
Chapter 7

The Future Demand for Food Supply Veterinarians in Swine 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 Swine 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 swine careers?
- II. Assuming a continuation of currently unfolding trends and the absence of major catastrophic events, what will be the demand for swine 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 swine area?
- IV. What are the issues and trends likely to drive the future supply of food supply veterinarians entering swine careers?
- V. Given the pattern of emerging trends and factors influencing the supply and demand and assuming the absence of major catastrophic events, what is the likely surplus or shortage of food supply veterinarians in swine 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 best could 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 own judgment in the face of conflicting viewpoint 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 would 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 projected shortages 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 Swine 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 latter 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 swine FSVM sector. Eleven additional items were derived from those open-ended comments for a total of 36 items. In the second survey, the 11 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 for swine practice veterinarians (starting with the most influential issues and trends first):¹

Trends Increasing Demand

1. Required third-party certification or verification of standards (mean: 5.84 on a 7-point scale)²
2. Public concerns over food safety (mean: 5.80)
3. Need for 3rd party auditing of food safety issues (mean: 5.79)

¹ Where significant differences exist between those focused on the Canadian context versus the US-focused sub-group mean, they are noted. However, the relatively few Canadians that completed the final survey make inferences about such contrasts quite limited. 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. Need for 3rd party auditing of animal welfare issues (mean: 5.64)
5. Tighter regulation of prescription drug use (mean: 5.63)
6. Increasing concern for animal welfare (mean: 5.44)
7. Availability of highly technical or specialized services (mean: 5.44)
Note that Canada-focused ratings (mean: 4.50) were significantly lower than ratings by US-focused panel members (mean: 5.55)
8. Growing need to track animals entering the food chain (mean: 5.32)
9. Zoonotic disease-related human health concerns (mean: 5.29)
10. Increasing concern for animal health (mean: 5.26)
11. Need to understand animal-human health eco-systems (mean: 5.23)
12. More access to global markets for food exports (mean: 5.22)
13. Need for animal disease research and control (mean: 5.20)
14. Public concerns over bio-terrorism (mean: 5.16)
15. Need to improve herd productivity (mean: 5.13)
16. Traceability and identification mandates (mean: 5.09)
17. Increased government regulation of the swine industry (mean: 5.00)

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 B 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 the demand for swine practice veterinarians. The survey items noted below are trends rated as *decreasing* future demand starting with the most influential factors first:

Trends Decreasing Demand

1. New DVMs not having the training needed for larger producer operations (mean: 3.14)³
2. Animal science specialists (or other non-DVMs specialists) filling needs (mean: 3.24)
3. Lack of veterinarian's practice management and business skill (mean: 3.26)
4. Slow adoption of new technologies by veterinarians (mean: 3.36)
5. Use of non-DVMs, such as veterinary technicians (mean: 3.48)
6. Client concerns about veterinary service costs (mean: 3.50)
7. Federal and/or State/Provincial budgetary constraints (mean: 3.60)
8. Move to larger-sized producer operations (mean: 3.67)⁴
Note that self-rated experts (mean: 4.20) saw a significantly weaker relationship to demand decreases than less-expert raters (mean: 3.25)
9. Curtailment of government support of veterinary services (mean: 3.70)
10. Use of programs like 90-day least cost production management (mean: 3.89)

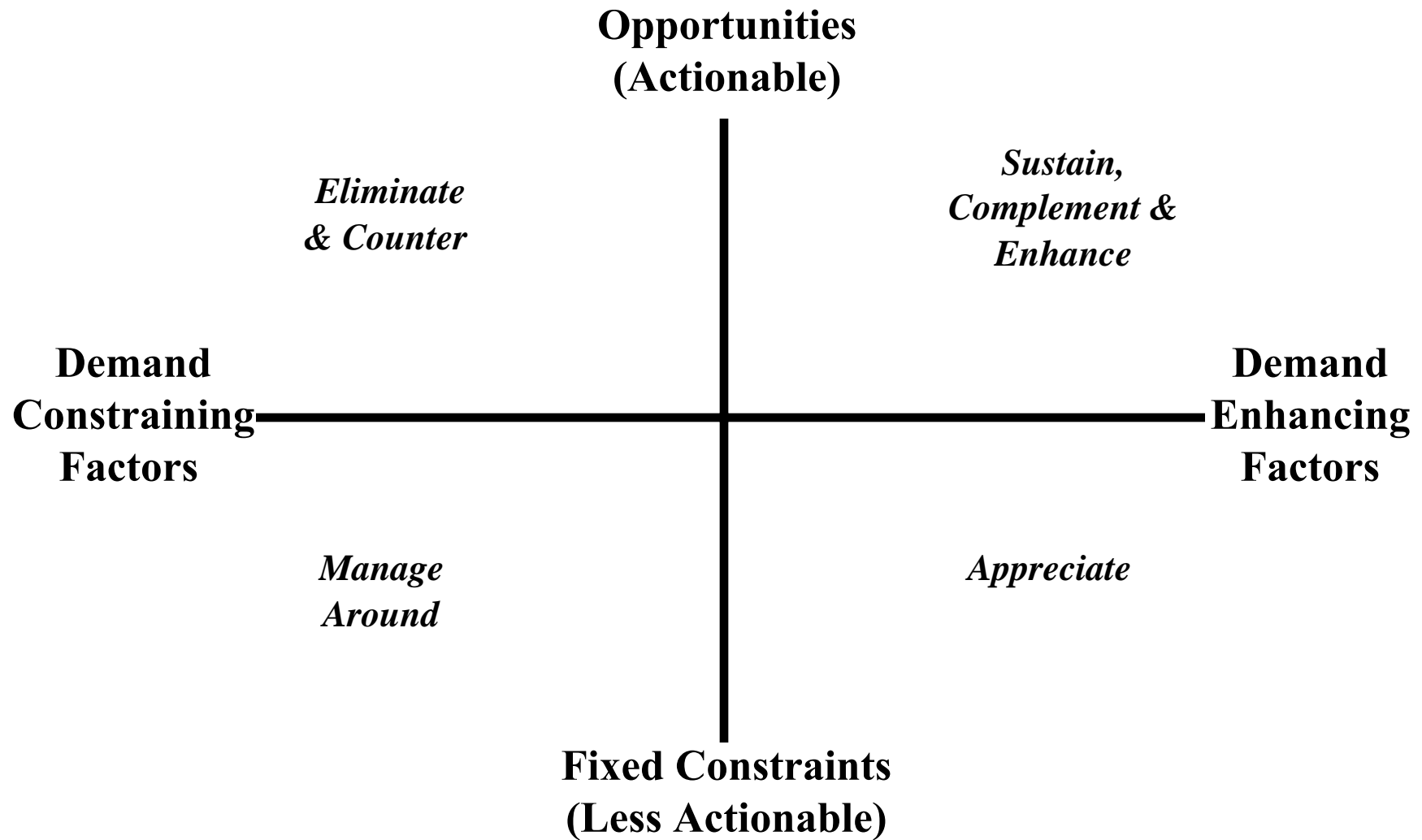
The Planning Matrix

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 alter the expected pattern of influence suggested by the panel's mean score. Others items

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 B 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. See Exhibit D for these values. The mean values noted for each of the above (and following) items are from the last survey in which each appeared.

Figure 1 Planning Matrix



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.

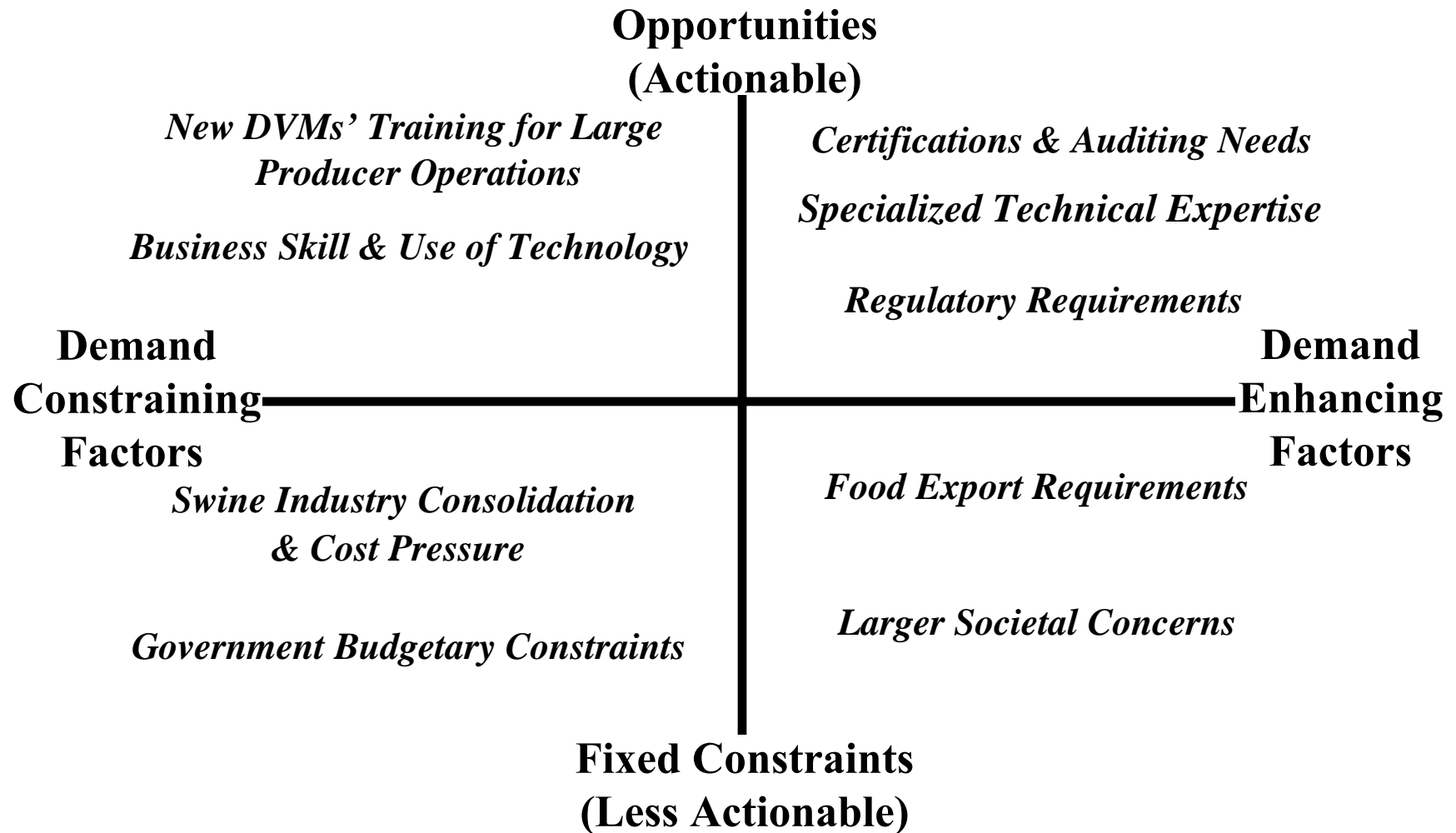
Figure 2 is an adaptation of Figure 1 that is used to organize the results from the above two listings. The listing of the 10 demand-decreasing items map to the left-side of Figure 2. The 17 demand-increasing items logically fit on the right-side of that figure. Two of the 10 demand-decreasing items (items 7 and 9) relate to *Government Budgetary Constraints* theme noted in Figure 2. These are the least actionable constraints on demand and fit in the lower-left quadrant. While there is some maneuvering room to help insure animal agriculture allocations are hurt less, the reality of large deficits represents a fairly fixed constraint that the profession must manage around. Similarly, item 2 (non-DVMs

filling needs), item 5 (use of non-DVMs), item 6 (client cost concerns), item 8 (move to larger operations), and item 10 (least-cost production management) all related to *Swine Industry Consolidation & Cost Pressure*. These are larger economic trends that will not be changed directly by strategic action. Strategic actions need to recognize this constraint and be responsive to the context this provides for the profession. It is also noted in the lower-left quadrant of Figure 2. In contrast, items 3 and 4 refer to veterinarians' practice management skills and resistance to new technology. These are self-imposed impediments to 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 in the upper-left quadrant. The remaining item (item 1) is the highest rated constraint on demand. It is related to swine practice veterinarians' response to industry consolidation and inadequacy of new veterinarians' training and preparation for the needs of large producer operations. This *New DVMs' Training for Large Producer Operations* theme is noted in the upper-left quadrant of Figure 2. It is a demand-diminishing factor that can be changed through educational initiatives.

