both panel-suggested supply related items as well as items drawn from the general FSVM literature. The latter set of 17 items was included in surveys to all 13 panels included in this study. Eight additional supply-related influence items were drawn from open-ended comments in the first survey and included in the second survey. Items from the initial set of 17 items were repeated in the second survey when there was fair disagreement within the panel on the influence of an item. The final survey included items with fair disagreement seen in the second survey ratings. The mean value of the last rating of an item is used in the summary below. There were only three factors rated as *increasing* the future supply of veterinarians entering beef cattle food supply careers:

Trends Increasing Supply

1. Creating Centers of Excellence in veterinary colleges focused on beef practice (mean: 5.90 on a 7-point scale)⁸
2. Expansion of mentoring by practicing veterinarians (mean: 5.48)
3. Targeted recruitment of food animal oriented students (mean: 5.14)

The panel identified several trends and factors that are *decreasing* the future supply of food supply veterinarians entering beef cattle careers. These are the most extreme supply-decreasing factors:

⁸ The items were rated on a 7-point Likert-type scale and evaluated based on their influence on future supply of veterinarians entering beef cattle careers. The mean rating for each item is noted in parentheses. The following scale anchor points will help interpret those means: 4. No Influence, 5. Slight Increase, 6. Increase, 7. Strong Increase.

Trends Decreasing Supply

1. Less emphasis on food animal practice in veterinary colleges (mean: 1.96)⁹
Note that the Canada-focused panel member mean of 2.67 is significantly higher than the US-focused sub-group mean of 1.84.
2. Little exposure to food supply career options in college (mean: 2.29)
Note that the Canada-focused panel member mean of 3.00 is significantly higher than the US-focused sub-group mean of 2.24.
3. Perceived lack of career opportunity in food animal medicine (mean: 2.48)
4. Need to work long hours and emergency calls (mean: 2.61)
Note that the self-rated forecasting experts' sub-group mean of 2.92 was significantly higher than the less-expert sub-group mean of 2.13.
5. Lack of spousal career options in rural areas (mean: 2.65)
6. Lack of student exposure to real-life food animal practice (mean: 2.67)
7. Poor training of students in beef practice realities (mean: 2.71)
8. Physical demands of large animal veterinary work (mean: 2.71)
9. The perception of long hours, low pay, and hard physical work in beef practice (mean: 2.86)
Note that the self-rated forecasting experts' sub-group mean of 3.23 was significantly higher than the less-expert sub-group mean of 2.25.
10. Limited life style and career opportunities in rural areas (mean: 3.00)
11. High debt load of veterinary school graduates (mean: 3.00)
12. Lack of food supply practice-related externships for students (3.05)
Note that the Canada-focused panel member mean of 4.00 is significantly higher than the US-focused sub-group mean of 2.94.
13. More women veterinarians entering the workforce (mean: 3.14)
14. Lack of positive role models in veterinary food supply practice (mean: 3.33)

⁹ The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future supply of beef cattle veterinarians. The mean rating for each item is noted in parentheses. The following scale anchor points will help in the interpretation of those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence.

Note that the Canada-focused panel member mean of 3.0 is significantly lower than the US-focused sub-group mean of 3.47.

15. Poor income opportunities in rural areas (mean: 3.35)

Note that the Canada-focused panel member mean of 1.67 is significantly lower than the US-focused sub-group mean of 3.75.

16. Perceived lack of demand for food supply animal skills (mean: 3.38)

17. Federal and/or State/Provincial budgetary constraints (mean: 3.43)

Note that the Canada-focused panel member mean of 3.00 is significantly lower than the US-focused sub-group mean of 3.59.

18. Lack of cultural and recreational opportunities in rural areas (mean: 3.44)

Note that the Canada-focused panel member mean of 3.00 is significantly lower than the US-focused sub-group mean of 3.66.

These supply-related factors can also be organized into the planning matrix introduced earlier. Figure 7 captures the general pattern seen in the above two listings. The list of 18 supply-decreasing factors identified by the panel all map to the left-side of the planning matrix. Many of the more extreme impediments to the future entering supply of veterinarians are very actionable in that they do not strongly depend on the infusion of resources or the cooperation of entities outside of the veterinary profession. This places them in the upper-left quadrant of Figure 7. Items 1, 2, 6, 7 and 12 relate to the lack of exposure and opportunity to develop food animal skills in colleges of veterinary medicine. These are referred to as *Non-FSVM Focus in CVMs* in Figure 7. Items 3, 9 and 16 are related in that the non-FSVM focus in colleges of veterinary medicine and represent a *Negative Views of FSVM Careers* theme. This and the *Negative Role Models* (item 14) and *Student Debt* (item 11) themes are additional supply constraints that can be changed with strategic initiatives. They are placed in the upper-left quadrant.

The *Student Debt* theme is placed near the center line in the upper-left quadrant.

The cost of veterinary education can probably not be reduced and relates to larger

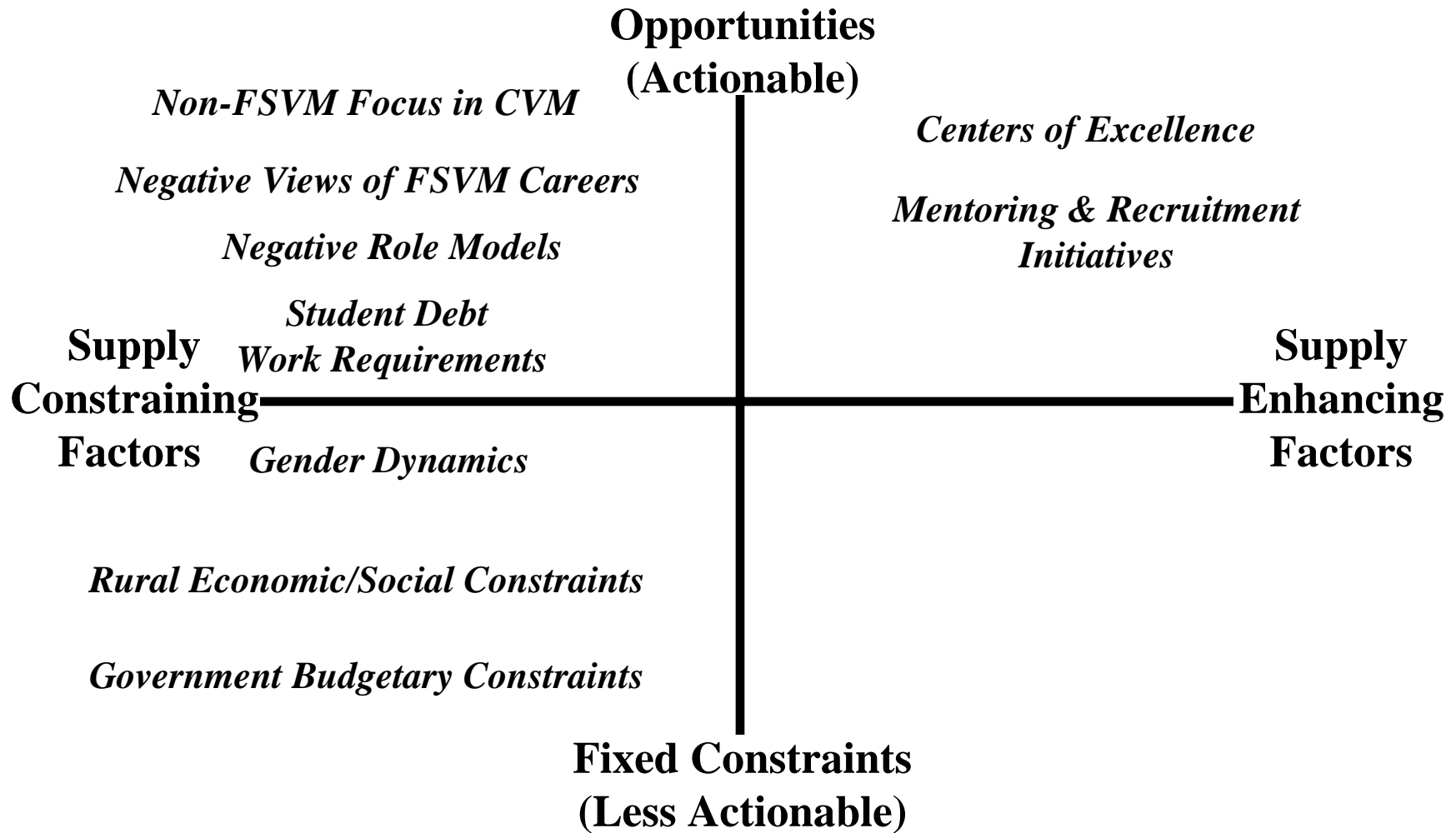
economic forces at work. However, different debt repayment initiatives using external resources that lessen student debt and attendant problems have been developed.

