Workforce Needs Assessment

PHASE 2: ACADEMIA

QUALITATIVE RESEARCH SUMMARY

APRIL 2020

This report summarizes discovery among academia, as Phase 2 of a three-part assessment of future human capital needs in swine production, with focus on Bachelor's and Advanced Degrees. This research was conducted to support the National Pork Board (NPB) work group in developing a fellowship program and to support the future human capital needs of U.S. Pork.

Phase 1 identified workforce needs through the lens of producers, and the expressed production needs were foundational to develop academia interview topics. This analysis includes a comparison of responses to identify commonalities and gaps between producer needs and the academic programs involving swine production. The third and final phase in May and June 2020 will assess allied industry needs for swine specialists with advanced degrees.

PHASE 2: ACADEMIC RESEARCH METHODOLOGY

- The NPB work group identified 42 faculty and administrators in the areas of Animal Science, Veterinary Medicine, Agricultural Economics, Agriculture and Biosystems and Ag Administration. Fourteen land-grant universities and four community colleges were represented on the original request list.
- Telephone interviews of 30-minutes were conducted in March 2020 with 23 members of the academic community that responded to the request. Each interview followed a standard questionnaire with a combination of quantitative and open-ended questions. (Reference Appendix C for questionnaire.)
- The survey objectives were to identify critical areas of need in academia to ensure a sustained supply of critical research outcomes, outreach activities and education of students suitable for management-level production positions.
- The assessment included identification of resources at academic institutions in top pork states, as well as cross-disciplinary initiatives to prepare students in areas of emerging interest (i.e. data, technology, engineering, computer science, genetics).

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EXECUTIVE SUMMARY: ACADEMIC OUTCOMES

Academic Respondent Demographics

- Twenty-three individuals from 12 land-grant universities and 2 community colleges were interviewed.
- Institutions represented are from 12 different states, all of which rank in the top 13 for hog inventory (2018, NPB). Illinois is the only leading production state not represented by their land grant institution in this survey (invited, no response).
- The 23 respondents represented these disciplines and roles, with a high proportion of respondents in leadership roles at departmental or college levels.

Discipline	# Individuals	# Institutions	Individual Role
Animal Science (Land grant)	10	10	Dept Chair/Director (9) Professor & Extension Specialist (1)
Agriculture Science (Community college)	2	2	Dean (1), Department Co-Chair (1)
Veterinary Medicine	3	3	Dean (2), Chair (1)
Ag Econ / Agribusiness	4	3	Chair/Director (3), Associate Professor (1)
Ag Biosystems / Biological Engineering	2	2	Dept Chair (2)
Ag Administration	2	2	Associate Dean, Academic Programs (2)

For some survey areas, additional detail and context is provided on responses by discipline.

Academic Executive Summary

- Q1: Fourteen of the 20 respondents described more demand than supply at present for swine technical experts and veterinarians. Several suggested there is greater need for technical experts currently, as DVM supply-demand appears aligned at present.
- Most academics predict demand will be higher in 10 years than today – for swine veterinarians and specialists with advanced degrees. This will be driven by increased demand from larger production operations and reduced supply, considering retirements and fewer swine-specific students at present. With these factors, vet colleges express concern about filling future faculty vacancies.
- Factors that influence the present number of students being trained for pork careers include a decrease in institutions that are training highly-qualified, swine-focused students, fewer students with rural backgrounds, an increase in veterinary students from urban backgrounds with companion animal interest, and the need to familiarize and recruit students to careers in modern pork production.
- Community college respondents provided valuable insights from two aspects:
    - Associate degree students who move to bachelor and advanced degree programs
    - Students with associate degrees trained to fill the high demand for swine technicians
- Animal Science department chairs interviewed understand that focus in one specialty area is no longer adequate for industry needs, and they are seeking approaches to develop relevant, scientific-specialty combinations and increase graduates' business acumen. Academic thought leaders suggest that faculty will need to adopt a multi-disciplined approach, embrace work with experts outside their field, show flexibility, establish good contact with industry and build bridges with other departments to give students a holistic perspective.
- For effective technical specialists, academia consider priority coursework needs as data science and analytics, environment and nutrient management, animal welfare, economics and business, and genetics, in addition to traditional Animal Science courses.
- Institutions provided current student numbers, categorized by degree program and specifying the number of swine-focused students when possible. Based on averages among reporting universities, 8% of undergraduate and 23% of graduate students in Animal Science are cited as specializing in swine. The proportion of swine emphasis reported in the two-year programs (26%) is higher (perhaps influenced by the specific schools and their locations in high-production states).
- Overall, faculty report upward trends in student enrollment in Animal Science bachelor's programs; this does not reflect increased interest in swine specialization. Faculty note that swine interest often develops at college through coursework, campus activities, internships and part-time jobs.
- Enrollment trends in Animal Science graduate programs vary significantly by institution.
- Three-fourths of reporting institutions have one or two swine undergraduate courses, while three stated that they expand their curriculum through Swine Online and AgIdea.
- None of the Animal Science departments interviewed offer a swine-specific graduate major. Most offer an Animal Science graduate major with emphasis or concentration in swine.
- The disciplines most-commonly pursued today in advanced degree programs include animal nutrition, veterinary medicine, animal science (general), agriculture economics, animal reproduction and genetics. Academics identified the top emerging disciplines as animal welfare, zoonotic disease, environmental science, precision ag and data sciences.