The 17 items noted in the listing of demand increasing trends and issues are the basis for the themes noted on the right-side of Figure 2. Several items related to the *Larger Societal Concerns* theme are noted in the lower-left quadrant. They cannot be directly changed and need to be appreciated for the demand-increasing influence they have on swine practice veterinarians. These include item 2 (food safety concerns), item 6 (animal welfare concerns), item 9 (zoonotic human health concerns), item 10 (animal

Figure 2

Demand Diminishing & Enhancing Issues in the Swine Sector



health concerns), item 11 (animal-human health eco-systems), and item 14 (bio-terrorism concerns). Item 12 is related to another trend, noted as *Food Export Requirements*, that is also a fairly fixed constraint that has a positive influence on demand and must be responded to in an appropriate fashion. It has been placed in the lower-quadrant but is closer to the middle line indicating more room for strategic action.

The remaining items are more actionable and have been placed in the upper-right quadrant of Figure 2. Item 1 (3rd party certifications), item 3 (food safety auditing), and item 4 (animal welfare auditing) are all highly influential on the demand for swine veterinary services and relate to the *Certification & Auditing Needs* theme. The *Specialized Technical Expertise* is a theme related to item 7 (highly technical or specialized services), item 13 (animal disease research), and item 15 (herd productivity improvement). These are actionable opportunities that can be used to enhance the demand for veterinary services. Finally, the *Regulatory Requirements* theme also noted in the upper-right quadrant is related to item 5 (prescription drug regulation), 16 (traceability and identification mandates), and item 17 (increased government regulation). These have a favorable influence on demand and represent actionable opportunities that can be further leveraged by the swine sector of the FSVM profession. It does relate to some large societal and economic trends and for this reason has been placed near the middle line.

The Future Demand for Swine 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 reconsider 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 reconsider 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 increasing agreement within the panel as they moved from the second to the third survey, but plenty of disagreement remained in the final estimates of future demand changes.

Figure 3

Short-Term Demand Change (2004-07)

2nd Survey Results:

- Mid-50% = -3.0% to +5.5%
- Mean = +.8% (■)
- Median = +3.0% (▲)

3rd Survey Results:

- Mid-50% = +1.0% to +6.0%
- Mean = +2.7% (■)
- Median = +3.0 (▲)

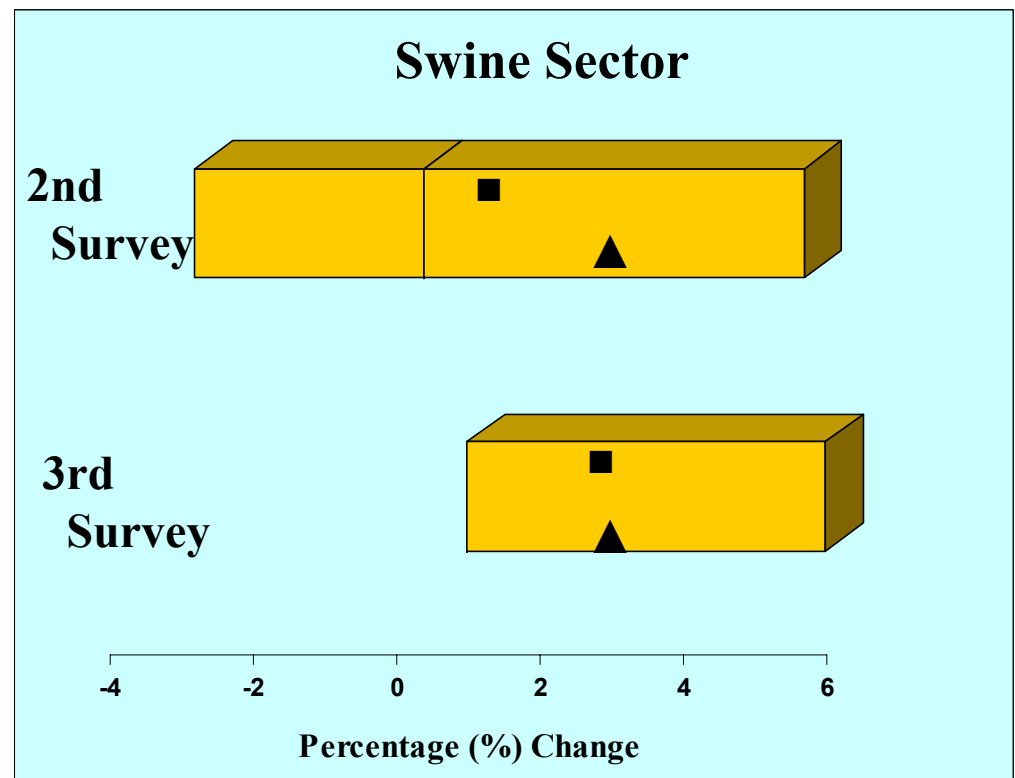


Figure 4

Medium-Term Demand Change (2007-10)

2nd Survey Results:

- Mid-50%: -1.5% to +5.0%
- Mean = +1.2% (■)
- Median = +2.0% (▲)

3rd Survey Results:

- Mid-50%: +0.3% to +4.0%
- Mean = +1.9% (■)
- Median = +3.0% (▲)

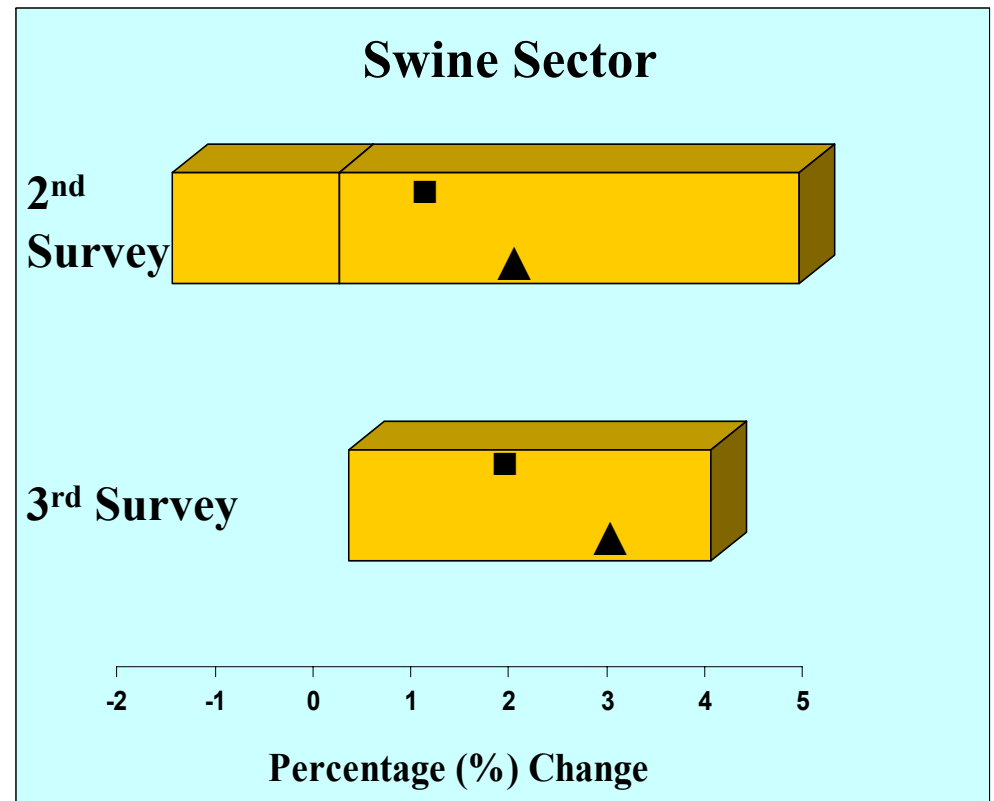


Figure 5

Long-Term Demand Change (2010-16)

2nd Survey Results:

- Mid-50%: 0% to +9.0%
- Mean = +3.0% (■)
- Median = +4.0% (▲)

3rd Survey Results:

- Mid-50%: +4.0% to +8.0%
- Mean = +5.7 % (■)
- Median = +7.0 % (▲)

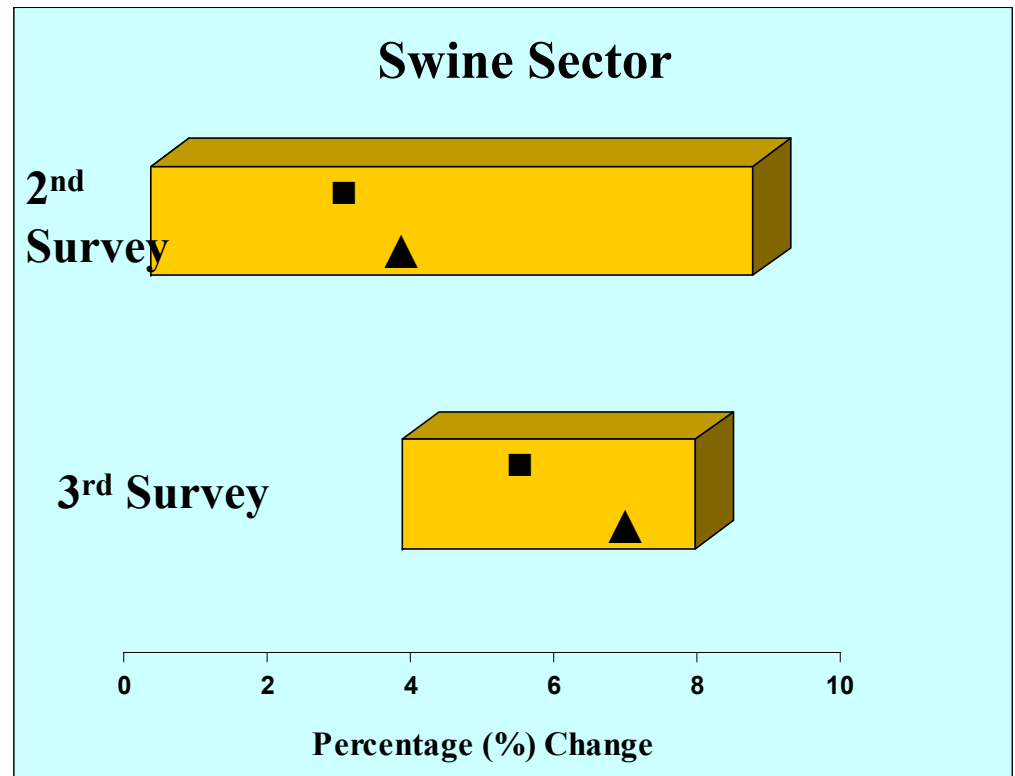


Figure 6

Future Demand Summary

Short-Term (2004-07):