Therefore, this is seen as fairly actionable. Initiatives related to the other constraints noted above are primarily under the control of the profession, particularly schools of veterinary medicine. Similarly, the *Work Requirements* theme, noted by item 8 (physical demands) and item 4 (long hours/emergencies), are a part of the beef veterinarians job descriptions. Bovines are large and physically demanding and have health needs that do not always fit into the 8-to-5 schedule. However, new practice management models and tools have lessened these problems. For this reason, this theme is also placed near the bottom of the upper-left quadrant.

A number of the items constraining supply noted above reflect larger demographic and social trends and, as such, are less directly actionable. They need to be understood and managed around by the profession. For example, items 5 (spousal career options), 10 (rural career opportunities), 15 (poor income opportunities), 18 (cultural and recreational opportunities) and 13 (more women veterinarians) reflect larger economic and demographic (urbanization) patterns in rural communities and the increasing number of females being attracted to professional programs in general. These logically fit in the lower-left quadrant of Figure 7 and are referred to as the *Rural Economic/Social Constraints* and *Gender Dynamics* themes. Similarly, item 17 relates to larger economic constraints associated with large deficits and competing demands for public funds. This is perhaps the least changeable supply-constraints and is noted as the *Government Budgetary Constraints* theme in the lower-left quadrant of Figure 7.

Figure 7

Supply Diminishing & Enhancing Issues in the Beef Sector



The three supply-increasing trends and issues presented above represent opportunities for promoting the profession and building the supply of beef cattle veterinarians. Item 1 (*Centers of Excellence*) is a very actionable strategic initiative that can be enhanced. While external resources are needed to fully realize this concept, the reallocation of existing resources can better realize the potential of this concept. This theme has been placed in the upper-left quadrant. Item 2 and 3 related to *Mentoring & Recruitment Initiatives* theme. Such trends can be extended to further promote FSVM careers and increase the supply of veterinarians entering beef cattle practice. No items logically fit in the lower-right quadrant of Figure 7.

The Future Shortages of Food Supply Veterinarians

After rating demand and supply related factors, panel members were asked the “most likely” estimate of the percent that the future available supply of veterinarians would differ from the expected demand over various time periods (i.e., the expected average percentage surplus or shortage of beef cattle veterinarians). As is the case with the demand estimates, the Delphi process gave panel members an opportunity to make initial estimates of future shortages or surpluses in the first survey. Second and third survey estimates provided additional opportunities to reconsider earlier estimates after seeing the collective views of other panel members. Estimates of shortages were grouped into three time periods: Short-Term (fall of 2004 to fall of 2007), Medium-Term (fall of 2007 to fall of 2010) and Long-Term (fall of 2010 to fall of 2016). Panelists were instructed to assume a continuation of current trends and an absence of any catastrophic events in making their forecasts. As was the case with demand estimates, both the range (i.e., the middle 50% of replies) and the arithmetic mean and the median (i.e., the 50th percentile of the distribution of estimates) are used to summarize these forecasts. Figures 8 through 10 provide the results of each period. Figure 11 provides the summary of the results from the final survey for all three periods. As was the case with the demand estimates, the presence of extreme outliers in the distribution were reviewed and eliminated in calculating statistics. For example, one panelist projected a 50% shortage in the long-term time frame. This was over 80% higher than the next extreme estimate of a 27.5% shortage. Extreme values, particularly in relatively small Delphi panels, make the means less representative of the panel and need to be removed from the analysis.

Figure 8

Short-Term Shortages (2004-07)

2nd Survey Results:

- Mid-50% = -2.0% to -5.4%
- Mean = -4.2% (■)
- Median = -4.3% (▲)

3rd Survey Results:

- Mid-50% = -2.0% to -6.0%
- Mean = -4.4% (■)
- Median = -3.5 (▲)

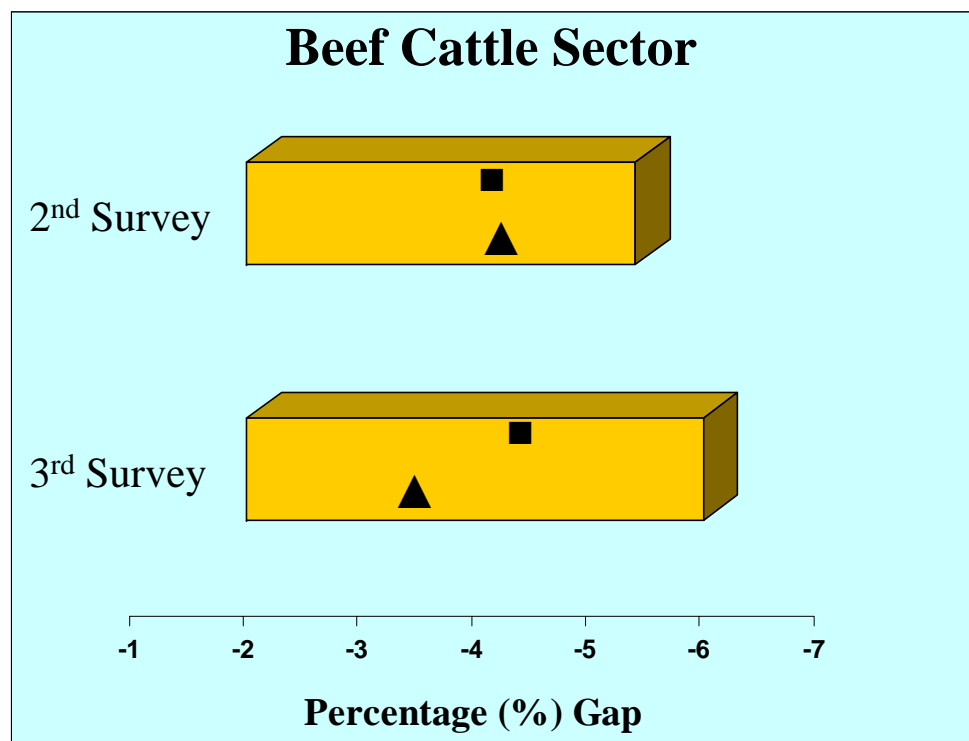


Figure 9

Medium-Term Shortages (2007-10)

2nd Survey Results:

- Mid-50% = -2.0% to -8.0%
- Mean = -4.7% (■)
- Median = -5.0% (▲)

3rd Survey Results:

- Mid-50% = -3.0% to -5.8%
- Mean = -5.3% (■)
- Median = -5.0% (▲)