- Several universities offer, or are considering, at least one interdepartmental graduate major related to swine or animal agriculture, and several respondents cited specific interdepartmental collaboration or course offerings to leverage expertise across the university.
- Interpersonal communication, business, financial and risk management coursework is frequently required in undergraduate programs – a positive foundational step to meet producer expectations. Several Masters, PhD and DVM programs encourage coursework in these areas, but few institutions have requirements.
- Survey responses provide some indications of future faculty needs. Across reporting universities, current vacancies for Animal Science faculty average 10% (relative to employed faculty) and 5% for Vet Med faculty. Vacancies for swine specialists appear proportionally higher than all animal science faculty (recognizing a small data set). Among reporting institutions, ~17% of current Animal Science faculty and ~6% of Vet Med faculty are expected to retire in the next five years.
- Accumulated responses from the 10 Animal Science departments estimate that research FTEs are presently double that of teaching or extension. FTE allocation between swine teaching and extension are similar when combined for all universities. Significant variance exists among institutions in the allocation of animal science faculty for research, teaching and extension.
- Pork producers voiced that hands-on experience in production facilities is critical to the effectiveness of advanced degree specialists and vets. Academia agree and expect this need to increase as fewer students have animal agriculture experience. While academia report various opportunities for barn-level experience, especially for undergraduates, opportunity exists to develop strategies and increase barn-level experience expectations for graduate students. No Animal Science graduate program cited a requirement for barn-level experience.
- All 16 of the animal science programs have at least one swine farm that offers student experience. Combined, the 16 institutions have nearly 30 facilities with hogs, considering on-campus and outreach sites. Per site capacity varies from 20 to 300 sows and up to 4500 finished hogs annually.

PRODUCER RESEARCH LEARNINGS AND APPLICATION

Producer Survey Methodology

- A quantitative online survey of the top 65 pork producers was administered in December 2019.
- Invitations were sent to HR professionals or CEOs/Owners, based on organization size and structure.

Producer Respondents

- 29 producers participated, representing approximately 1,518,800* sows in production in 2019 (nearly one-quarter of all sows in U.S.). Respondents represent diverse operation sizes and production models within the Top 65.

**Sow production figure based on Successful Farming Pork Powerhouse Ranking for Top 40 and information provided by NPB for producers ranked 41-65.*

Producer Outcomes: Advanced Degree Specialties

- Nutrition and Feed Mill Management are currently among the most-staffed specialties, and producers rate availability of these candidates lower than other specialties.
- Demand for Geneticists is expected to increase in the next five years, and the availability of candidates for this specialty is currently rated third-lowest among positions presented.
- Producers anticipate an ongoing need for Doctor of Veterinary Medicine (DVM) and Animal Science professionals with swine expertise. While availability is currently rated as relatively strong by producers currently staffing these positions, there will be more demand in the next five years.
- Facility, Business and Financial Management, along with foreign language and human resources, are the most desired skills for Advanced Degree specialists (beyond specific academic disciplines).
- Experience and specialization in pork production is required or strongly preferred by nearly half of producers, especially those raising 30,000+ sows.
- Business management, leadership and communication skills, and practical and industry experience are among the talent gaps most-often mentioned by producers.

Producer Outcomes: Barn-Level Positions

- Farm and Production Manager positions are currently harder to staff, among the barn-level manager positions listed. Production Manager is most likely to have a requirement or preference for advanced or Bachelor's degrees. Producers with headquarters in Minnesota, Iowa and Michigan rate Production Manager availability as more difficult than those headquartered in other regions.
- Environmental Manager is the most likely position to be added in the next five years for those not currently staffing it, and most producers with Environmental Managers have been requiring a Bachelor's Degree at minimum.
- Lack of practical and industry experience, a shortfall of qualified candidates, and leadership and communication skills are among the gaps mentioned by producers for these positions.