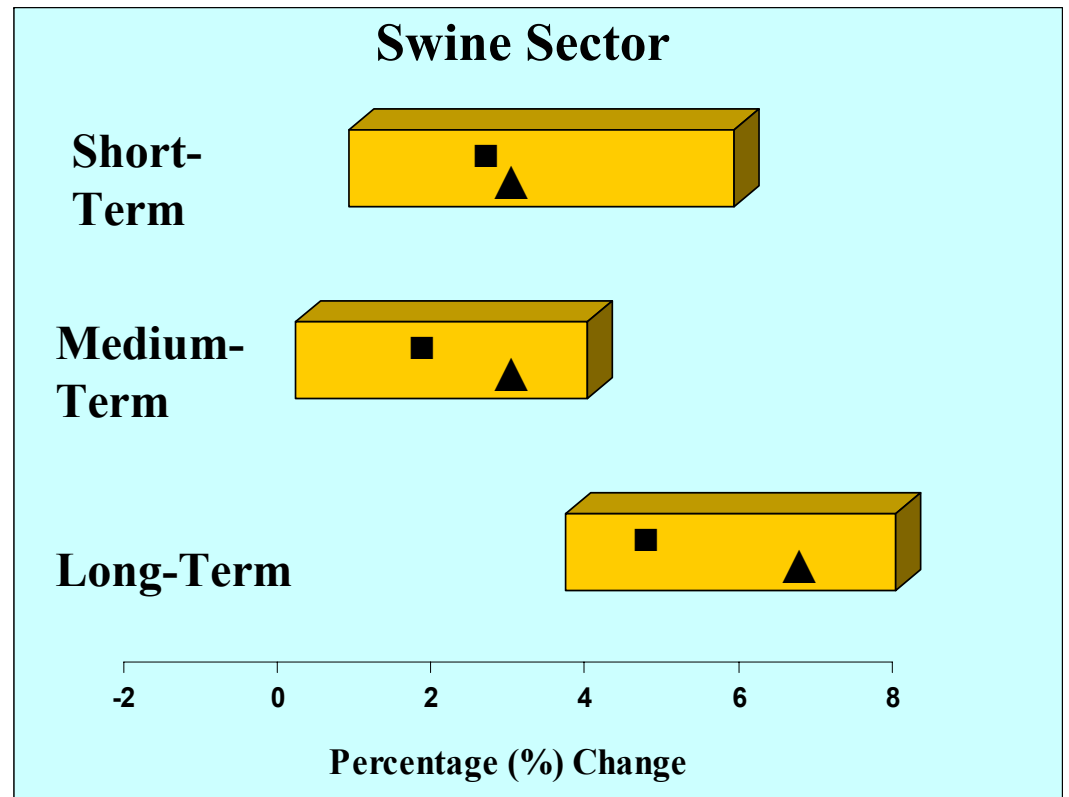
- Mid-50% = +1.0% to +6.0%
- Mean = +2.7% (■)
- Median = +3.0 (▲)

Medium-Term (2007-10):

- Mid-50%: +0.3% to +4.0%
- Mean = +1.9% (■)
- Median = +3.0% (▲)

Long-term (2010-16):

- Mid-50%: +3.8% to +8.0%
- Mean = +4.5 % (■)
- Median = +7.0 % (▲)



The middle 50% range (those between the 25th and 75th percentile of the distribution) included some negative numbers (indicating decreasing demand), but the ranges for the final survey are always indicated increasing demand. As noted on the summary in Figure 6, the middle 50% of the panel predicted a +1.0% to +6.0% increase for the short-term (2004-07) and a +.3% to +4.0% increase for the medium-term (2007-10). The 2010-16 long-term forecast predicted a +4.0% to +8.0% demand increase. The point estimates, means and median (a median is the estimate at the 50th percentile of the distribution), were generally in the +2% to +3% range for the two nearer time periods and double that in the 2010-16 time frame. The means and median values are always positive and indicate between +2% to +3% increases in demand for the first two periods and point estimates of close to +6% to +7% in the panel's final long-term forecast. Around 22% of the panel predicted decreasing demand while the rest see varying degrees of increasing demand.

Growing or Declining Demand

To more fully understand the range of demand projections, analyses were done that contrasted the perceptions of those forecasting demand decreases and lower increases versus those projecting increases in demand above the panel median estimate. Several significant differences between those seeing weaker demand increases (or decreases) versus those seeing stronger demand increases are identified. The median average demand change (over all time periods) for the those seeing weaker demand was +.5%, while the higher-demand sub-group had a median score of +5.2%. The following demand-increasing influences (noted in the previous section) had statistically significant

higher ratings by the sub-group projecting higher (versus lower) increasing future demand:⁵

- Public concerns over bio-terrorism (mean equals 5.50 on a 7-point scale in the higher increasing demand sub-group versus a mean of 4.80 in the lower or decreasing demand sub-group)
- Availability of highly technical or specialized services (mean equals 5.75 in the higher increasing demand sub-group versus a mean of 5.11 in the lower or decreasing demand sub-group)
- Need for animal disease research & control (mean equals 5.50 in the higher increasing demand sub-group versus a mean of 4.80 in the lower or decreasing demand sub-group)

Those seeing higher demand compared to those seeing lower or decreasing demand also made significantly *higher* rating on the following demand-decreasing factors:

- Move to larger sized producer operations (mean equals 4.25 in the higher demand sub-group versus 3.00 in the lower or decreasing demand sub-group)
- Animal science specialists (or other non-DVM specialists) filling needs (mean equals 3.67 in the higher demand sub-group versus 2.90 in the lower or decreasing demand sub-group)

The consolidation is a dominant reality in the swine industry. Those seeing higher future demand do not see the same decreasing-demand influence in the move to larger producer operations. For them this was a fairly neutral issue (mean equals 4.25), while those projecting lower demand (or decreases) see consolidation as having a negative influence on demand (mean equals 3.0). Similarly, the increased use of non-DVMs in these large operations was also not seen as a strong brake on the demand for veterinary services. The panel members in the higher-demand sub-group are also more optimistic

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.

about the opportunities that specialized services, including animal disease research and control, will create for veterinarians. 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 swine veterinarians in a precarious position marked by lower or 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 swine veterinary services. These suggestions were content analyzed and 14 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. 3rd Party validation of certification programs (mean: 5.56 on a 7-point scale)⁶
Note that self-rated experts (mean: 5.90) saw a significantly higher demand than less-expert raters (mean: 5.42)
2. Managing animal health teams in large producer operations (mean: 5.44)
Note that Canada-focused ratings (mean: 6.00) were significantly higher than ratings by US-focused panel members (mean: 5.25)
3. Applied research and diagnostic skills (mean: 5.36)
4. Food safety and related activities (mean: 5.36)
5. Developing animal health procedures and policies (mean: 5.16)
6. Bilingual communication skills (mean: 5.09)
7. Training farm workers in animal health issues (mean: 4.92)
Note that Canada-focused ratings (mean: 6.00) were significantly higher than ratings by US-focused panel members (mean: 4.70)
8. Herd health monitoring and oversight (mean: 4.88)
9. Operation production management and flow (mean: 4.80)
10. Support of niche production systems (e.g., no antibiotic use) (mean: 4.72)

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.

11. Herd inspection activities (mean: 4.40)

12. Animal health technicians providing services (mean: 4.08)

The two activity areas rated as facing *lower* future demand than the general pattern seen for swine practice veterinary services are:

1. Activities such as blood testing and injections (mean: 2.92 on a 7-point scale)⁷

2. Animal reproduction services and pregnancy diagnosis (mean: 3.75)

These results shed further light on the conflicting views (increasing demand vs. decreasing demand) seen in the panel's future demand projections. Many of the 12 "higher demand" activities generally assume a large producer operation context. Items 2, 5, 6, 7, 8, 9, 11 and 12 either explicitly reference the larger producer context or are more likely to be used in that context. Those 12 activities also provide some detail on the demand-enhancing opportunity themes noted in the upper-right quadrant of Figure 2. Many of these items (e.g., items 5, 8, 9 and 11) are examples of the *Specialized Technical Expertise* theme.

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, 6. Decrease, 7. Strong Decrease.

Trends and Issues Driving the Future Supply of Swine

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. Nine 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 four factors rated as *increasing* the future supply of veterinarians entering swine practice careers:

Trends Increasing Supply

1. Good income opportunities in swine practice (mean: 5.54 on a 7-point scale)⁸
2. Initiatives to attract veterinary students with food animal interests (mean: 5.32)
3. Few emergency calls being required (mean: 5.24)
4. Government programs such as education debt assistance initiatives (mean: 5.09)

The panel identified several trends and factors that are *decreasing* the future supply of food supply veterinarians entering swine practice 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 swine 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: 2.00)⁹
2. Little exposure to food supply career options in college (mean: 2.13)
3. Limited lifestyle and career opportunities in rural areas (mean: 2.86)
4. Lack of spousal career options in rural areas (mean: 2.88)
5. Entering veterinary students not having agricultural backgrounds (mean: 2.96)
6. Lack of cultural and recreational opportunities in rural areas (mean: 3.04)
Note that Canada-focused ratings (mean: 4.00) were significantly higher than ratings by US-focused panel members (mean: 2.89)
7. Lack of food supply practice-related externships for students (mean: 3.05)
Note that self-rated experts (mean: 2.70) saw a significantly stronger relationship to supply decreases than less-expert raters (mean: 3.33)
8. Perceived lack of demand for food animal skills (mean: 3.05)
Note that Canada-focused ratings (mean: 4.00) were significantly higher than ratings by US-focused panel members (mean: 2.82)
9. Student admissions policies in CVMs that do not favor farm experience (mean: 3.09)
10. Lack of positive role models in veterinary food supply practice (mean: 3.19)
11. New DVMs lack training for modern production settings (mean: 3.20)
12. Need to work long hours and emergency calls (3.32)
13. Lifestyle options in rural communities (mean: 3.45)
Note that self-rated experts (mean: 4.00) saw a significantly weaker relationship to supply decreases than less-expert raters (mean: 3.00)
14. Physical demands of large animal veterinary work (mean: 3.52)
Note that Canada-focused ratings (mean: 4.00) were significantly higher than ratings by US-focused panel members (mean: 3.35)

⁹ The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future supply of swine 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.