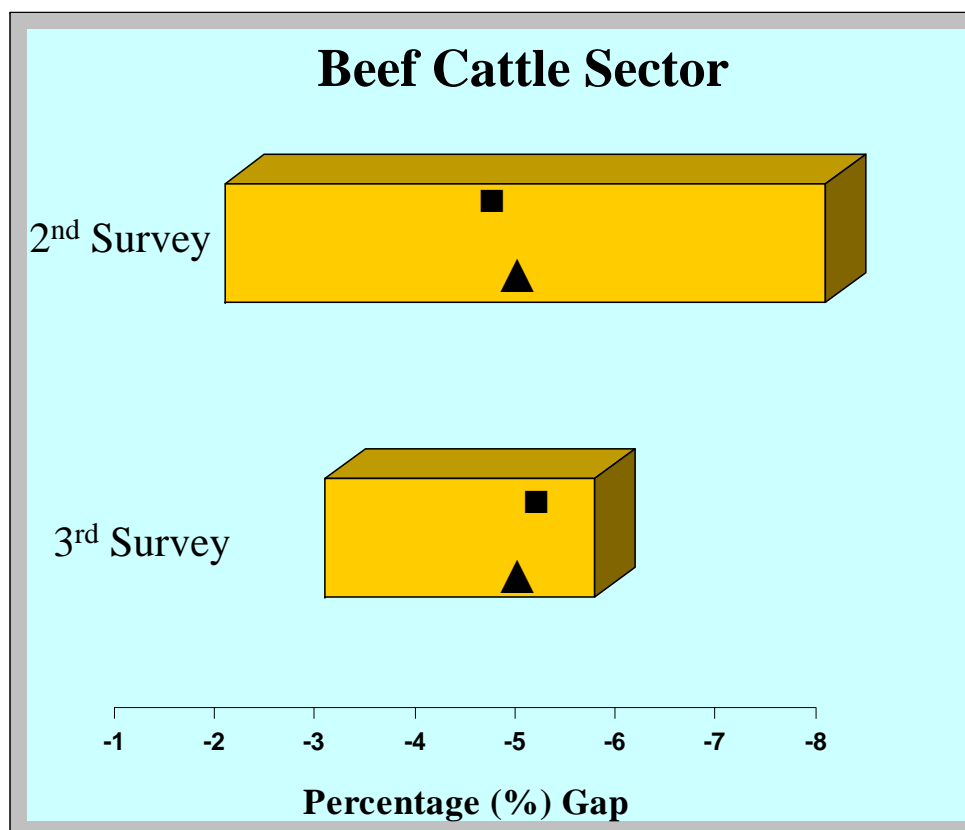


Figure 10

Long-Term Shortages (2010-16)

2nd Survey Results:

- Mid-50% = -2.0% to -7.5%
- Mean = -4.6% (■)
- Median = -4.0% (▲)

3rd Survey Results:

- Mid-50% = -1.1% to -5.8%
- Mean = -5.5% (■)
- Median = -4.5% (▲)

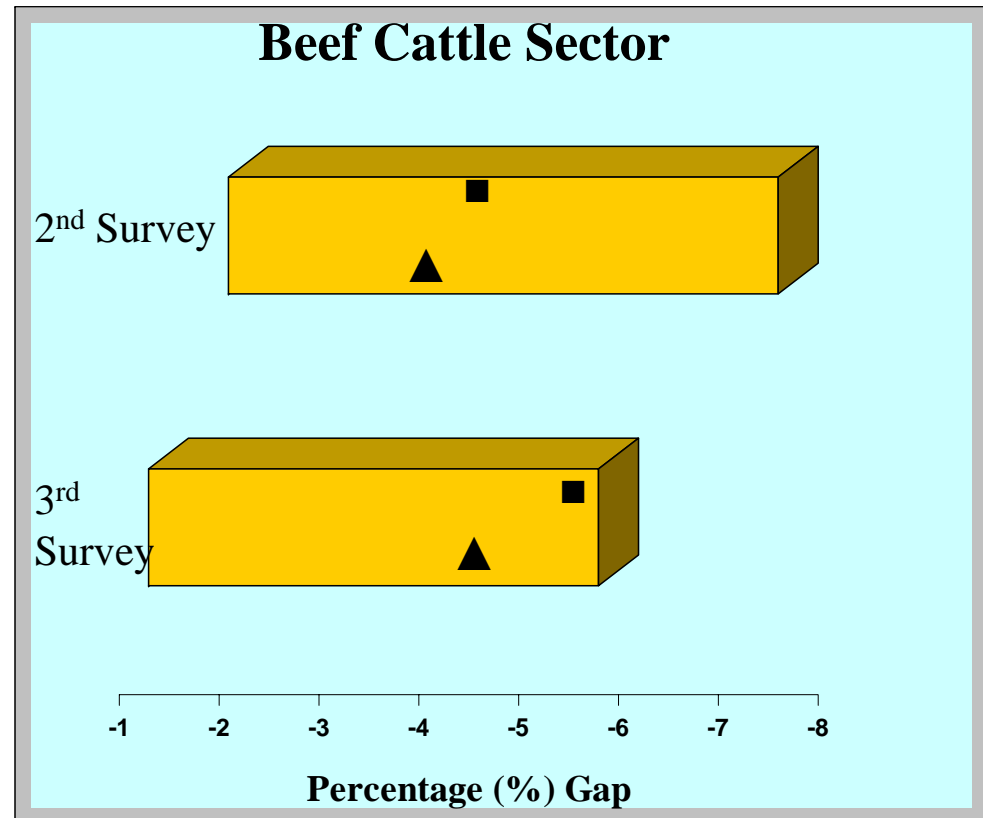


Figure 11

Future Shortages Summary

Short-Term (2004-07):

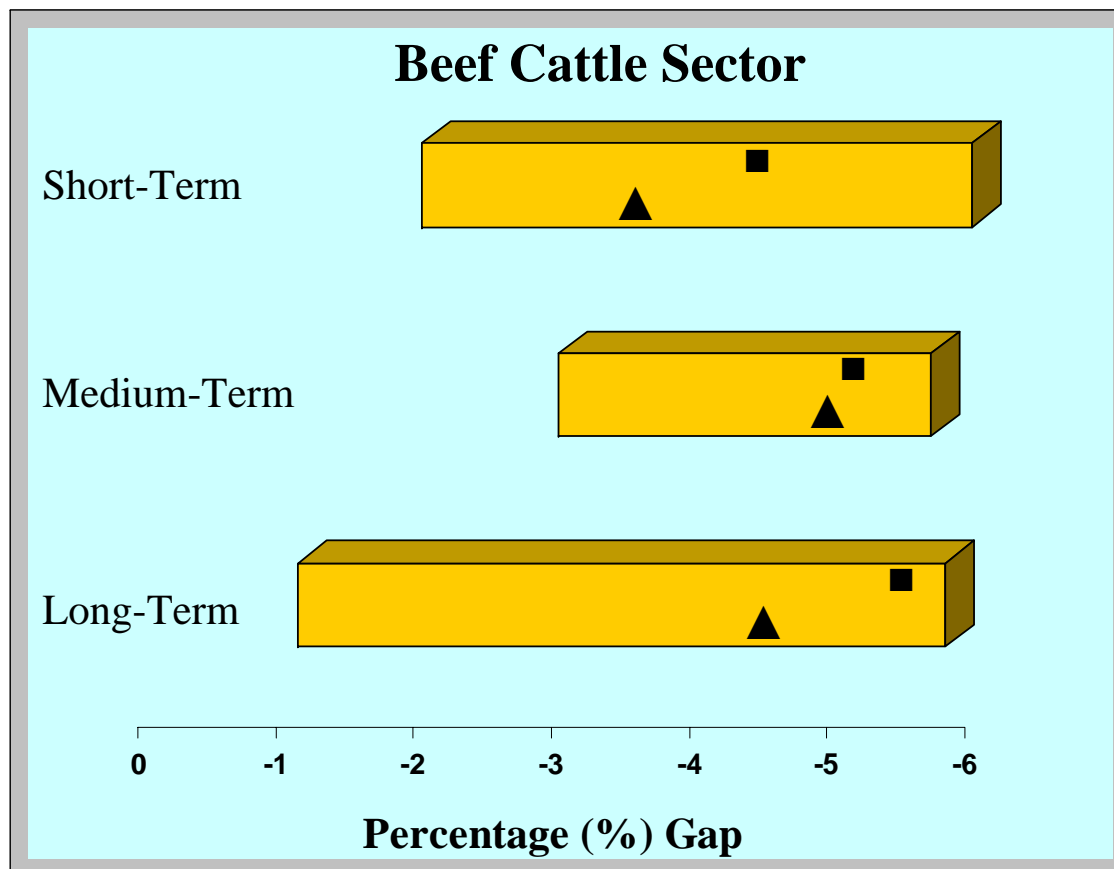
- Mid-50% = -2.0% to -6.0%
- Mean = -4.4% (■)
- Median = -3.5% (▲)

Medium-Term (2007-10):

- Mid-50% = -3.0% to -5.8%
- Mean = -5.3% (■)
- Median = -5.0% (▲)

Long-Term (2010-16):

- Mid-50% = -1.1% to -5.8%
- Mean = -5.5% (■)
- Median = -4.5% (▲)



The middle 50% of the panel always forecasts a shortage of food supply veterinarians in beef practice. This is generally in the 2% to 5% range. The point estimates of future shortages are very consistent over the forecast period. The means and median ratings are in the 3.5% to 5.5% shortage range. In contrast to the forecasts addressing whether demand for beef cattle veterinarians is increasing or decreasing, there is solid agreement that there will be a shortage. While there was general consensus that, given current trends and assuming no catastrophic events, consistent shortages will occur over the foreseeable future, there was not high agreement on how high these shortages will be. While the estimates of the panel members focused on Canada versus the US context consistently suggested less extreme shortages in Canada, these differences were not statistically significant due in part to the relatively few number of Canadian panelists and the wide range of estimates (and the role variance plays in calculating statistical significance). Contrasts between self-rated experts versus less-expert forecasters did not reveal significant differences in these ratings.