COMPARISON OF PRODUCER AND ACADEMIC FINDINGS

Areas of Producer-Academia Alignment

- Producers and academic groups agree that demand outweighs supply of swine-focused advanced degree specialists and veterinarians, currently and into the next decade.
- Academia predicts that larger operations will require more technical specialists, and mid-size operations that currently rely on extension or external expertise will hire in-house specialists and veterinarians as they grow. Producer survey outcomes validate these academic assumptions.
- Producers and academia agree a more holistic approach is required of technical specialists and veterinarians, compared to traditional focus on a single specialty. Nearly half of the academics (48%) support increased emphasis on business management skills, compared to 60% of producers.
- Producers and academia appear aligned in the growing needs for expertise in economics and business management, environment, animal welfare and genetics.
- Producers and academics agree that enhancements to current educational programs, along with collaboration, is required to effectively recruit and train students for swine specialties. The thought leaders interviewed described ways their institutions collaborate with producers now and expressed openness to producer input to better prepare the future workforce.
- Current academic curriculums and university research capabilities appear well-aligned with producer-identified needs in animal nutrition, genetics and environmental management.
- Community college educators understand the need for skill-based coursework and barn-level experiences to support high demand for swine production technicians and veterinary technicians.

Gaps Between Academic and Producer Priorities

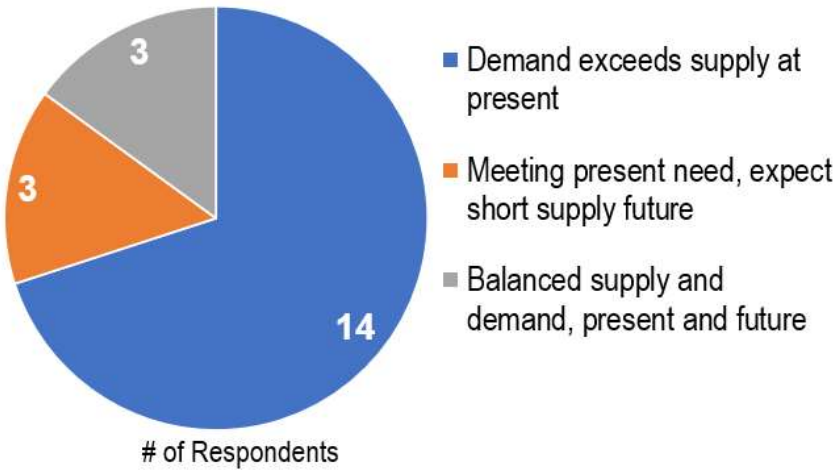
- Although 70% of producers surveyed report DVM availability as “Very Good” or “Excellent” at present, this is predicted as a future expertise gap considering retirements at vet colleges and clinics, fewer swine vet students and increasing veterinary hires as production systems expand.
- Producers reported that nutrition and feed mill specialists are currently the most-staffed and least available specialists. These survey outcomes indicate these needs are not as high on academics’ radar screens overall. Only two university respondents mentioned feed mills. While nutrition is the leading discipline mentioned in current programs, it was rarely mentioned among the emerging needs.
- Academics more frequently referenced precision animal agriculture and data sciences, while these areas were rated as mid-to-low priorities by producers.
- The infrequent mention by academia of hands-on experience, communication and foreign language skills signals less focus on practical skills that producers expect for success in today’s workforce.
    - Producers rated the importance of 16 skill areas for advanced degree specialists (Q19 in Producer Phase 1). The top 6 skill set needs identified by producers were previous pork work, facility management, swine specialty, foreign language, business management, and human resources. Data science and computer science rated mid-to-low among producer priorities.
- Producers consistently voiced needs and concerns around barn-level experience. While several institutions encourage experience in production facilities, few have requirements, particularly for graduate students.

Detailed Academic Survey Findings

SUPPLY AND DEMAND FOR SWINE VETERINARIANS, TECHNICAL EXPERTS

Q1. In your experience and opinion, how would you describe the current needs (supply and demand) for swine veterinarians and/or swine technical experts? *(n=20)*

- Fourteen of the 20 respondents described more demand than supply at present for swine technical experts and veterinarians, and they expressed concern for the future.
- Several suggested the need for technical experts is greater than for DVMs at present, as DVM supply-demand is currently steady; however, the need for swine veterinarians is expected to increase in the future for production and vet college faculty.