15. Federal and/or State/Provincial budgetary constraints (mean: 3.53)
16. High debt load of veterinary school graduates (mean: 3.59)
17. More women veterinarians entering the workforce (mean: 3.59)
Note that self-rated experts (mean: 4.00) saw a significantly weaker relationship to supply decreases than less-expert raters (mean: 3.25)
18. Requirement for education beyond a DVM (mean: 3.64)

These supply-related factors can also be organized using the planning matrix introduced earlier. Figure 7 captures the general pattern seen in the two above 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 (noted by low mean ratings) 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. Six of the nine items with the lowest ratings (a lower score means a stronger influence on decreasing the supply) relate to the *Veterinary College Student Selection & Non-FSVM Focus* theme. These include: item 1 (less emphasis on food animal practice), item 2 (little exposure to food supply career options), item 5 (students not having agricultural backgrounds), item 7 (lack of food supply externships), item 8 (perceived lack of demand for food animal skills), item 9 (student admissions policies), and item 11 (lack of training for modern production settings). The *Ineffective Role Models* theme also noted in the upper-left quadrant is identified by item 10. Item 12 (long hours and emergency calls) is related to how swine practices are organized (*Practice Modes*). There are some constraints and limits to how much this can be eliminated. Animal health problems that need immediate attention will always occur outside of regular work hours. However,

ways of organizing practices can lessen this problem. The fact that “few emergency calls” was noted as a demand-increasing factor (in an earlier section) underscores this. For these reasons, the *Practice Modes* theme is noted near the middle line indicating a mixture of fixed constraints and actionable opportunities.

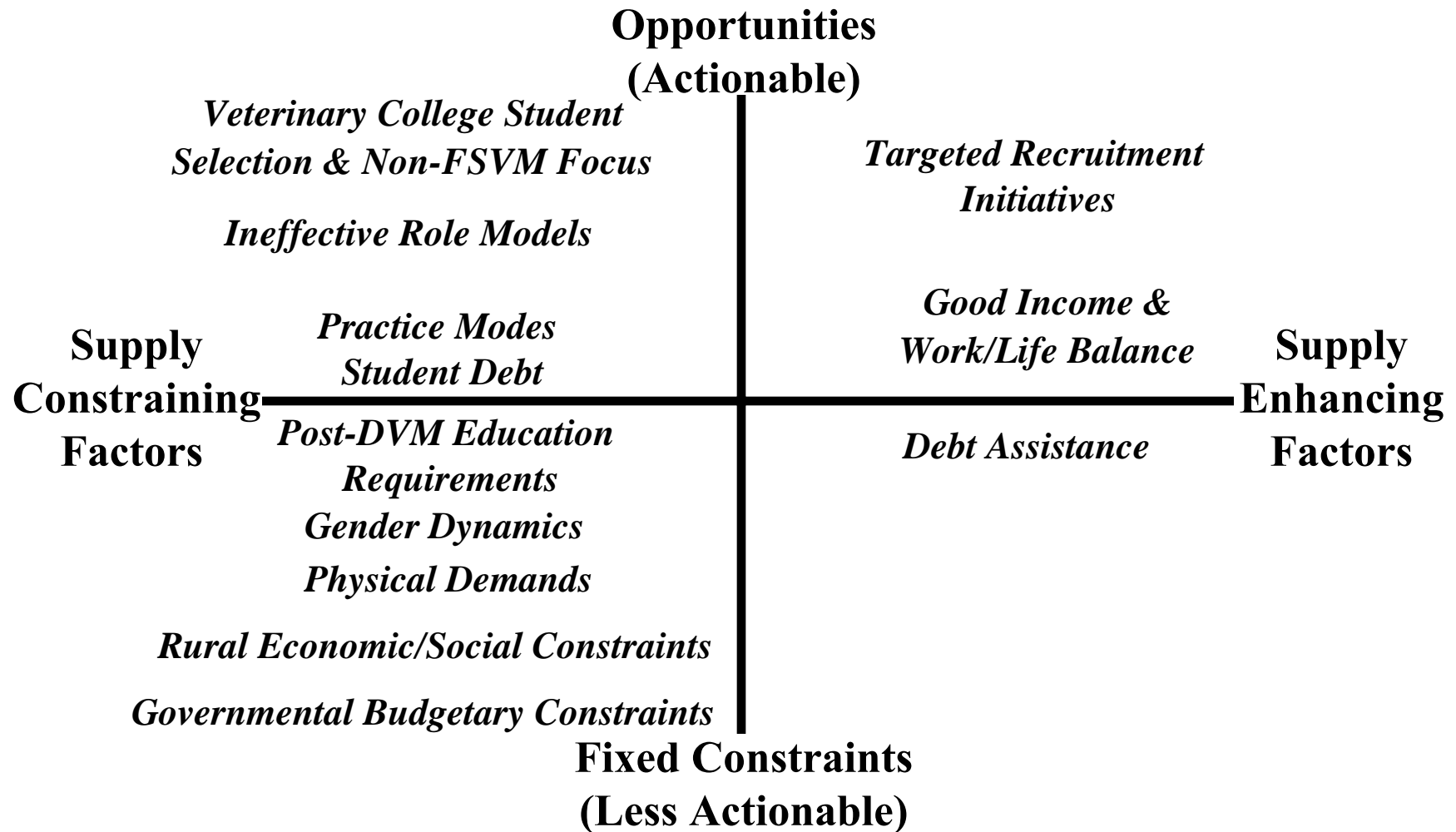
The *Student Debt* theme, which is identified by item 16, is partly constrained and partly actionable and has also been placed close to the middle line in Figure 7. Low tuition is not a reasonable option given the economics of higher education and patterns of low governmental support, but there are emerging strategies, including debt repayment for service in areas of need, that at least partially counters the student debt constraint.

Practice modes and the identification of “best practices” as well as educational strategies that make swine practice careers a good income choices relative to alternatives will go far in mitigating this supply constraint.

The other supply-constraining items are less actionable and more heavily reflect fixed constraints that are less changeable by strategic action. Item 18 notes the need for education beyond the DVM degree as a constraint. This is identified as *Post-DVM Education Requirements* theme in Figure 7. It has been placed near the line but in the lower-left quadrant in recognition of the slightly less actionable nature of this constraint. Changes such as moving away from the generalist model of DVM education and allowing early specialization in food animal and swine practice would certainly change this placement but this is probably not a likely near-term change. Item 17 notes the increasing numbers of women in veterinary schools and the perception that they are less attracted to swine practice careers. The increasing number of women attracted to professional careers is a larger societal trend that is a fixed constraint. At the same time,

Figure 7

Supply Diminishing & Enhancing Issues in the Swine Sector



there are many ways to make swine practice careers more attractive to women. For these reasons, the related *Gender Dynamics* theme has been placed near the middle line but in the lower-left quadrant. Item 14 notes the *Physical Demands* of large animal veterinary work. While tools can be used to lessen this challenge, it remains a constraint that will not be greatly changed with strategic action. The *Rural Economics/Social constraints* theme relates to several items that are seen as more extreme supply-decreasing factors (as indicated by low means). These are: item 3 (rural lifestyle and career opportunities), item 4 (lack of spousal career options), item 6 (lack of cultural and recreational opportunities, and item 13 (rural lifestyle options). These are not very actionable constraints.

Governmental Budgetary Constraints (item 15) are probably the most fixed supply constraint that strategic action must recognize. The reality of large deficits and competing demands for government budgets will not be changed. This should not be interpreted as suggesting that actions focused on getting a more adequate share of the federal budget for animal agriculture needs should not be pursued. Rather, the intended message is that alternative tactics, particularly those noted in the actionable quadrants, need to be central to a larger strategy focused on increasing the supply of veterinarians into swine practice. While items mapped to the lower-left quadrant present some opportunities for strategic action, they are at least partially fixed constraints that need to be recognized in developing a larger strategy to improve the FSVM profession.

The four supply-increasing trends and issues presented above represent opportunities for promoting the profession and building the supply of veterinarians entering the swine practice sector. Related themes have been noted on the right-side of Figure 7. Item 2 refers to *Targeted Recruitment Initiatives* aimed at attracting students

with food animal interests to colleges of veterinary medicine. This theme is noted in the upper-right quadrant. It is a very actionable and is a high-leverage tactic (given the relatively high mean) that can be extended and refined. Items 1 (good income opportunities) and 3 (few emergency calls required) are also strong influence items (with means of 5.54 and 5.24, respectively). These items directly counter item 12 (long hours and emergency calls) noted in the supply-decreasing list of factors and relate to the *Good Income & Work Life Balance* theme. This is placed near the middle line but in the upper-right quadrant. Incomes are based on larger economic factors that cannot be easily managed. However, there are ways to organize veterinary practices that focus on high-value adding services that merit high fees and doing so with fewer intrusions on non-work arenas of one's life. There are "best practices" that can be better understood and used more broadly within the swine practice area. The last factor, item 4, relates to the *Debt Assistance* theme placed near the middle line but in the lower-right quadrant. While larger budgetary constraints place limits on the extent that high amounts of federal dollars will be obtained for these initiatives, strategies that result in even modest increases will be very helpful. A combination of private and public financing of these debt assistance initiatives will at least partially counter the student debt supply constraint noted in the lower-left quadrant of Figure 7.

The Future Shortages of Swine Veterinarians

After rating demand and supply related factors, panel members were asked the “most likely” estimate of the percent that the future available supply veterinarians would differ from the expected demand over various time periods (i.e., the expected average percentage surplus or shortage of swine practice 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 and learning from 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 the 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 -20% shortage in the short-term time frame. This doubled the next most extreme estimate of a -10% shortage. Extreme values, particularly in relatively small sized 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% = -1.6% to -5.0%
- Mean = -3.5% (■)
- Median = -3.0% (▲)

3rd Survey Results:

- Mid-50% = -2.1% to -4.8%
- Mean = -3.9%(■)
- Median = -3.5% (▲)

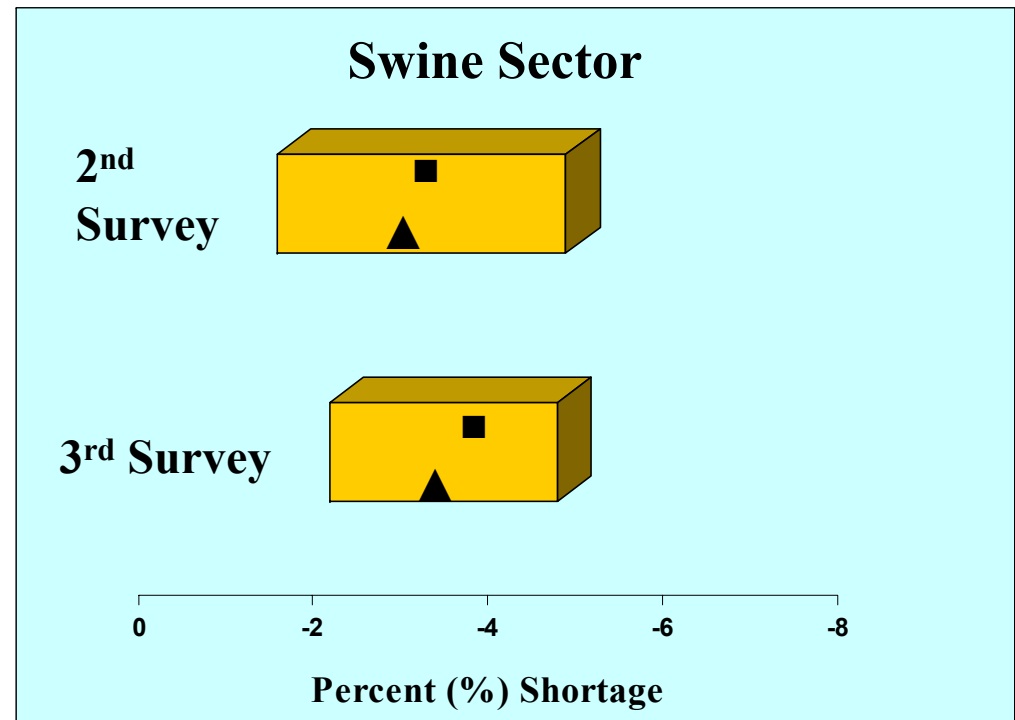


Figure 9

Medium-Term Shortages (2007-10)