To better understand the disagreement within the panel about the extent of future shortages, additional analyses determined the factors that differentiated those making more conservative estimates versus those projecting more extreme shortages. A median split, based upon the median shortage estimated over all time periods was used to place panelists into “limited-shortage” and “deeper-shortages” sub-groups. This analysis indicates that those seeing deeper future shortages differ from the more conservative panelists in their views of the following *supply-related* factors:

- Lack of positive role models (mean of 3.70 in the deeper-shortages sub-group versus 3.00 for those seeing limited-shortages)¹⁰
- Lack of student exposure to real-life food animal practices (mean of 2.40 in the deeper-shortages sub-group versus 3.27 for those seeing limited-shortages)
- Poor training of students in the beef practice realities (mean of 2.30 in the deeper-shortages sub-group versus 3.27 for those seeing limited-shortages)

Analyses were also done to identify the *demand-related* factors that are seen

differently by the deeper- versus limited-shortages sub-group:

- Limited public understanding of food quality and safety issues (mean of 4.50 in the deeper-shortages sub-group versus 3.88 for those seeing limited-shortages)
- Client use of veterinary herd management services (mean of 5.00 in the deeper-shortages sub-group versus 5.64 for those seeing limited-shortages)
- Constraints on non-DVMs giving prescription drugs (mean of 5.10 in the deeper-shortages sub-group versus 4.36 for those seeing limited-shortages)

¹⁰ The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future supply of beef cattle veterinarians. The mean rating in the parentheses is for the sub-group that see deeper shortages (those seeing a 5% or higher average shortage) and the second mean is for the limited-shortages sub-group (less than a 5% average shortage). The following scale anchor points will help in the interpretation of those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence.

Solutions for the Future Shortage of Beef Cattle Veterinarians

How can the FSVM profession prepare for a better future and counter the trends that are going to lead to a consistent shortage of veterinarians available to fulfill the need for these professionals? Finding targets of opportunity to improve the future of the food supply veterinary profession has been the main focus of previous sections. To develop those ideas further, 18 potential general solutions to shortages were developed and evaluated by all 13 panels. Their ratings are based on the extent to which each solution will *eliminate* the expected veterinarian shortages. In interpreting the mean ratings noted below, one should keep in mind that a rating of 7 on the 7-point rating scale indicates that a solution would be “highly effective” at *eliminating* the expected shortage. The mean is the arithmetic average of all panel members. The following are the solutions that are rated above the mid-point of the scale. These are listed in order of rated effectiveness in eliminating shortages:

1. More involvement of food supply practitioners in training veterinary students (mean of 5.62 on a 7-point scale)¹¹
2. Appointment of more food supply faculty at colleges of veterinary medicine (mean of 5.38)
3. Expand the Centers of Excellence concept with a nationally recognized focus on different food supply sectors (mean of 5.38)
4. Mentoring initiatives for students and those starting a food supply career (mean of 5.14)
5. Focused recruitment of high school and college students with food supply interests into veterinary colleges (mean of 5.14)

¹¹ Panel members rated the extent that each possible solution will lead to an *elimination* of a shortage of veterinarians. This high standard should be noted in interpreting the meaning of the mean rating. The following rating scale was used: 1. Not at all Effective, 3. Slightly Effective, 5, Effective, 7. Highly Effective.

Note that the Canada-focused panel member mean of 3.67 is significantly lower than the US-focused sub-group mean of 5.29.

6. Reserve class slots for academically qualified students with food supply interests and relevant background (mean of 5.10)
Note that the Canada-focused panel member mean of 3.67 is significantly lower than the US-focused sub-group mean of 5.35.
7. Expanded postgraduate fellowships in food supply areas (mean of 4.95)
8. Expanded business and practice management coverage in the DVM curriculum (mean of 4.90)
Note that the Canada-focused panel member mean of 3.00 is significantly higher than the US-focused sub-group mean of 5.24.
9. Expanded job placement services in the food supply veterinary medicine area (mean of 4.85)
10. Student debt repayment and scholarship programs for service in areas of need (mean of 4.76)
11. Paid externship requirement in food supply medicine during the summer (mean of 4.57)
12. Expanded paid work-study programs during the final year of the DVM programs (mean of 4.55)
13. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities (mean of 4.48)
Note that the Canada-focused panel member mean of 3.00 is significantly lower than the US-focused sub-group mean of 4.71.
14. Increased focus of food supply coverage early in the DVM curriculum (mean of 4.38)
Note that the Canada-focused panel member mean of 3.00 is significantly lower than the US-focused sub-group mean of 4.71.

These items represent possible tactics that can be a part of a larger strategy for dealing with future shortages. For example, 5, 6, 9, 10, and 13 focus on increasing interest of pre-veterinary students in FSVM careers, making sure that academically qualified food animal oriented student are admitted, and then facilitating their later entry

into FSVM career positions. These strategies will address both the pre-veterinary student population but also make the food supply track more attractive to veterinary students. The appointment of more food supply faculty (item 2) along with curricular changes will facilitate students getting more early exposure to food supply careers (item 14) and the use of more practitioners, which was the highest rated item (item 1), could be used to augment scarce faculty resources to help educate students. Items 7, 11 and 12 are educational strategies for giving students more hands-on FSVM work experiences during training. Besides helping students develop skills in this area, these externships and postgraduate fellowships provide bridges to post-graduation FSVM jobs. This lessens the likelihood of being attracted to alternative employment. The introduction of more business and practice management skills into the curriculum, as suggested by item 8, will also better prepare graduates for the business realities of food supply careers. The Centers of Excellence concept was the third highest rated item (item 3). It is a large scale strategy that could build in a number of other highly rated solutions. A beef cattle-focused Center of Excellence could be a means for delivering more hands-on experience, obtaining more faculty resources to teach them, and attracting more students.

Conclusion: A Need for Action

The data from this study reveals a clear pattern of increasing demand and significant future shortages in the food supply veterinary medicine profession. The Veterinarian's Oath clearly states the obligation of this profession in servicing the needs of society. If the projected shortages are allowed to unfold along the currently forecasted course, the profession will not fulfill its professional obligation! Animal health will suffer as will food safety and human health.

A clear premise of this research is that the future we will live in tomorrow is created by action we take today. While there are larger trends (such as urbanization) that will not be changed and must be adjusted to and managed around, the future is not a deterministic function of unchangeable large social and economic forces. It is very much created by our choices. Many of the trends and issues shaping the future of the food supply veterinary profession are created by choices that can be thoughtfully reviewed and revised. Strategic actions implemented in the near-term can change the trends that will otherwise shape a future that is not good for beef veterinarians or society. If action is not taken to address the future shortages then others will likely attempt to fill the void created. This is already being seen. We should not expect, however, that the unplanned responses that will emerge to fill the void caused by shortages will avert the negative economic impact and challenges to societal well-being that the lack of adequate numbers of beef cattle veterinarians will create. The veterinary profession can do better! Fulfilling its credo and responsibilities to society requires immediate strategic action to counter these trends. Dealing with the challenges of consolidation in the beef industry and

preparing veterinarians to provide high value added services to large producer operations should be the central strategic focus for leaders in the beef cattle FSVM sector.

The shortages forecasted for beef food supply veterinarians are conservative. The range of shortages noted by the middle 50% of panel experts are based on the assumption that no major disease, agro-terrorism or other severe or catastrophic events will occur. It is one thing to hope for such luck; it is another thing to plan for this rosy scenario! History tells us we must be prepared now to counter such events.

The planning matrix presented with several analyses provides guidance on the opportunities and constraints that must be considered in planning future action. This is, however, only a starting point. The profession must address where its strengths and weaknesses are in moving beyond these starting points. Thoughtful leaders in the larger profession need to identify where they have the best advantage to take effective collective action. All professions have strengths and weaknesses; effective leaders understand how to leverage their strengths while being mindful of their weaknesses. The identified solutions provide a starting point for developing effective elements of an effective coherent strategy of collective action.