Current Needs: Responses by Discipline

Discipline	Demand exceeds supply at present	Meeting present need, expect short supply future	Balanced supply and demand, present and future
Animal Science	8	1	1
Veterinary Medicine	1	1	1
Ag Economics	2	1	1
Administration	3		
Overall (20 responses)	14	3	3

Two ag engineer department chairs answered from the sole perspective of demand for ag engineers. They may teach courses for vet or animal science students on facility and manure management; however, their responses indicate that their engineering students are not filling swine production roles at present. One indicated modest demand for engineering graduates. The other noted difficulty to fill open specialist positions at the university.

Key Factors Influencing Student Supply-Demand:

- There is a decrease in the number of institutions training highly-qualified students in Animal Science and specifically in swine.
- A high percent of current students at veterinary colleges are from urban backgrounds and specializing in companion animals. This is coupled with changing rural demographics (i.e. fewer farms).

- There is need for more intentional work to promote pork careers, attract high school and college students to food animal production and address the true reasons for workforce availability challenges.

> *"Our grad students in Animal Science and Vet School grads all have multiple job offers. They have been our easiest students to place over the last decade. This doesn't necessarily mean we are actually meeting demand." North Carolina State University*

- Respondents from Purdue and Penn State indicated they are not seeing the gap in supply versus demand for swine technical experts and DVMs, citing consolidation of operations and interest in other species. This may indicate a regional difference or interpretation of fewer swine vets in private practice, as it is a departure from other academic and producer opinions. Per the producer survey, larger operations are likely to hire more swine veterinarians, swine technical specialists and barn-level management with advanced degrees (i.e. Production Managers).
- Academic entrance requirements keep going up. STEM students can gain admission based on academics but have no agricultural experience. This was specificity cited at Big 10 institutions. This can result in selection against students that have years of experience working with livestock on rural farms. With this model, continued decline can be expected in the number of students experienced in working with animals for food production. (Marcus Fernandez, Purdue)
- Community college respondents provided valuable insights from two aspects:
    - Associate degree students who move to bachelor and advanced degree programs
    - Students with associate degrees can support the very high demand for swine technicians

> *"There's a need above and beyond DMACC's ability to satisfy and it's been that way for a long time. Any student interested in an animal tech career will have no problem getting an entry level position in the swine industry with ample opportunity to move up." Des Moines Area Community College*

Q2. How would you describe the <u>expected need 10 years from now</u>, for swine veterinarians and/or technical experts?

- Most academics predict that demand will be higher in 10 years than today – for swine veterinarians and specialists with advanced degrees. This will generally be driven by more demand from larger production operations and reduced supply, considering Baby Boomer retirements and fewer swine-specific students at present.
- Academics predict that larger operations will require more technical specialists. Mid-size operations that currently rely on extension or external expertise will hire in-house technical specialists and veterinarians as they grow. The producer survey outcomes validate these academic assumptions.

> *"A lot will depend on how quickly the integrators, and farmers to a lesser degree, begin to adopt technology." Chair of Food, Agriculture and Biological Engineering Department*

- Veterinary medicine colleges are concerned about filling faculty vacancies, considering the number of retirements in the next 5 to 10 years and fewer swine-focused students at present.
- New skill sets will be required of advanced-degree professionals including data analytics, technological systems and pathology. Needs will be driven by the pace of technology adoption by farms and integrators. Expanding exports will necessitate broader understanding of export requirements for sanitation, swine health, etc.

- Expectations of veterinarians are expanding, with more technical and consultative skills required today than ever before.
- Societal expectations are expanding the veterinarian role and needs in production operations (i.e. Veterinary Feed Directive requires vet involvement whenever antibiotics are used).

> *"It might get worse because of the way the pork industry is stereo-typically labeled. Most of our students come to us with practically no knowledge of how pork is produced and the opportunities available in the industry." Kirkwood Community College*