2nd Survey Results:

- Mid-50% = -3.0% to -5.0%
- Mean = -4.5% (■)
- Median = -4.5% (▲)

3rd Survey Results:

- Mid-50% = -2.5% to -7.0%
- Mean = -4.7%(■)
- Median = -4.0% (▲)

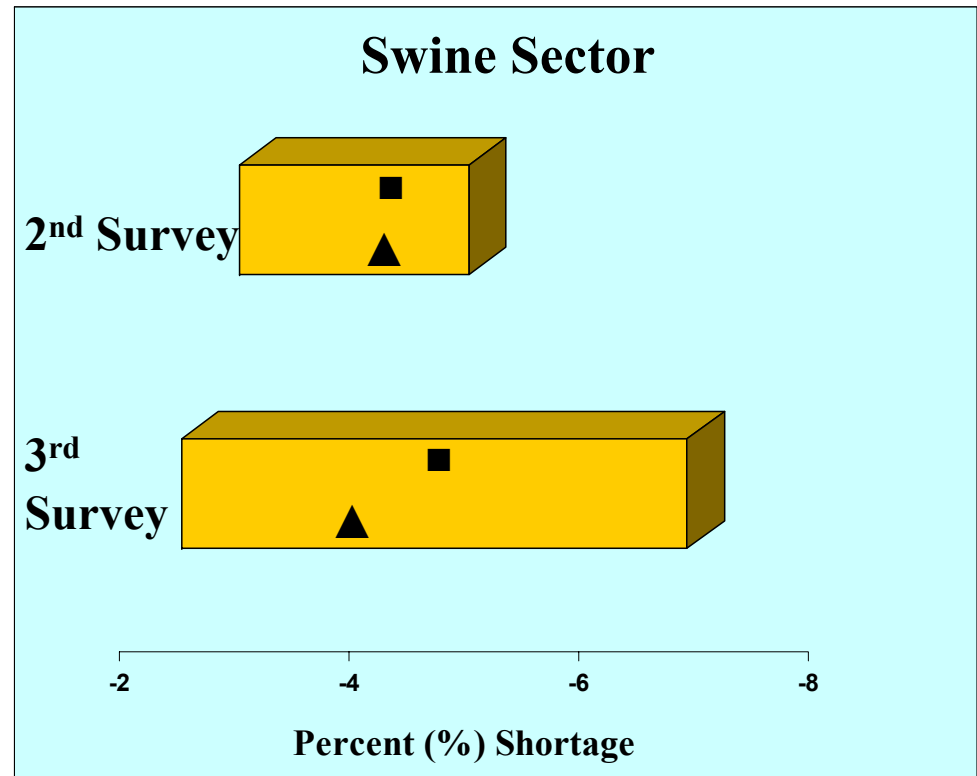


Figure 10

Long-Term Shortages (20010-16)

2nd Survey Results:

- Mid-50%: -2.6% to -5.9%
- Mean = -4.9% (■)
- Median = -4.8% (▲)

3rd Survey Results:

- Mid-50%: -2.0% to -6.3%
- Mean = -4.5 % (■)
- Median = -4.5 % (▲)

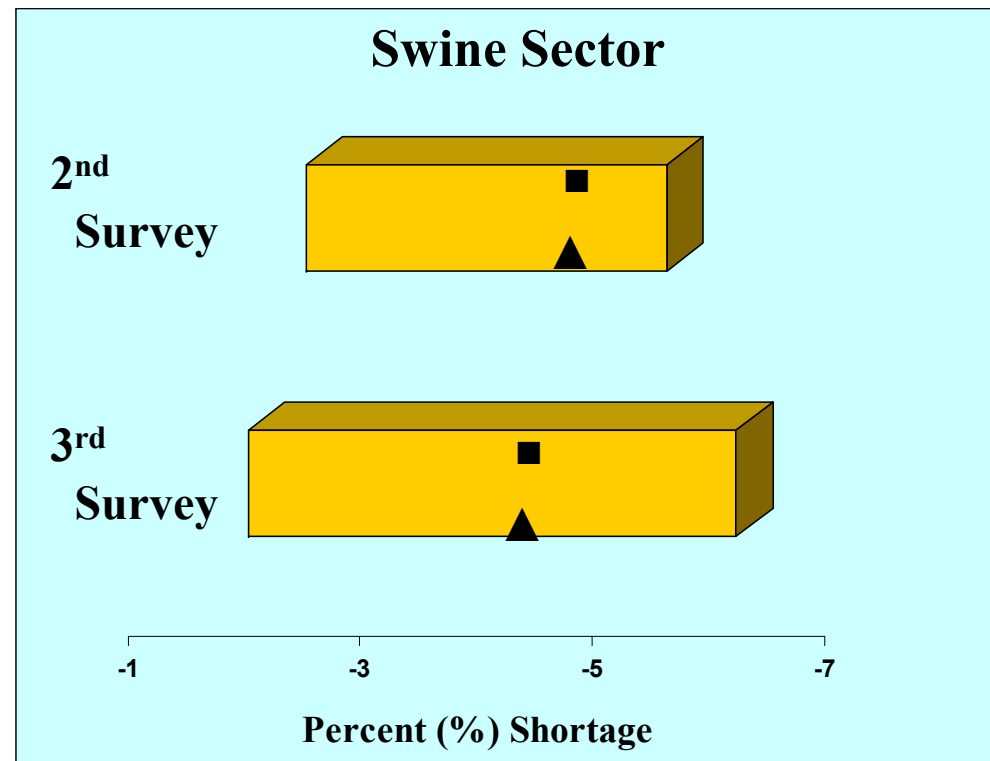


Figure 11

Future Shortages Summary

Short-Term (2004-07):

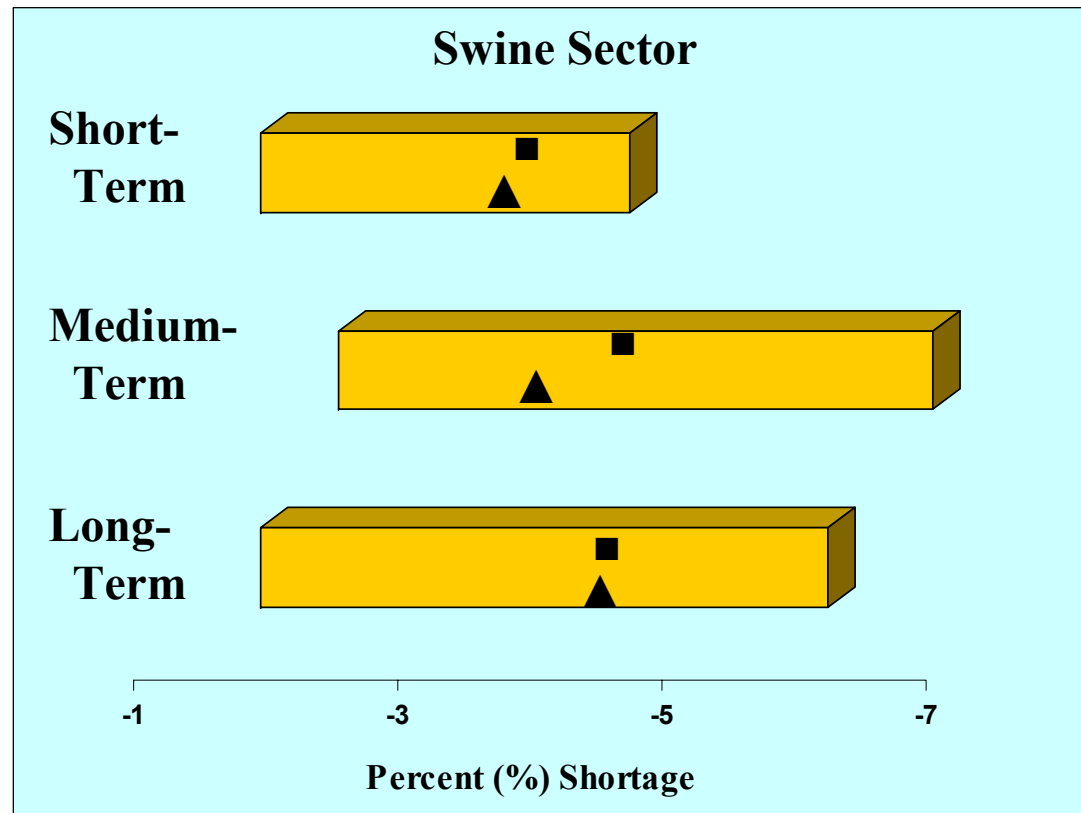
- Mid-50% = -2.1% to -4.8%
- Mean = -3.9% (■)
- Median = -3.5 (▲)

Medium-Term (2007-10):

- Mid-50%: -2.5% to -7%
- Mean = -4.7% (■)
- Median = -4.0% (▲)

Long-term (2010-16):

- Mid-50%: -2.0% to -6.3%
- Mean = -4.5% (■)
- Median = -4.5% (▲)



The middle 50% of the panel always forecasts a shortage of food supply veterinarians in swine practice. This is generally in the 2% to 7% shortage range. The point estimates of future shortages are fairly consistent over the forecast period. The means and median ratings from the final survey are in the 3.5% to 4.7% shortage range. The shortage figures are slightly higher than the demand increase percentages. This implies that future shortages will be a function of inadequate inflows of new swine veterinarians needed to keep up with (1) increases in demand *and* (2) the outflows of veterinarians from the profession due to retirements or career changes. While there was general consensus that, given current trends, consistent shortages will occur over the foreseeable future, there was some disagreement on exactly how high these shortages will be. These differing views are not as high as seen in other panels. Further analyses were conducted to understand differences in shortage estimates with the swine Delphi panel. Contrasts between Canada- versus US-focused members found consistent differences. The estimates of the panel members focused on Canada versus the US context suggested less extreme shortages in Canada. Their mean shortage estimates are as follows:¹⁰

- Short-Term (2004-07) Shortages: The US shortage estimate of -4.56% is significantly deeper than the Canadian estimate of -2.00%.
- Medium-Term (2007-2010) Shortages: The US shortage estimate of -5.35% is significantly deeper than the Canadian estimate of -2.67%.
- Long-Term (2010-2016) Shortages: The US shortage estimate of -5.12% is more extreme than the Canadian estimate of -2.67%. This difference narrowly missed the level required for statistical significance.

¹⁰ The relatively few number of panel members focusing on the Canadian context makes inferences about the Canadian estimates more limited. There is not that problem with the estimates of US-focused panel members.