Supplemental Information

The following additional information is provided to help the reader understand the results reported in this chapter:

1. Temporary links to the three the beef cattle surveys are noted, but these will not be available indefinitely. The larger final report, which presents the results of Delphi panels focused on other sectors, includes a sample copy of three surveys for one selected panel. While the first survey was quite similar in all 13 panels, the nature of the Delphi process resulted in questions that formed unique surveys for the second and third rounds of each panel. However, the larger designs of all second- and all third-round survey are very similar. Try these web-links to view a copy of the three surveys completed by the beef cattle panel:
 - a. First Survey: <http://survey.cba.ksu.edu/prince/beef1/index.htm>
 - b. Second Survey: <http://survey.cba.ksu.edu/prince/beef2/index.htm>
 - c. Third Survey: <http://survey.cba.ksu.edu/prince/beef3/index.htm>
2. Exhibit A provides a listing of all members that originally agreed to participate in the Delphi panel.
3. Exhibits B and C provides copies of the interim feedback reports that accompanied the second and third surveys. The first report (Exhibit B) summarizes trends found in the first survey data and provides guidance for interpreting the feedback incorporated into the second survey. The second report (Exhibit C) serves a similar function for the second survey data trend and accompanied the third survey.

4. Exhibit D provides a summary of the data results for major sections of the three surveys completed by the beef cattle panel.

Exhibit A

Original Beef Cattle Delphi Panel
Members¹²

- | | |
|---------------------|-----------------------|
| 1. Michael Apley | 13. Tom Kasari |
| 2. Ed Avery | 14. Phillip Kesterson |
| 3. Pat Bierman | 15. Bill Kvasnicka |
| 4. John Campbell | 16. Larry Moczygemba |
| 5. Jim Clement | 17. Glenn Rogers |
| 6. Terry DeGroff | 18. Bob Smith |
| 7. Craig Dorin | 19. Wade Taylor |
| 8. Arnold Gertonson | 20. Kurt Walters |
| 9. Dee Griffin | 21. Gary Warner |
| 10. Tim Guichon | 22. Galen Weaver |
| 11. Tom Hairgrove | 23. Mike Whitehair |
| 12. Mike Jelinski | 24. Steven Wikse |

¹² Note that not all panel members completed all three surveys. These individuals originally agreed to participate.

Exhibit B

Beef Practice Panel 1st Survey Interim Feedback Report

This report summarizes replies to the 1st survey of the Beef Practice Delphi forecasting panel. *This brief report is focused on helping you be more informed as you complete the 2nd survey.* (A full summary of the Beef panel's data will be provided after you complete the 3rd survey.)

This report identifies a few key patterns and more specific information from the 1st survey is included in the 2nd survey. Questions with more disagreement are repeated in the 2nd survey and panel averages and the ranges of the middle 50% of replies (between the 25% and 75% percentiles) are noted. When there is a difference between self-rated forecasting “experts” (i.e., those rating themselves as better than the panel’s median score on question #30 of the 1st survey) versus those rating themselves as “less expert” in making forecasts, then those contrasts are noted. Where Canadian & US members had a rating difference of .5 or more (on the 7-point scale), those respective means are noted. For example, item #1 in the first section of the 2nd survey (“Move to larger sized producer operations”) has the following notation:

“1st Survey: Average = 3.9 & Mid-50% = 2 to 6; Experts = 4.2 (vs. 3.3)” CDN = 2.7 & US = 4.0;

This indicates that the mean of the panel was 3.9 on a 7-point scale (just below “4. No Influence”) and the middle-50% of panelists (between the 25th and 75th percentiles) rated it between “2. Decrease” and “6. Increase”. This indicates that replies were quite varied – there was not high agreement. Self-rated “experts” had a higher mean rating (mean = 4.2) than the “less-expert” group mean of 3.3. This means that experts saw moving to larger sized operations as having a more positive (or less negative) influence compared to those less confident in their forecasts. Canadian members saw this factor as having a more negative influence on demand (mean = 2.7 on the 7-point scale) and US members saw a more neutral influence with a mean of 4.0 (“4. No Influence”). Statistical information from the 1st survey will be presented in this format throughout the 2nd survey.

Please review this feedback before (or as) you complete the 2nd survey.

I. Factors Influencing Demand for Food Supply Veterinarians in Beef Careers

The first section in the 1st survey asked you to rate the influence of 25 different demand related issues. The top-rated influences seen as *increasing* future demand are:

- Public concerns over food safety
- Growing need to track animals entering the food chain
- Public concerns over bio-terrorism

- Increasing concerns for animal health
- Availability of highly technical or specialized services
- Zoonotic disease-related human health concerns

The top-rated influences *decreasing* future demand are:

- Lack of veterinarian's practice management & business skills
- Slow adoption of new technologies by veterinarians
- Client concerns about veterinary service costs
- Curtailment of government support of veterinary services
- Federal and/or State/Provincial budgetary constraints

II. Future Demand Estimates for Beef Practice Food Supply Veterinarians

The mean value for the general forecast of future demand for the 1st survey was 4.7 on a 7-point scale (below "5. Increase Slightly"). The middle 50% of panelists (between the 25th to 75th percentiles) rated demand between "3. Slightly Decrease" and "6. Increase". This wide range indicates that there was plenty of disagreement about future demand. There were no systematic differences in contrasts between self-rated experts vs. less-expert or Canadian vs. US panelists. (See question #3 in the 2nd survey.)

Additional questions asked for the "most likely" range of changes in future demand for several time periods. The mid-points of panelists' range estimates were used to calculate estimates. For each of the four time periods starting in the fall of 2005, the panel saw average demand increases between 1% to 3% and the middle 50% estimates ranged between -1.3% (decrease) to as high as +7.53% (increase). For the current time period (fall of 2004 to fall of 2005), a +1% increase was the mean forecast and the middle 50% range was 0 to +3%.

Panel members seeing *stronger* future demand (compared to those seeing *weaker* demand) rated the following "demand influences" (from question #1 in the 1st survey) as having significantly *more positive* influences on demand:

- Public concerns over food safety
- Veterinary service agreements required for agri-business loans

Those seeing *stronger* future demand also rated "Slow adoption of new technologies by veterinarians" as having a significantly *more negative* influence on demand.

Those rating themselves as more "expert" (versus "less-expert") tended to see more increasing future demand (but this difference was not statistically strong, so it should be interpreted cautiously).

III. Factors Influencing the Supply for Beef Practice Food Supply Veterinarians

The more extreme negative influences on the future supply for beef veterinarians (low ratings on the question #10 items from the 1st survey) are:

- Less emphasis on food animal practice in veterinary colleges
- Little exposure to food supply career options in college
- Need to work long hours and emergency calls
- More women veterinarians entering the workforce
- Lack of spousal career options in rural areas

IV. Projected Shortage or Surplus of Beef Practice Food Supply Veterinarians

The panel sees a future shortage of DVMs in the beef practice area. The general question asking them to estimate the degree of surplus vs. shortage over the next 12 years produced a mean of 5.4 on a 7-point scale (between “5. Slight Shortage” and “6. Shortage”). Additional questions asked for the “most likely” range of changes in future demand for several time periods. The mid-points of the panelists’ range estimates were used to calculate panel averages. The averages over all time periods were between -3.3% to -4.8% (shortages). The middle 50% always projected shortages and the range of values were fairly large. So, while the estimated increases in demand (noted above) were relatively modest (and more divided), the concerns about future shortages (while also quite varied) were more extreme. This implies a concern about the future supply, i.e., the numbers of new DVM entering the beef practice and current beef veterinarians staying in this career area. Canadians tended to see less of a shortage. Experts (vs. less expert forecasters) tended to see deeper shortages but these differences were not statistically strong.

Next Steps...

The patterns that are starting to emerge tell an interesting story for DVMs in beef practice careers. It is one that is different from what I am seeing in other panels! Your replies to the second survey will add and clarify this story even more.

Thank you for your continuing help and involvement!