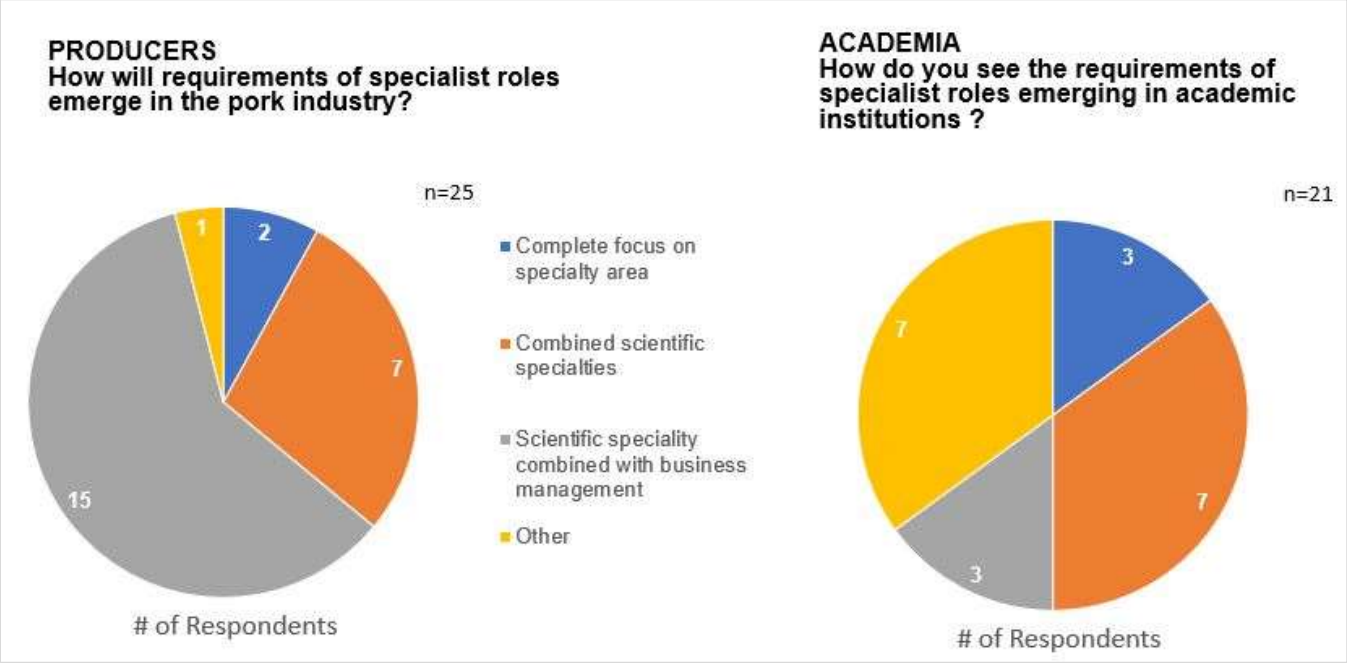
REQUIREMENTS OF SPECIALIST ROLES

Q5. How do you see the requirements of specialist roles emerging in academic institutions (choose one)? *(n=21)*

a) *Complete focus on one specialty area*
b) *More need for combined scientific specialties (i.e. genetics and biostatistics, animal science and environmental studies)*
c) *More need for scientific specialty expertise and business (i.e. animal science and MBA)*
d) *Other (explain)*

> *"The first statement is where we are currently. The next two are where we need to go."*
> *Animal Science department head*

- The pie chart compares the academic response to the producer outcomes in Phase 1.



- Overall, the academic respondents and producers are aligned in supporting a more diverse approach. Only 8% of producers and 14% of academics support complete focus on a single specialty.

- Generally, academia placed less importance – compared to the producers surveyed – on the need for business management combined with scientific expertise. The majority, 60% of producers selected combination of business management with scientific specialties.
- Among academia, one-third (7 participants) selected "Other" and chose both statements b (combined scientific specialties) and c (scientific + business). Thus, 10 of 21 of academic respondents (48%) support increased emphasis on business management.
- The Other (1) response among producers was foreign language.
- **Animal Science:** Those in Animal Science understand that focus in one specialty area is no longer adequate for industry needs and are considering both diversification strategies (combined scientific specialties and inclusion of business competence with scientific specialty).

> *"I'm looking for a combination of all of these. If I'm looking at a research-intensive faculty member, I want them focused on one specialty area. Extension program leaders, on the other hand, need to be strong in a specialty but also be more diversified." North Carolina State University*

- **Veterinary Medicine:** The multi-species generalist is being replaced by specialists in a species or clinical area. Complementary expertise in business management, data science and communication will be important. Understanding disease and the immune system and weaving that with production (alternatives to antibiotics; the role the microbiome plays in health and production). Specialists will have to understand health and production or health and economics.