Contrasts between self-rated expert and less-expert forecasters did not reveal significant differences in these ratings.

To understand other possible reasons for disagreement within the panel about the extent of future shortages, additional analyses were used to determine 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” (shortages of -4.0% or less) and “deeper-shortages” (shortages deeper than -4.0%) sub-groups. This analysis indicates that those seeing deeper future shortages did not differ from the more conservative panelists on any *supply-related* factors. Ratings on supply factors from earlier surveys were sometimes significantly different, but the differences on the same item do not reach statistical significance when they were re-rated in later surveys. A similar analysis on the *demand-related* analysis for the following significant differences:

- Slow adoption of new technologies by veterinarians (mean of 3.00 in the deeper-shortages sub-group versus 3.90 for those seeing limited-shortages)¹¹
- Increasing concern for animal health (mean of 4.90 in the deeper-shortages sub-group versus 5.67 for those seeing limited-shortages)
- Limited public understanding of food quality and safety issues (mean of 4.22 in the deeper-shortages sub-group versus 5.11 for those seeing limited-shortages)

The different patterns of shortages in the US versus Canada partially explain the differences shortages estimates. The US-focused panel members tended to see more extreme shortages. The other noted differences and the absence of clear differences on

¹¹ The items were rated on a 7-point Likert-type scale and evaluated based on their influence on the future demand of swine veterinarians. The mean rating in the parentheses is for the sub-group that sees deeper shortages (those seeing an average shortages more extreme than -4.0%) and the second mean is for the limited-shortages sub-group (those seeing shortages of -4.0% or less). The following scale anchor points will help in the interpretation of those means: 1. Strong Decrease, 2. Decrease, 3. Slight Decrease, 4. No Influence, 5. Slight Increase.

supply-related factors do not provide a very clear explanation for why these differences exist.

Solutions for the Future Shortage of Swine 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? Improving the demand for swine veterinary services means that more value is being added to producer operations. Improvements in animal health, food safety and public health (including human health) outcomes are also more likely if veterinarians are providing more services. Continuing shortages will result in sub-optimal outcomes for producers, society, and the veterinary profession as a whole. 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. These are listed in order of rated effectiveness in eliminating shortages. The following are the solutions that are rated above the mid-point of the scale:

1. Student debt repayment and scholarship programs for service in food supply areas of need (mean of 4.95 on a 7-point scale)¹²

¹² 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 self-rated experts' rating (mean: 5.60) was significantly higher than the less-expert mean of 4.36). Also, note that Canada-focused ratings (mean: 3.33) were significantly lower than ratings by US-focused panel members (mean: 5.24)

2. More involvement of food supply practitioners in training veterinary students (mean: 4.91)
Note that self-rated experts (mean: 5.50) rating was significantly higher than the less-expert mean of 4.42)
3. Reserve class slots for academically qualified students with food supply interests and relevant background (mean of 4.76)
Note that self-rated experts (mean: 5.30) rating was significantly higher than the less-expert mean of 4.27).
4. Expanded postgraduate fellowships in food supply areas (mean of 4.73)
5. Focused recruitment of high school and college students with food supply interests into veterinary colleges (mean of 4.71)
6. Appointment of more food supply faculty at colleges of veterinary medicine (mean of 4.64)
Note that self-rated experts (mean: 5.30) rating was significantly higher than the less-expert mean of 4.08)
7. Expand the Centers of Excellence concept where veterinary colleges provide a professional program with a nationally recognized focus on different food supply sectors (mean of 4.57).
Note that self-rated experts (mean: 5.70) rating was significantly higher than the less-expert mean of 3.55). Also, note that Canada-focused ratings (mean: 3.00) were significantly lower than ratings by US-focused panel members (mean: 4.82)
8. Mentoring initiatives for students and those starting a food supply career (mean of 4.55)
9. Increased focus of food supply coverage early in the DVM curriculum (mean of 4.52)
10. Paid externship requirement in food supply medicine during the summer (mean of 4.50)
Note that self-rated experts (mean: 5.30) rating was significantly higher than the less-expert mean of 3.83).
11. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities (mean of 4.45)

12. Expanded paid work-study programs during the final year of the DVM programs (mean of 4.15)

Note that self-rated experts (mean: 4.90) rating was significantly higher than the less-expert mean of 3.40).

These items represent tactics that could be a part of a larger strategy for dealing with future shortages. These solutions are directly related to the themes noted in Figure 7. They address actionable opportunities for reducing the projected likely supply-constraining factors or leveraging likely supply-enhancing factors. For example, item 5 (focused recruitment of students with food supply interests) and 11 (marketing campaigns to increase awareness of food supply careers) focus on the *targeted recruitment* of veterinary students in FSVM careers. This extends current initiatives and was noted in the upper-left quadrant of Figure 7. Item 3 (reserve class slots for qualified food supply students) counters the supply-constraining effect of current and projected *CVM selection* processes that disadvantage students who are more likely to select a food supply related career. This was noted in the upper-right quadrant of Figure 7. The highest rated item focused on student debt repayment and scholarship programs for those entering areas of need in the food supply area. This would lessen the *student debt* supply-constraint and would further leverage currently projected *debt assistance* initiatives also noted in Figure 7. These programs attract new students and retain current students into food supply career tracks. Several items focus on the educational process and enhance students' preparation for a food supply career. Items 2 (more involvement of food supply practitioners in training students), items 4 (post-graduate fellowships), items 6 (appointment of more food supply faculty), item 9 (increased food supply coverage early in the curriculum), item 10 (paid food supply externships) and item 12 (work-study programs in the fourth year) are all suggestions would build on the improved recruitment and selection processes

and change the food supply career preparation the students would get. This lessens the likelihood of students being attracted to alternative employment. Improved mentoring (item 8) would also help retain and develop food supply career-bound students. The mentoring initiative also extends beyond college and into the early phase of a DVM's career. Such initiatives counter the *ineffective role models* supply-constraint noted in Figure 7. The Centers of Excellence concept (item 7) is a larger strategy that could further enhance FSVM education and incorporate other highly rated solutions noted above. A swine-focused Center of Excellence is 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 pattern of increasing demand and future shortages in the food supply veterinary medicine profession. The data shows that, even with the economies of scale associated with consolidation and the trend to larger swine production operations, demand is increasing – not decreasing. While there are other areas with stronger increasing demand, swine FSVM is an area of increasing opportunity. The consistent shortages projected by the Delphi panel exceed the levels of demand increases. This suggests a supply problem. This likely has its basis in both the likely number of veterinarians who will be leaving swine practice (perhaps through retirements) and the expectation that fewer CVM students will opt for this career track. Shortages are serious problems! One needs to keep in mind the limited rate of current food supply veterinarians being produced in the 32 colleges of veterinary medicine in the US and Canada. Even limited shortages in one area, given that there are shortages in several other FSVM areas, become difficult to deal with quickly. The Veterinarian's Oath clearly states this profession's obligation to service the needs of society. If the projected shortages are allowed to unfold along the currently forecasted course, the veterinary profession will not fulfill its professional obligation! Animal health will suffer as will food safety and human health. Adequate numbers of food supply veterinarians in all sectors are vital to societal well-being!

A clear premise of this research is that the future we will live in tomorrow is created by actions that we take today. While there are larger trends (such as urbanization and the number of women being attracted to professions) that will not be changed and

must be adjusted to and managed around, the future is not a deterministic function of unchangeable larger social and economic forces. It is very much created by our collective choices. Many of the trends and issues shaping the future of the food supply veterinary profession are being created by choices that can be thoughtfully reviewed and reconsidered. Strategic actions implemented in the near-term will change the trends that will otherwise shape a future that is not optimal for swine 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 swine veterinary shortages will avert the negative economic impacts and challenges to societal well-being that are a natural consequence of shortages. The veterinary profession can do better! Fulfilling its responsibility to society requires thoughtful strategic action to counter the trends noted in this study.

The shortages forecasted for swine 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; however, it is another thing to plan for this rosy scenario! The history of veterinary medicine tells us we must be prepared now to counter such events.

The planning matrices used to summarize the opinions of panel experts 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 this starting point. 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 solutions identified in the previous section 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 swine practice 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 swine Delphi panel:
 - a. First Survey: <http://survey.cba.ksu.edu/prince/swine1/index.htm>
 - b. Second Survey: <http://survey.cba.ksu.edu/prince/swine2/index.htm>
 - c. Third Survey: <http://survey.cba.ksu.edu/prince/swine3/index.htm>
2. Exhibit A provides a listing of all members that completed at least the first survey.
3. Exhibits B and C provides copies of the interim feedback reports that accompanied the second and third surveys to the Delphi panel. 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 swine Delphi panel.

Exhibit A

Swine Delphi Panel Members¹³

- | | |
|--------------------|-----------------------|
| 1. Tara Donovan | 15. K T Wright |
| 2. Bob Morrison | 16. John Deen |
| 3. Locke Karriker | 17. Karen Lehe |
| 4. Patrick Halbur | 18. Rick Swalla |
| 5. Steven Henry | 19. Lisa Becton |
| 6. Bill Brown | 20. Dwain Gugenbiller |
| 7. Thomas Burkgren | 21. Jer Geiger |
| 8. Michael Senn | 22. Timothy Trayer |
| 9. Robert Wills | 23. Daryl Olsen |
| 10. Joe Connor | 24. Mike Sheridan |
| 11. Glen Almond | 25. John Harding |
| 12. James McKean | 26. Julie Menard |
| 13. Ralph Vinson | 27. Camille Moore |
| 14. Keith Wilson | |

¹³ Note that not all panel members completed all three surveys. These individuals originally agreed to participate.

Exhibit B

Swine Panel 1st Survey Interim Feedback Report

This report summarizes replies to the 1st survey of the Swine 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 swine 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 where there was 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 = 3.0 & Mid-50% = 2 to 4; Experts = 3.8 (vs. 2.2)”

This indicates that the mean of the panel was 3.0 on a 7-point scale (“3. Slight Decrease”) and the middle-50% of panelists (between the 25th and 75th percentiles) rated it 2, 3 or 4 (between “2. Decrease and “4. No Influence”). Self-rated “experts” had a significantly higher mean rating (mean = 3.8) than the “less expert” group mean of 2.2. (This means that experts saw moving to larger sized operations as less of a negative factor.) There was no difference between Canadian and US means. 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 Swine 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:

- Required 3rd-party certification or verification of standards
- Public concerns over food safety
- Increasing concerns for animal welfare
- Zoonotic disease-related human health concerns

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

- Move to larger sized producer operations
- Lack of veterinarian’s practice management & business skill
- Slow adoption of new technologies by veterinarians
- Use of non-DVMs, such as veterinary technicians
- Client concerns about veterinary service costs

II. Future Demand Estimates for Swine Food Supply Veterinarians

The mean value for the general forecast of future demand for the 1st survey is 4.0 (“4. Stay Exactly the Same”). (See question 3 in the 2nd survey.) No panel member actually made this forecast. Nearly 50% marked 1 to 3 (indicating a decrease) and the others saw an increase and marked 5, 6, or 7. Over 40% checked “5. Increase Slightly”. The middle 50% (25th to 75th percentile) rated demand as 3 or 5. Self-rated experts saw more demand than the less-expert group.