Dr. J. Bruce Prince
Professor of Management
Kansas State University
785-532-7459
jbprince@ksu.edu

May 26, 2005

Beef Panel

2nd Survey Interim Feedback Report

This report summarizes replies to the 2nd survey of the Beef Delphi panel. *This brief report is focused on helping you be more informed as you complete the 3rd survey.* (A full summary of the Beef panel's data will be provided after I analyze the 3rd survey.)

This report identifies a few key patterns and more specific information from the 2nd survey is included in the 3rd survey. Questions where there was more disagreement are repeated in the 3rd survey and panel averages and the ranges of the middle 50% of replies (between the 25% and 75% percentiles) are noted in that survey. When there is a difference between self-rated forecasting “experts” versus those rating themselves as “less expert” in making forecasts, then those contrasts are noted. Where Canadian & US members had a rating difference of .5 or more (on the 7-point scale), those respective averages are noted. For example, item #1 in the first section of the 3rd survey, (“Use of non-DVMs, such as veterinary technicians”) has the following notation:

“Average=4.0 & Mid-50% = 3 to 6; Experts = 4.4 (vs. 3.5); CD=3.0 & US=4.1.”

This indicates that the average of the panel was 4.0 on a 7-point scale (“4. No Influence”) and the middle-50% of panelists rated it 3 to 6 (from “3. Slight Decrease” and “6. Increase”). This range suggests plenty of disagreement about the influence of this factor on demand. Self-rated “experts” had a significantly higher average rating (mean = 4.4) than the “less expert” subgroup (mean = 3.5). This indicates that more experts (compared to those in the less-expert subgroup) were inclined to see the “use of non-DVMs...” as a demand enhancing factor (although not a short one). Panel members focused on the Canadian situation (with a mean rating of 3.0 on the 7-point scale compared to US-focused panelists who rated it 4.1) saw this factor as having a more demand constraining influence. Statistical information from the 2nd survey will be presented in this format throughout the 3rd survey.

Please review this feedback before (or as) you complete the 3rd survey.

V. Factors Influencing Demand for Veterinarians in Beef Careers

The first section in the 1st survey asked you to rate the influence of 25 different demand related issues. Several of these plus new items suggested by the panel were included in the 2nd survey. The top-rated influences seen as *increasing* future demand from both surveys are:

- Public concerns over food safety
- Growing need to track animals entering the food chain

- Large operations needing more production medicine consulting
- Large operations seeking practice management and business advice
- Public concerns over bio-terrorism
- Increasing concerns for animal health
- Increasing need for cost-efficient animal production

The top-rated influences *decreasing* future demand (from both surveys) are:

- Producers becoming less dependent on services from DVMs
- Lack of veterinarian's practice management & business skill
- Slow adoption for new technologies by veterinarians
- Client concerns about veterinary service costs
- Curtailment of government support of veterinary services
- Decreasing demand for individual animal care

VI. Future Demand Estimates for Beef Food Supply Veterinarians

The average value for the general forecast of future demand from the 2nd survey is 4.3 (just over “4. Stay Exactly the Same”). Only one panel member actually selected #4. Over 30% saw a decrease (and marked 2 or 3) while the rest saw an increase in demand (and marked 5, 6 or 7). The middle 50% (between the 25th to 75th percentiles) rated demand as 3, 4 or 5. There was not a different rating pattern between self-rated experts and less-expert forecasters. Canadian-focused panel members saw lower demand (mean = 3.3) compared to the US members (mean = 4.5).

Additional questions asked for the “most likely” estimate of changes in future demand for several time periods. Around 20% consistently saw *decreasing* demand (negative numbers) and around 70% saw *increasing* demand for future time periods. The average ratings were in the +2.0% to +3.0% increase range and the middle 50% ratings included a low number close to 0% (no change) to as high as +5.8% (increase).

Panel members seeing *stronger* future demand (compared to those seeing *weaker* demand) rated each of the following “demand influences” (from question 1 in the 1st and 2nd surveys) as having a significantly *more positive* influence on demand:

- Demand for nutrition consulting
- Public concerns over food safety
- Veterinary service agreements required for agri-business loans
- Increasing need for cost-efficient animal production
- Large operations seeking practice management and business advice

Selected activities and skills where there was uniquely higher or lower demand were identified in the 1st survey and rated in the 2nd survey. Areas of lowest decreasing

demand are: Doing vaccinations, Obstetrics, Treating individual animals, and Surgery. The areas of the highest increasing demand included:

- Production management data analysis
- Developing health management systems
- Training staff in large operations
- Management and business consulting

VII. Factors Influencing the Supply for Beef Food Supply Veterinarians

The more extreme *negative* influences on the future supply for beef food supply veterinarians noted in the two previous surveys are:

- Less emphasis on food animal practice in veterinary colleges
- Little exposure to food supply career options in college
- The perception of long hours, low pay, and hard physical work in beef practice
- Poor training of students in beef practice realities
- More women veterinarians entering the workforce
- Lack of spousal career options in rural areas

The more extreme positive influences on the future supply of beef veterinarians noted are:

- Creating centers of excellence in veterinary colleges focused on beef practice
- Expansion of mentoring by practicing veterinarians
- Targeted recruitment of food animal oriented students
- Funding of the National Veterinary Service Act

Questions #7 in the 3rd survey presents the supply constraint questions where there was some disagreement within the panel.

VIII. Projected Shortage or Surplus of Beef Food Supply Veterinarians

The panel continues to see a general shortage of beef cattle veterinarians. The question on the general forecast (see question #9, 3rd survey) produced an average of just over “5. Slight Shortage” (mean=5.3). Most of the panel members marked “5. Slight Shortage” or “6. Shortage.” Canadians saw less of a shortage with a mean of 4.7 (vs. 5.4 for the US panel members). The specific shortage estimates over all time periods projected shortages of -4.0% to -5.0% and the middle 50% (between the 25th and 75th percentile) always predicted a shortage. This substantiates the picture that emerged in the 1st round survey. Specifically, estimates of shortages exceed the estimates of increasing demand, thus implying inadequacies in the projected future

supply of DVMs entering the beef practices area. Those seeing more extreme shortages (compared to those seeing less of a shortage) had a *more positive* view from the following demand influences:

- Large operations seeking practice management and business advice
- Large operations needing production medicine consulting
- Client use of veterinary herd management services.

Those seeing more extreme shortage also had *more negative* views about the following supply constraints:

- Lack of student exposure to real-life food animal practice
- Poor training of students in beef practice realities

Next Steps...

The patterns flagged in the 1st survey have become clearer in the 2nd survey. This presents a unique and interesting story for DVMs in beef careers. Your replies to the third and final survey will add to and clarify this story even more. Besides making the final estimates to some previously seen questions, you will evaluate several potential solutions for the shortage problem noted above.

Thank you for your continuing help and involvement!

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Exhibit D

Section I. Factors Influencing Future Demand for Veterinarians in Beef FSVM Careers

Survey Item	Survey Wave ¹³	% Decrease ¹⁴	% No Influence	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Public concern over food Safety	1 st	0	0	100	6.0	.72	5 to 6.3	22
2. Use of non-DVMs, such as veterinary technicians	1 st	30.4	34.8	34.8	4.1	1.16	3 to 5	23
2. Use of non-DVMs, such as veterinary technicians	2 nd	50	20	30	4.0	1.40	3 to 5.8	20
2. Use of non-DVMs, such as veterinary technicians	3 rd	33.3	38.1	28.6	4.1	1.24	3 to 5.5	21
3. Public concern over bio-terrorism	1 st	0	22.7	77.3	5.5	1.10	4.8 to 6.3	22
3. Public concern over bio-terrorism	2 nd	5.3	36.8	57.9	4.7	1.00	4 to 5	19
3. Public concern over bio-terrorism	3 rd	0	14.3	85.7	5.2	.68	5 to 6	21
4. Zoonotic disease-related human health concerns	1 st	0	13	87	5.4	.89	5 to 6	23
5. Required third party certification or verification of standards	1 st	0	14.3	85.7	5.2	.77	5 to 6	21
6. Limited public understanding of food quality and safety issues	1 st	10	65	25	4.2	.81	4 to 4.8	20
7. More meat consumption in the US and Canada	1 st	4.5	36.4	59.1	4.8	.91	4 to 6	22
8. More access to global markets for food exports	1 st	5	20	75	5.3	1.12	4.3 to 6	20
8. More access to global markets for food exports	2 nd	5	35	60	4.9	1.35	4 to 6	20
8. More access to global markets for food exports	3 rd	0	19	81	5.1	.73	5 to 6	21

¹³ The “1st” refers to the 1st Delphi survey. The “2nd” refers to the 2nd Delphi survey, while the “3rd” refers to the 3rd Delphi survey.