> *"Not every school can have expertise in every area, so schools must decide what makes sense for them." Iowa State College of Veterinary Medicine*

- **Ag Economics:** Not surprisingly, Ag Econ faculty are very supportive of developing business acumen. Recommendations were made for animal disciplines to more effectively utilize courses and expertise through Ag Economic and Ag Business programs. Graduate studies that combine Animal Science or Vet Med with Ag Econ or MBA programs were suggested.

> *"Veterinary and Animal Science students are lacking in exposure to the intricacies of running their own business or understanding the business of pork production. For example, there needs to be a better understanding that all decisions are not necessarily based on animal health. There are business components to making decisions." Iowa State University Economics*

ADVANCED DEGREE PROGRAM OF THE FUTURE

Q3. If you were responsible to design a new advanced degree program to develop talent to meet the needs of pork production in 2030, what areas or coursework would you include? *(n=21)*

- Priority coursework suggested by academia are data science and analytics, environment and nutrient management, animal welfare, economics and business, and genetics.
- Producers and academia appear aligned in the growing needs for knowledge in economics and business management, environment, animal welfare and genetics.
- Producers were asked to rate importance of specific skill sets for advanced degree specialists, from a list of 16 options. (Q19 in Producer Phase 1). The top 6 skill sets for producers were previous pork work, facility management, swine specialty, foreign language, business and financial management, and human resources. Data science and computer science rated middle to low for producer priorities. While the question is phrased differently, the comparison signals a few areas of potential misalignment. Academia is placing more importance on data sciences than producers. The infrequent mention by academia of hands-on experience, communication and language skills signals less focus relative to producers' reported needs for practical skills. Another high need for producers is feed mill management, which was only referenced by two respondents.

Responses to this open-ended question were categorized, with the number of individuals mentioning each topic in parenthesis.

Data analysis, statistics, bioinformatics, big data (9)
Environmental systems, nutrient management (6)
Animal welfare, handling or care (5)
Economics, business management (5)
Genetics, genomics (5)
Nutrition, microbiome (4)
Human resources, people management (3)
Advocacy, social systems (3)
Reproductive physiology (3)
Swine health (3)
Precision animal agriculture (2)
Risk management (2)
Foreign language (2)
Meat quality (1)
Communications (1)
Hands on experience (1)
Industry partnerships (1)

Many respondents answered in the context of "additions beyond" current animal and veterinary science coursework, noting fewer responses in traditional areas like nutrition and swine health.

Animal Science faculty perspectives:

- Enhance feasibility to concurrently earn Masters of Business Administration (MBA) and a scientific graduate degree.
- Consider an integrated biology or multi-disciplined approach (i.e. combine nutrition with genetics).
- For veterinarians, design a "consultative curriculum" with increased knowledge in nutrition, genetics, reproduction and business management.

> *"We can very well handle the areas of nutrition, reproduction, genetics and meat science. Looking ahead we'll need to do more in foreign language, environmental management, risk management, human resources, personnel management. Meanwhile, the Regents are telling us to graduate students in four years. We'll have to be creative in our efforts to give students the skill sets they need to be successful." Animal Science Chair*

- Animal science departments and vet colleges must integrate more diverse course offerings.

Veterinary Medicine

- Swine veterinarians must have higher level of thinking and problem-solving to support environment and animal welfare issues.
- Veterinarians must be able to interpret large data sets and help producers design studies to learn what works in their operations.
- There's greater need for interdisciplinary courses (i.e. intersection of health, economics and disease).

Community College

- Courses to address concerns in public perception of animal agriculture will be important.

Ag Economics

- Combination of technical production with economics is imperative, along with increased focus on big data and understanding of the intersection between environmental impact and production.

Q3a. For this new advanced degree vision, how would your faculty needs and expertise change compared to today? *(n=20)*

- The specific faculty expertise and skill sets is a greater change than the number of faculty required.

Themes from Animal Science

- Faculty will become more interdisciplinary … be specialist able to work with experts outside their field.
- Faculty of the future need to have flexibility, multi-disciplined approach, good contact with industry and constant curiosity to ask the right questions.
- Instead of changing faculty, need to tear down silos and build bridges between departments that can provide additional skill sets. Engage economics, communications, natural resources and others to give students a broader perspective.
- Collaboration with other universities and online connectivity can provide supplemental expertise and address faculty shortages. Specific programs cited were Swine Online, Great Plains Idea Distance Education Consortium, AgIdea for Intro to Swine Science and Swine Production courses at University of Nebraska., SDSU and MN 2+2

> *"The poultry model is where swine is headed … specialized faculty with areas of concentration. There are less than 10 universities in the U.S. that focus on poultry research. Kansas State, for example, has a faculty group focusing on swine nutrition. I think we'll see the same thing happening for swine in areas such as genetics, reproductive physiology and animal handling." Oklahoma State University*

Community College

- Current staff must grow and become more familiar with issues important to the swine industry.
- Newer agricultural disciplines like biosystems seek progressive faculty members with experience outside of agriculture that can be applied to instructing ag students in new technology.