Additional questions asked for the “most likely” range of changes in future demand for several time periods. The mid-point of panelist’s range estimates was used to calculate point estimates. Just less than half saw *decreasing* demand and one-half saw *increasing* demand (the rest saw *no change*).

Panel members seeing *increasing* demand (compared to those seeing *decreasing* demand) rated the following “demand influences” (from question 1 in the 1st survey) as having a significantly *more positive (or less negative)* influence on demand:

- Move to large size producer operations
- Need to understand animal-human eco-systems
- Availability of highly technical or specialized services
- Federal and/or State/Provincial budgetary constraints
- Limited understanding of food quality and safety issues

Those rating themselves as more “expert” (versus “less-expert”) tended to see increasing demand (versus decreasing demand), but this difference was not statistically strong, so should be interpreted cautiously. The few Canadians in this panel tended to see increasing demand, but the difference was not statistically strong.

III. Factors Influencing the Supply for Swine Food Supply Veterinarians

The more extreme negative influences on the future supply for Swine food supply 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
- Lack of spousal career options in rural areas
- Limited life style and career opportunities in rural areas

- Lack of food supply practice-related externships for students

IV. Projected Shortage or Surplus of Veterinarians

In spite of close to half of the panel members seeing decreasing demand (see section II above), there is a consistent pattern of projected shortages of needed swine veterinarians. While there was agreement that shortages are likely, it was striking how varied those estimates were. There were no differences on Canadian versus US and expert versus less-expert contrasts.

Next Steps...

The patterns that are starting to emerge tell an interesting story for DVMs in swine careers and one that is different from other panels! Your replies to the second survey will add and clarify this story 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

Exhibit C

Swine Panel 2nd Survey Interim Feedback Report

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

This report is formatted similarly to the 1st survey feedback report. It identifies a few key patterns and directs you to more specific information incorporated into 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. 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 averages are noted. For example, item #1 in the first section of the 3rd survey (“Move to larger sized producer operations”) has the following notation:

“2nd Survey: Average = 3.6 & Mid-50% = 2 to 4; Experts = 4.2 (vs. 3.1); CDN = 3.0 & US = 3.8”

This indicates that the mean of the panel was 3.6 on a 7-point scale (between “3. Slight Decrease” and “4. No Influence”) and the middle-50% of panelists (between the 25th and 75th percentiles) rated it 2, 3 or 4 (between “2. Decrease and “4. No Influence”). Self-rated “experts” had a significantly higher average rating (mean = 4.2) than the “less expert” group average of 3.1. The Canadian average (mean = 3.0) differed from the US average (mean = 3.8) by at least .5 so it is reported. 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 Food Supply Veterinarians in Swine 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:

- Required 3rd-party certification or verification of standards
- Public concerns over food safety
- Need for 3rd party auditing of food safety issues

- Need for 3rd party auditing of animal welfare issues
- Tighter regulation of prescription drug use
- Increasing concerns for animal welfare

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

- Animal science specialists (or other non-DVM specialists) filling needs
- Lack of veterinarian's practice management & business skill
- New DVMs not having the training needed for large producer operations
- Slow adoption of new technologies by veterinarians
- Use of non-DVMs, such as veterinary technicians

VI. Future Demand Estimates for Swine Food Supply Veterinarians

The average value for the general forecast of future demand for the 2nd survey is 4.4 on the 7-point scale (between “4. Stay Exactly the Same” and “5. Increase Slightly”). (See question 3 in the 3rd survey.) 36% marked 1 to 3 (indicating a decrease) and 60% saw an increase and marked 5, 6, or 7. 44% checked “5. Increase Slightly”. The middle 50% (25th to 75th percentile) rated demand as 3, 4 or 5.

Additional questions asked for the “most likely” estimate of changes in future demand for several time periods. The panel average was always positive and ranged from a 1% to 3% increase. Self-rated experts consistently predicted significantly higher demand increases than the “less expert” sub-group. Around one-third predicted *decreasing* demand and 60% saw *increasing* demand (the rest forecasted *no change*).

Panel members seeing *increasing* demand (compared to those seeing *decreasing* demand) rated the following “demand influences” (from question 1 in the 1st & 2nd survey) as having a significantly *more positive* (or *less negative*) influence on demand:

- Move to large size producer operations
- Need to understand animal-human eco-systems
- Availability of highly technical or specialized services
- Limited understanding of food quality and safety issues
- Need for animal disease research & control

The 2nd survey evaluated several skill and activity areas suggested in the 1st survey comments where there will be higher or lower demand relative to the general pattern noted above. Two areas of clear *decreasing* demand noted are: “Activities such as blood testing and injections” and “Animal reproduction services & pregnancy diagnosis.” Activities where there is the highest *increasing* demand are:

- 3rd party validation of certification programs
- Managing animal health teams in large producer operations

- Food safety related activities
- Applied research & diagnostic skills

VII. Factors Influencing the Supply for Swine Food Supply Veterinarians

Factors influencing the supply of DVMs entering swine careers were evaluated in both prior surveys (see question 7, 3rd survey). The more extreme *negative influences* on the future supply for Swine food supply veterinarians noted in the 1st and 2nd surveys are:

- Less emphasis on food animal practice in veterinary colleges
- Little exposure to food supply career options in college
- Lack of spousal career options in rural areas
- Limited lifestyle and career opportunities in rural areas
- Lack of food supply practice-related externships for students

The 2nd survey evaluated several supply-influences drawn from comments to the 1st survey. The highest rated *positive* influences identified are:

- Good income opportunities in swine practice
- Initiatives to attract veterinary students with food animal interests
- Few emergency calls required
- Government programs such as education debt assistance initiatives

VIII. Projected Shortage or Surplus of Veterinarians

In spite of close to one-third of the panel members seeing decreasing demand (see section II above), there is a consistent pattern of projected shortages of needed swine veterinarians. In the general question (see question 9 in the 3rd survey), 92% marked “5. Slight Shortage” or “6. Shortage.” Specific estimates of the shortage or surplus of swine DVMs (see #11 in the 3rd survey) presents a clear pattern of projected shortages averaging -3.0% to -5.0% over several periods. The middle 50% always saw shortages. This implies that panel members have some concerns that the numbers of new DVMs entering swine practice will not be adequate to meet projected demand. There were no differences on Canadian versus US and expert versus less-expert contrasts on these forecasts.

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 swine careers. Your replies to the third and final survey will add to and clarify this story even more. Besides making the

final estimates of some previously seen questions, you will evaluate several 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 Swine FSVM Career

Survey Item	Survey Wave ¹⁴	% Decrease ¹⁵	% No Influence	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Public concern over food Safety	1 st	0	4.0	96.0	5.8	.58	6 to 6	25
2. Use of non-DVMs, such as veterinary technicians	1 st	45.8	45.8	8.3	3.5	1.02	3 to 4	24
3. Public concern over bio-terrorism	1 st	0	20	80	5.2	.85	5 to 6	25
4. Zoonotic disease-related human health concerns	1 st	0	25	75	5.4	1.06	4.3 to 6	24
4. Zoonotic disease-related human health concerns	2 nd	0	12.5	87.5	5.3	.81	5 to 6	24
5. Required third party certification or verification of standards	1 st	0	4	96	5.8	.69	5.5 to 6	25
6. Limited public understanding of food quality and safety issues	1 st	9.5	42.9	47.6	4.6	1.02	4 to 5	21
7. More meat consumption in the US and Canada	1 st	0	60	40	4.6	.76	4 to 5	20
8. More access to global markets for food exports	1 st	0	26.1	73.9	5.2	1.00	4 to 6	23
9. Changing dietary habits in third-world countries	1 st	0	37.5	62.5	4.9	.90	4 to 5	24
10. Need to protect indigenous wildlife from exotic diseases	1 st	0	72.7	27.3	4.5	.86	4 to 5	22
11. Federal and/or state/provincial budgetary constraints	1 st	45.8	25	29.2	3.8	1.13	3 to 5	24
11. Federal and/or state/provincial budgetary constraints	2 nd	41.7	45.8	12.5	3.7	.76	3 to 4	24
12. Curtailment of government support of veterinary services	1 st	47.8	30.4	21.7	3.7	1.02	3 to 4	23
13. Increasing concern for animal wildlife	1 st	0	12.5	87.5	5.8	1.06	5 to 7	24
13. Increasing concern for animal wildlife	2 nd	4	4	92	5.4	.87	5 to 6	25
14. Increasing concern for animal health	1 st	0	26.1	73.9	5.3	.96	4 to 6	23
15. Need to understand animal-human health eco-systems	1 st	0	56.5	43.5	4.8	1.07	4 to 6	23
15. Need to understand animal-human health eco-systems	2 nd	0	39.1	60.9	5.0	1.02	4 to 6	23
15. Need to understand animal-human health eco-systems	3 rd	0	18.2	81.8	5.2	.87	5 to 6	22
16. Availability of highly technical or specialized services	1 st	20	28	52	5.0	1.53	4 to 6.5	25
16. Availability of highly technical or specialized services	2 nd	0	12.5	87.5	5.4	.83	5 to 6	24
17. Veterinary services agreements required for agri-business loans	1 st	0	39.1	60.9	4.9	.87	4 to 5	23

¹⁴ 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.

¹⁵ 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.

18. Growing need to track animals entering the food chain	1 st	0	32	68	5.2	1.04	4 to 6	25
18. Growing need to track animals entering the food chain	2 nd	4	16	80	5.4	1.08	5 to 6	25
18. Growing need to track animals entering the food chain	3 rd	0	18.2	81.8	5.3	.95	5 to 6	22
19. Constraints on non-DVMs giving prescription drugs	1 st	0	30.4	69.6	5.2	1.04	4 to 6	23
19. Constraints on non-DVMs giving prescription drugs	2 nd	0	33.3	66.7	5.0	.91	4 to 6	24
19. Constraints on non-DVMs giving prescription drugs	3 rd	0	31.8	68.2	5.0	.79	4 to 6	22
20. Slow adoption of new technologies by veterinarians	1 st	47.8	39.1	13	3.4	1.27	2 to 4	23
20. Slow adoption of new technologies by veterinarians	2 nd	63.6	31.8	4.5	3.4	1.09	3 to 4	22
20. Slow adoption of new technologies by veterinarians	3 rd	61.9	28.6	9.5	3.5	1.03	3 to 4	21
21. Move to larger sized producer operations	1 st	76	4	20	3.0	1.54	2 to 3.5	25
21. Move to larger sized producer operations	2 nd	60	12	28	3.6	1.66	2.5 to 5	25
21. Move to larger sized producer operations	3 rd	45.4	36.4	18.1	3.7	1.39	2.8 to 4	22
22. Client use of veterinary herd management services	1 st	8	24	68	4.7	1.10	4 to 5	25
23. Client concerns about veterinary service costs	1 st	44	44	12	3.6	1.00	3 to 4	25
24. Lack of veterinarian's practice management and business skill	1 st	60.9	30.4	8.7	3.3	.96	3 to 4	23
25. Part-time farmers needing more veterinary services	1 st	10	45	45	4.5	1.00	4 to 5	20
45. Need for 3 rd party auditing of food safety issues	2 nd	0	0	100	5.6	.64	5 to 6	25
46. Tighter regulation of prescription drug use	2 nd	0	8	92	5.4	.77	5 to 6	25
47. Traceability and identification mandates	2 nd	0	26.1	73.9	5.3	1.01	4 to 6	23
47. Traceability and identification mandates	3 rd	0	22.7	77.2	5.1	.87	4.8 to 5.3	22
48. Need for 3 rd party auditing of animal welfare issues	2 nd	0	4.2	95.8	5.6	.88	5 to 6	24
49. Need for animal disease research and control	2 nd	0	20	80	5.2	.82	5 to 6	25
50. Need to improve herd productivity	2 nd	0	25	75	5.1	.85	4.3 to 6	24
51. Animal science specialists (or other non-DVMs specialists) filling needs	2 nd	66.7	20.8	12.5	3.3	1.08	3 to 4	24
51. Animal science specialists (or other non-DVMs specialists) filling needs	3 rd	66.6	33.3	0	3.2	.63	3 to 4	21
52. New DVMs not having the training needed for large producer operations	2 nd	65.2	17.4	17.4	3.3	1.33	2 to 4	23
52. New DVMs not having the training needed for large producer operations	3 rd	72.7	18.2	9	3.1	1.08	2.8 to 4	22
53. Increased government regulation of the swine industry	2 nd	0	34.8	65.2	4.9	.82	4 to 5	23
53. Increased government regulation of the swine industry	3 rd	0	22.7	77.2	5.0	.76	4.8 to 5	22
54. Lack of consensus on animal welfare issues	2 nd	21.7	39.1	39.1	4.3	.92	4 to 5	23
54. Lack of consensus on animal welfare issues	3 rd	0	45.5	54.6	4.6	.66	4 to 5	22
55. Use of programs like 90-day least cost production management	2 nd	27.8	55.6	16.7	3.9	1.13	3 to 4	18