¹⁴ The “% Decrease” is the percentage that marked 1, 2 or 3. This ranges from a “Strong Decrease” to “Slight Decrease” on the 7-point scale. The “% No Influence” is the percentage marking “No Influence.” It is the mid-point of the scale. The “% Increase” is the percentage marking 5, 6 or 7, which ranged from “Slight Increase” to “Strong Increase.” Those marking “no trend” or “no opinion” are excluded.

9. Changing dietary habits in third-world countries	1 st	4.3	39.1	56.5	4.9	1.06	4 to 6	23
9. Changing dietary habits in third-world countries	2 nd	5	35	60	4.8	.85	4 to 5	20
10. Need to protect indigenous wildlife from exotic diseases	1 st	4.8	52.4	42.9	4.5	.87	4 to 5	21
11. Federal and/or state/provincial budgetary constraints	1 st	45.5	31.8	22.7	3.9	1.04	3 to 4.3	22
11. Federal and/or state/provincial budgetary constraints	2 nd	38.1	42.9	19	3.9	1.01	3 to 4	21
12. Curtailment of government support of veterinary services	1 st	54.5	31.8	13.6	3.6	.85	3 to 4	22
13. Increasing concern for animal wildlife	1 st	9.1	18.2	72.7	5.2	1.34	4 to 6	22
14. Increasing concern for animal health	1 st	0	13.6	86.4	5.4	.73	5 to 6	22
15. Need to understand animal-human health eco-systems	1 st	0	47.4	52.6	4.7	.82	4 to 5	19
16. Availability of highly technical or specialized services	1 st	0	10	90	5.4	.94	5 to 6	20
17. Veterinary services agreements required for agri-business loans	1 st	0	45	55	5.0	1.05	4 to 6	20
17. Veterinary services agreements required for agri-business loans	2 nd	0	38.1	61.9	4.8	.75	4 to 5	21
18. Growing need to track animals entering the food chain	1 st	0	5	95	5.6	.82	5 to 6	20
19. Constraints on non-DVMs giving prescription drugs	1 st	4.3	47.8	47.8	4.7	.97	4 to 5	23
20. Slow adoption of new technologies by veterinarians	1 st	50	40	10	3.6	1.32	3 to 4	20
20. Slow adoption of new technologies by veterinarians	2 nd	68.4	31.6	0	3.2	.77	3 to 4	19
21. Move to larger sized producer operations	1 st	56.5	8.7	34.8	3.9	1.98	2 to 6	23
21. Move to larger sized producer operations	2 nd	61.9	4.8	33.3	3.8	1.64	2.5 to 5.5	21
21. Move to larger sized producer operations	3 rd	38.1	9.5	52.4	4.4	1.40	3 to 5.5	21

22. Client use of veterinary herd management services	1 st	18.2	4.5	77.3	5.1	1.36	4.8 to 6	22
22. Client use of veterinary herd management services	2 nd	0	14.3	85.7	5.3	.80	5 to 6	21
23. Client concerns about veterinary service costs	1 st	40.9	45.5	13.6	3.6	1.14	3 to 4	22
23. Client concerns about veterinary service costs	2 nd	33.3	61.9	4.8	3.6	.74	3 to 4	21
24. Lack of veterinarian's practice management and business skill	1 st	47.4	42.1	10.5	3.5	1.31	3 to 4	19
24. Lack of veterinarian's practice management and business skill	2 nd	76.2	19	4.8	3.1	.77	3 to 3.5	21
25. Part-time farmers needing more veterinary services	1 st	8.7	13	78.3	5.0	1.21	5 to 6	23
25. Part-time farmers needing more veterinary services	2 nd	0	25	75	5.0	.80	4.3 to 5	20
65. Animal tracking and identification requirements	2 nd	0	25	75	5.3	.98	4.3 to 6	20
65. Animal tracking and identification requirements	3 rd	0	4.8	95.2	5.5	.75	5 to 6	21
66. Large operations needing production medicine consulting	2 nd	0	28.6	71.4	5.5	1.17	4 to 6.5	21
66. Large operations needing production medicine consulting	3 rd	4.8	19	76.2	5.2	1.08	4.5 to 6	21
67. Demand for nutrition consulting	2 nd	0	25	75	5.3	.91	4.3 to 6	20
67. Demand for nutrition consulting	3 rd	0	19	81	5.2	.81	5 to 6	21
68. Expansion of food safety related regulations	2 nd	0	15	85	5.3	.80	5 to 6	20
69. Increasing need for cost-efficient animal production	2 nd	4.8	14.3	81	5.4	1.02	5 to 6	21
69. Increasing need for cost-efficient animal production	3 rd	5	5	90	5.5	.89	5 to 6	20
70. Large operations seeking practice management and business advice	2 nd	0	23.8	76.2	5.4	1.08	4.5 to 6	21

70. Large operations seeking practice management and business advice	3 rd	4.8	19	76.2	5.2	1.09	4.5 to 6	21
71. Decreasing financial support for extension specialists	2 nd	4.8	42.9	52.4	4.7	.91	4 to 5	21
72. Decreasing demand for individual animal care	2 nd	47.6	33.3	19	3.7	.96	3 to 4	21
72. Decreasing demand for individual animal care	3 rd	52.4	28.6	19	3.7	1.24	3 to 4	21
73. Producers becoming less dependent on services from DVMs	2 nd	70	30	0	3.1	.83	3 to 4	20
74. Continuing consolidation of large producer operations	2 nd	65	0	35	4.0	1.64	3 to 5.8	20
74. Continuing consolidation of large producer operations	3 rd	42.9	14.3	42.9	4.2	1.60	3 to 6	21

Section II. Specialized Activities Increasing or Decreasing in Demand Relative to the General Pattern

Survey Item	Survey Wave	% Lower ¹⁵	% No Difference	% Higher	Mean	Standard Deviation	Middle 50% Range	N
1. Animal identification and source verification	2 nd	0	14.3	85.7	5.6	.98	5 to 6	21
2. Management and business consulting	2 nd	0	9.5	90.5	5.6	.93	5 to 6	21
3. Using research skills	2 nd	0	14.3	85.7	5.4	.87	5 to 6	21
4. Using immunology expertise	2 nd	4.8	28.6	66.7	5.1	1.07	4 to 6	21
5. Using genetics expertise	2 nd	0	19	81	5.1	.85	5 to 5.5	21
6. Production management data analysis	2 nd	0	9.5	90.5	5.8	.87	5 to 6	21
7. Training staff in large operations	2 nd	0	9.5	90.5	5.7	.90	5 to 6	21
8. Regulatory requirements	2 nd	0	19	81	5.2	.75	5 to 6	21
9. Developing health management systems	2 nd	0	14.3	85.7	5.7	1.06	5 to 7	21
10. Treating individual animals	2 nd	57.1	23.8	19	3.4	1.24	2.5 to 4	21
11. Obstetrics	2 nd	57.1	23.8	19	3.3	1.19	2 to 4	21
12. Surgery	2 nd	42.9	38.1	19	3.7	1.24	3 to 4	21
13. Doing vaccinations	2 nd	75	25	0	2.6	1.05	2 to 3.8	20

¹⁵ The “% Lower” is the percentage that marked 1, 2 or 3. This ranges from “Significantly Lower” to “Slightly Lower” on the 7-point scale. The “% No Difference” is the percent that marked 4. This is the mid-point of the scale. The “% Higher” is the percentage marking 5, 6 or 7, which ranged from “Slightly Higher” to “Significantly Higher.”