Changes Underway:

- Respondents volunteered these university actions underway:
    - Iowa State Vet College: hiring vets with expertise in bioinformatics and clinical trial design

- Minnesota Vet School: seeking faculty member to bridge health and economics and conduct research in those areas
- Purdue Vet College: need to add faculty expertise in data analytics and possibly epidemiology
- Ohio State Animal Science: Hiring faculty with computer science backgrounds, recognizing need to align with artificial intelligence and analyze big data sets
- South Dakota and Minnesota 2+2 Program: Vet students complete first two years of courses at SDSU and then final two years at Minnesota; 40 students expected in first two years.

STUDENTS IN SWINE SPECIALITIES

Q6. For Animal Science, please provide numbers reflecting students at your institution. *For those not in Animal Science, do you have a feel for how many swine / animal science students are in your department?*

- Participating institutions provided current student numbers, categorized by degree program and specifying numbers of swine-focused students when possible. The chart below provides a summary.

	# Students in AAS program (2-yr)		# Students in An Bachelor's program		# Students in Dept Graduate Level		# Students in Vet Med	
	Avg # students per program (range)	# of programs providing data	Avg # students per program (range)	# of programs providing data	Avg # students per program (range)	# of programs providing data	Avg # students per program (range)	# of programs providing data
Animal Science (all)	**50** (21-70)	**5**	**564** (377-950)	**10**	**57** (32-97)	**10**		
An Sci (Swine emphasis)	**13** (2-22)	**4**	**43** (18-150)	**10**	**13** (1-45)	**10**		
Vet Med (all)							**354** (52-648)	**6**
Vet Med (Swine emphasis)							**19**	**1**
Ag Economics			**250**	**3**	**45**	**2**		

Institutions providing data about AAS (2-year degree programs): Des Moines Area Community College (IA), Kirkwood Community College (IA), Michigan State University, North Carolina State University, The Ohio State University

Institutions providing data about Animal Science Bachelor's Degree and Graduate programs: Michigan State, University of Minnesota, University of Missouri, University of Nebraska, North Carolina State, Ohio State, Oklahoma State, Penn State, Purdue, South Dakota State

Ag Econ program data: Iowa State, Kansas State, South Dakota State

DVM program data: Iowa State, Minnesota, Nebraska, North Carolina State, Ohio State, Purdue

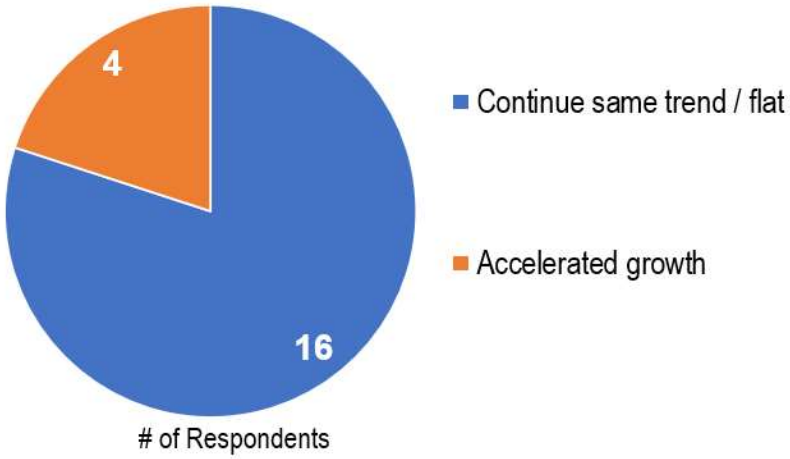
- Based on averages from reporting universities, 8% of undergraduates and 23% of graduate students in Animal Science are cited as specializing in swine. The estimated percentage of swine emphasis is higher among two-year programs (26%), which may be influenced by locations in high-production states like Iowa and North Carolina.

- Swine emphasis in Vet Med programs were not as widely reported. According to one veterinary college leader, Iowa State and Minnesota are the only programs nationwide with double-digit numbers of swine-specialty vet students.

6a. Has student enrollment in these areas trended up or down in the last 5 years?