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

Survey Item	Survey Wave	% Decrease ¹⁶	% No Difference	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Managing animal health teams in large producer operations	2 nd	4	12	84	5.4	.96	5 to 6	25
2. Applied research and diagnostic skills	2 nd	0	16	84	5.4	.86	5 to 6	25
3. Herd health monitoring and oversight	2 nd	8	32	60	4.9	1.17	4 to 6	25
4. 3 rd party validation of certification programs	2 nd	0	8	92	5.6	.71	5 to 6	25
5. Support of niche production systems (e.g., no antibiotic use)	2 nd	4	28	68	4.7	.68	4 to 5	25
6. Training farm workers in animal health issues	2 nd	4.2	29.2	66.7	4.9	.93	4 to 5.8	24
7. Bilingual communication skills	2 nd	4.3	30.4	65.2	5.1	1.35	4 to 6	23
8. Developing animal health procedures and policies	2 nd	4	20	76	5.2	1.07	4.5 to 6	25
9. Animal health technicians providing services	2 nd	40	28	32	4.1	1.35	3 to 5	25
10. Animal reproduction services and pregnancy diagnosis	2 nd	33.3	50	16.7	3.8	1.15	3 to 4	24
11. Operation production management and flow	2 nd	12	20	68	4.8	1.12	4 to 5.5	25
12. Herd inspection activities	2 nd	16	48	36	4.4	1.16	4 to 5	25
13. Food safety related activities	2 nd	0	8	92	5.4	.76	5 to 6	25
14. Activities such as blood testing and injections	2 nd	60	36	4	2.9	1.19	2 to 4	25

¹⁶ 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 Swine FSVM Careers

Survey Item	Survey Wave	% Decrease ¹⁷	% No Influence	% Increase	Mean	Standard Deviation	Middle 50% Range	N
1. Less emphasis on food animal practice in veterinary colleges	1 st	90.9	0	9.1	2.3	1.39	1.8 to 2.3	22
1. Less emphasis on food animal practice in veterinary colleges	2 nd	96	4	0	2.0	.65	2 to 2	25
2. More women veterinarians entering the workforce	1 st	56	28	16	3.2	1.42	2 to 4	25
2. More women veterinarians entering the workforce	2 nd	52	44	4	3.3	.89	2.5 to 4	25
2. More women veterinarians entering the workforce	3 rd	50	36.4	13.6	3.6	.96	3 to 4	22
3. Physical demands of large animal veterinary work	1 st	40	56	4	3.5	.82	3 to 4	25
4. Need to work long hours and emergency calls	1 st	56	32	12	3.3	.99	2.5 to 4	25
5. Little exposure to food supply career options in college	1 st	88	8	4	2.4	1.12	2 to 3	25
5. Little exposure to food supply career options in college	2 nd	95.7	4.3	0	2.1	.69	2 to 2	23
6. Lack of food supply practice-related externships for students	1 st	66.7	27.8	5.6	2.9	1.26	2 to 4	18
6. Lack of food supply practice-related externships for students	2 nd	60.9	39.1	0	2.9	1.08	2 to 4	23
6. Lack of food supply practice-related externships for students	3 rd	72.6	27.3	0	3.1	.79	3 to 4	22
7. Lack of positive role models in veterinary food supply practice	1 st	56.3	37.5	6.3	3.2	1.05	2.3 to 4	16
8. Poor income opportunities in rural areas	1 st	65	25	10	3.1	1.19	2.3 to 4	20
8. Poor income opportunities in rural areas	2 nd	28.6	61.9	9.5	3.8	1.21	3 to 4	21
9. Lack of cultural and recreational opportunities in rural areas	1 st	69.6	30.4	0	3.0	.77	2 to 4	23
10. Lack of spousal career options in rural areas	1 st	90.9	4.5	4.5	2.6	1.29	2 to 3	22
10. Lack of spousal career options in rural areas	2 nd	87.5	8.3	4.2	2.9	.95	2 to 3	24
11. Limited lifestyle and career opportunities in rural areas	1 st	86.4	9.1	4.5	2.9	1.04	2 to 3	22
12. Federal and/or state/provincial budgetary constraints	1 st	42.1	47.4	10.5	3.5	.96	3 to 4	19
13. High debt load of veterinary school graduates	1 st	48	40	12	3.2	1.26	2 to 4	25
13. High debt load of veterinary school graduates	2 nd	64	25	12	3.3	.90	3 to 4	25
13. High debt load of veterinary school graduates	3 rd	40.8	45.5	13.6	3.6	1.26	3 to 4	22
14. Expected high number of food supply veterinarians retiring in the near future	1 st	25	25	50	4.4	1.72	3.3 to 6	24
14. Expected high number of food supply veterinarians retiring in the near future	2 nd	16	20	64	4.8	1.29	4 to 5.5	25

¹⁷ 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	22.7	13.6	63.6	4.7	1.39	3.8 to 6	22
15. Limited capacity of existing veterinary colleges in the US and/or Canada	1 st	13	82.6	4.3	3.9	.55	4 to 4	23
16. Perceived lack of demand for food animals	1 st	61.9	38.1	0	3.1	.97	2.5 to 4	21
17. Requirement for education beyond a DVM	1 st	40	56	4	3.6	.76	3 to 4	25
29. Good income opportunities in swine practice	2 nd	0	4.2	95.8	5.5	.78	5 to 6	24
30. Few emergency calls being required	2 nd	0	16	84	5.2	.83	5 to 6	25
31. Lifestyle options in rural communities	2 nd	47.8	17.4	34.8	3.8	1.23	3 to 5	23
31. Lifestyle options in rural communities	3 rd	49.9	36.4	13.6	3.5	1.14	3 to 4	22
32. Veterinary college partnerships focused on food animal training	2 nd	4	32	64	4.8	.97	4 to 5	25
32. Veterinary college partnerships focused on food animal training	3 rd	18.1	9.1	72.7	4.6	1.18	4 to 5	22
33. Government programs such as education debt assistance initiatives	2 nd	0	28	72	5.1	.91	4 to 6	25
33. Government programs such as education debt assistance initiatives	3 rd	0	18.2	81.8	5.1	.75	5 to 5.3	22
34. Initiatives to attract veterinary students with food animal interests	2 nd	4	8	88	5.3	.90	5 to 6	25
35. New DVMs lack training for modern production settings	2 nd	76	29	4	3.2	.87	3 to 3.5	25
36. Entering veterinary students not having agricultural backgrounds	2 nd	78.3	21.7	0	3.0	.71	2 to 3	23
37. Student admission policies in CVMs that do not favor farm experience	2 nd	83.3	8.3	8.3	3.0	1.22	2.3 to 3	24
37. Student admission policies in CVMs that do not favor farm experience	3 rd	72.7	18.2	9.1	3.1	.97	2.8 to 4	22

Section IV. Solutions for Shortages in Swine Practice

Survey Item	Survey Wave	% Less Effective ¹⁸	% 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	23.8	47.6	28.6	4.9	1.44	3.8 to 6	21
2. Expand the Centers for Excellence concept where nationally recognized focus on different food supply sectors	3 rd	33.3	33.3	33.3	4.7	1.83	3 to 6	21
3. Focused recruitment of high school and college students with food supply interests into veterinary colleges	3 rd	23.8	52.4	23.8	4.9	1.36	3.8 to 6	21
4. Increased focus of food supply coverage early in DVM curriculum	3 rd	33.3	33.3	33.3	4.3	1.99	3 to 6	21
5. Expanded business and practice management coverage in DVM curriculum	3 rd	27.3	68.2	4.5	3.9	1.60	2 to 5	22
6. Expanded postgraduate fellowships in food supply areas	3 rd	22.7	54.5	22.7	4.7	1.32	3.8 to 5.3	22
7. Expanded paid work-study programs during the final year of DVM	3 rd	35	50	15	4.5	1.97	3 to 5.3	20
8. More involvement of food supply practitioners in training veterinary students	3 rd	27.3	40.9	31.8	4.9	1.44	3 to 6	22
9. Provide expanded job placement services in the food supply veterinary medicine areas	3 rd	50	36.4	13.6	3.8	1.56	3 to 5	22
10. Appointment of more food supply faculty at colleges of veterinary medicine	3 rd	31.8	40.9	27.3	4.6	1.71	3 to 6	22
11. Paid externship requirement in food supply medicine during the summer	3 rd	22.7	59.1	18.2	4.5	1.44	3.8 to 5	22
12. Marketing campaigns to increase awareness of food supply career and lifestyle opportunities	3 rd	31.8	50	18.2	4.5	1.54	3 to 5	22
13. Student debt repayment and scholarship programs for service in food supply areas of need	3 rd	14.3	52.4	33.3	5.1	1.74	4 to 7	21
14. Development of a government-supported Reserve Corps of food supply DVMs for disease surveillance and control activities	3 rd	66.7	28.6	4.8	3.0	2.00	1 to 4	21

¹⁸ 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.”

15. Low cost (subsidized) consulting in business and practice management for new food supply DVMs	3 rd	66.7	28.6	4.8	3.2	2.06	1 to 5	21
16. Mentoring initiatives for students and those starting a food supply career	3 rd	31.8	40.9	27.3	4.6	1.57	3 to 6	22
17. Focused recruitment of women students in food supply areas	3 rd	61.9	33.3	4.8	3.4	2.06	1 to 5	21
18. Development and dissemination of Business Best Practices for food supply veterinary enterprises	3 rd	63.2	31.6	5.3	3.8	2.15	2 to 5	19