Section III. Factors Influencing Future Supply for Veterinarians in the Beef FSVM Careers

Survey Item	Survey Wave	% Decrease ¹⁶	% No Influence	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Less emphasis on food animal practice in veterinary colleges	1 st	100	0	0	2.0	.77	1 to 3	23
2. More women veterinarians entering the workforce	1 st	69.6	26.1	4.3	2.7	1.30	2 to 4	23
2. More women veterinarians entering the workforce	2 nd	57.1	38.1	4.8	3.0	1.43	2 to 4	21
2. More women veterinarians entering the workforce	3 rd	57.1	28.6	14.3	3.1	1.49	2 to 4	21
3. Physical demands of large animal veterinary work	1 st	78.3	21.7	0	2.8	.78	2 to 3	23
4. Need to work long hours and emergency calls	1 st	87	13	0	2.6	.78	2 to 3	23
5. Little exposure to food supply career options in college	1 st	90.5	4.8	4.8	2.1	1.07	1 to 2.5	21
5. Little exposure to food supply career options in college	2 nd	95.2	4.8	0	2.3	.72	2 to 3	21
6. Lack of food supply practice-related externships for students	1 st	50	45	5	3.0	1.36	1.3 to 4	20
6. Lack of food supply practice-related externships for students	2 nd	65	25	10	3.3	1.07	2.3 to 4	20
6. Lack of food supply practice-related externships for students	3 rd	76.2	23.8	0	3.1	.67	3 to 3.5	21
7. Lack of positive role models in veterinary food supply practice	1 st	50	35	15	3.3	1.68	2 to 4	20
7. Lack of positive role models in veterinary food supply practice	2 nd	66.7	23.8	9.5	3.2	1.12	2.5 to 4	21
7. Lack of positive role models in veterinary food supply practice	3 rd	61.9	28.6	9.5	3.3	.86	3 to 4	21
8. Poor income opportunities in rural areas	1 st	50	35	15	3.4	1.50	2 to 4	20
9. Lack of cultural and recreational opportunities in rural areas	1 st	61.1	33.3	5.6	3.4	.86	3 to 4	18
10. Lack of spousal career options in rural areas	1 st	91.3	4.3	4.3	2.7	.98	2 to 3	23
11. Limited lifestyle and career opportunities in rural areas	1 st	73.7	26.3	0	3.0	.75	2 to 4	19
12. Federal and/or state/provincial budgetary constraints	1 st	36.8	57.9	5.3	3.7	1.06	3 to 4	19
12. Federal and/or state/provincial budgetary constraints	2 nd	52.4	42.9	4.8	3.4	.75	3 to 4	21
13. High debt load of veterinary school graduates	1 st	65.2	21.7	13	3.2	1.34	2 to 4	23
13. High debt load of veterinary school graduates	2 nd	66.7	19	14.3	3.0	1.27	2 to 4	21
13. High debt load of veterinary school graduates	3 rd	71.4	23.8	4.8	3.0	1.27	2 to 4	21
14. Expected high number of food supply veterinarians retiring in the near future	1 st	33.3	19	47.6	4.2	1.86	2.5 to 6	21
14. Expected high number of food supply veterinarians retiring in the near future	2 nd	33.3	19	47.6	4.2	1.55	3 to 5.5	21

¹⁶ The “% Decrease” is the percentage that marked 1, 2 or 3. This ranges from a “Strong Decrease” to “Slight Decrease” on the 7-point scale. The “% No Influence” is the percentage marking “No Influence.” It is the mid-point of the scale. The “% Increase” is the percentage marking 5, 6 or 7, which ranged from “Slight Increase” to “Strong Increase.” Those marking “no trend” or “no opinion” are excluded.

14. Expected high number of food supply veterinarians retiring in the near future	3 rd	38.1	19	42.9	4.1	1.32	3 to 5	21
15. Limited capacity of existing veterinary colleges in the US and/or Canada	1 st	30	70	0	3.5	.95	3 to 4	20
16. Perceived lack of demand for food animals	1 st	47.6	47.6	4.8	3.4	.87	3 to 4	21
17. Requirement for education beyond a DVM	1 st	47.6	47.6	4.8	3.3	1.07	2 to 4	21
17. Requirement for education beyond a DVM	2 nd	42.9	42.9	14.3	3.6	.98	3 to 4	21
46. Targeted recruitment of food animal oriented students	2 nd	9.5	0	90.5	5.1	1.06	5 to 6	21
47. Funding of the National Veterinary Service Act	2 nd	5.9	29.4	64.7	4.8	.95	4 to 5	17
47. Funding of the National Veterinary Service Act	3 rd	0	50	50	4.7	.75	4 to 5	20
48. Expansion of mentoring by the practicing veterinarians	2 nd	0	4.8	95.2	5.5	.60	5 to 6	21
49. Creating centers of excellence in veterinary colleges focused on beef practice	2 nd	0	4.8	95.2	5.9	.83	5 to 6.5	21
50. The perception of long hours, low pay, and hard physical work in beef practice	2 nd	81	14.3	4.8	2.6	1.16	2 to 3	21
50. The perception of long hours, low pay, and hard physical work in beef practice	3 rd	81	14.3	4.8	2.9	1.24	2 to 3	21
51. Lack of student exposure to real-life food animal practices	2 nd	81	9.5	9.5	2.9	1.11	2 to 3	21
51. Lack of student exposure to real-life food animal practices	3 rd	95.2	0	4.8	2.7	1.11	2 to 3	21
52. Poor training of students in beef practice realities	2 nd	76.2	19	4.8	2.8	1.03	2 to 3.5	21
52. Poor training of students in beef practice realities	3 rd	95.2	0	4.8	2.7	1.10	2 to 3	21
53. Perceived lack of career opportunity in food animal medicine	2 nd	90.5	4.8	4.8	2.5	.98	2 to 3	21

Section IV. Solutions for Shortages

Survey Item	Survey Wave	% Less Effective ¹⁷	% Effective	% Highly Effective	Mean	Standard Deviation	Middle 50% Range	N
1. Reserve class slots for academically qualified students with food supply interests and relevant background	3 rd	28.6	23.8	47.6	5.1	1.87	3 to 7	21
2. Expand the Centers for Excellence concept where nationally recognized focus on different food supply sectors	3 rd	9.5	47.7	42.9	5.4	1.47	5 to 7	21
3. Focused recruitment of high school and college students with food supply interests into veterinary colleges	3 rd	14.3	42.9	42.9	5.1	1.35	4 to 6	21
4. Increased focus of food supply coverage early in DVM curriculum	3 rd	38.1	38.1	23.8	4.4	1.69	3 to 5.5	21
5. Expanded business and practice management coverage in DVM curriculum	3 rd	23.8	33.3	42.9	4.9	1.58	3.5 to 6	21
6. Expanded postgraduate fellowships in food supply areas	3 rd	23.8	38.1	38.1	5.0	1.77	3.5 to 7	21
7. Expanded paid work-study programs during the final year of DVM	3 rd	30	40	30	4.6	1.47	3 to 6	20
8. More involvement of food supply practitioners in training veterinary students	3 rd	14.3	23.8	61.9	5.6	1.47	5 to 7	21
9. Provide expanded job placement services in the food supply veterinary medicine areas	3 rd	15	50	35	4.9	1.46	4 to 6	20

¹⁷ The “% Less Effective” is the percentage that marked 1, 2 or 3. This ranges from “Not at all Effective to Slightly Effective” on the 7-point scale. The “% Effective” is the percentage marking 4 or 5 where 5 is “Effective.” The “% Highly Effective” is the percentage marking 6 or 7 where 7 is “Highly Effective.”

10. Appointment of more food supply faculty at colleges of veterinary medicine	3 rd	9.5	47.6	42.9	5.4	1.32	4.5 to 7	21
11. Paid externship requirement in food supply medicine during the summer	3 rd	23.8	47.6	28.6	4.6	1.50	3.5 to 6	21
12. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities	3 rd	19	61.9	19	4.5	1.29	4 to 5	21
13. Student debt repayment and scholarship programs for service in food supply areas of need	3 rd	28.6	33.3	38.1	4.8	1.76	3 to 6.5	21
14. Development of a government-supported Reserve Corps of food supply DVMs for disease surveillance and control activities	3 rd	63.2	31.6	5.3	3.4	1.42	2 to 4	19
15. Low cost (subsidized) consulting in business and practice management for new food supply DVMs	3 rd	57.9	31.6	10.5	3.5	1.50	2 to 5	19
16. Mentoring initiatives for students and those starting a food supply career	3 rd	9.5	52.4	38.1	5.1	1.35	5 to 6	21
17. Focused recruitment of women students in food supply areas	3 rd	65	30	5	3.1	1.36	2 to 4	20
18. Development and dissemination of Business Best Practices for food supply veterinary enterprises	3 rd	60	25	15	3.9	1.62	3 to 5	20