- Generally, there are positive trends in Animal Science bachelor's programs with participating faculty reporting these trends: Significantly up (2), slightly up (4), steady (3) and down (1).
- Several suggested that increases are for animal science overall and do not reflect increased interest in swine specialization.
- With fewer responses, the trends for animal science graduate programs and DVM programs are varied depending on the institution. While a few programs trend up, others have fixed enrollments. One Vet School faculty cites a shift from DVM interest to graduate school, with the increased focus on population medicine.

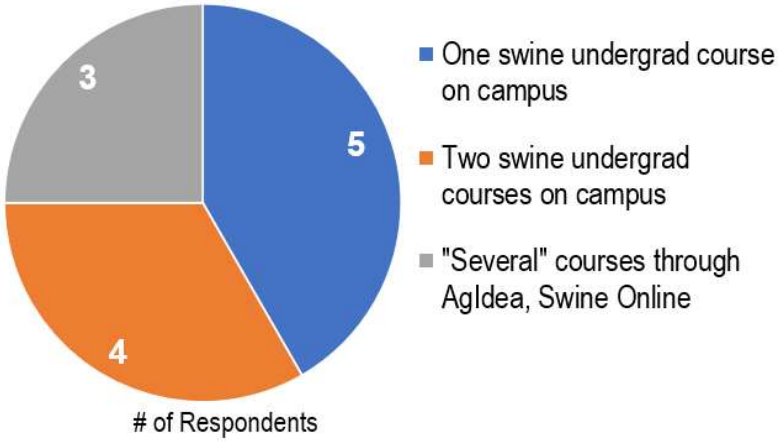
6b. Do you expect the trends (for student enrollment) to continue in the next 5 years? *(n=20)*



- Factors that contribute to flat enrollment expectations include limited physical capacity, decline of in-state high school graduates, and higher academic acceptance requirements.
- Several note that swine interest tends to develop through experiences during college through coursework, on-campus activities, internships and part-time work. Few students arrive on campus with swine interest, due to lack of familiarity, poor industry perception and other factors. First-hand experience, plentiful job opportunities, attractive starting salaries and faculty encouragement help recruit students into pork industry careers.
- Those outside of Animal Science expect increased student enrollment and interest in nutrient management, ag systems management and ag economics.

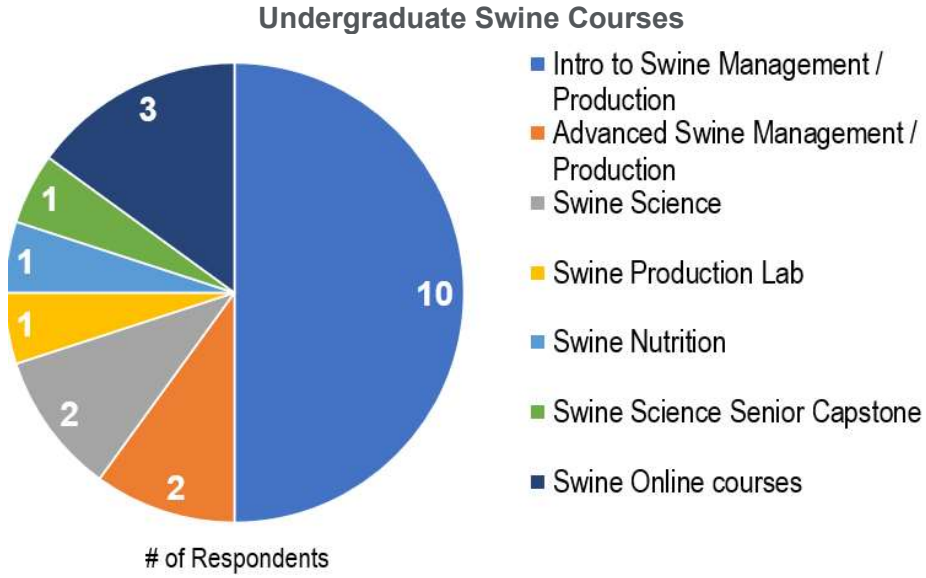
UNDERGRADUATE COURSES

Q9. For Animal Science, how many swine-specific undergraduate courses are taught at your institution? *(n=12 respondents)*



- Three-fourths of respondents report they have one or two swine undergraduate courses, while three stated that they expand their curriculum through Swine Online, AgIdea and other resources.

Q9a. What are the topics of these courses? *(n=12)*



- Swine nutrition is commonly taught within a non-ruminant nutrition course. General animal science courses like Physiology, Animal Handling and Animal Welfare have a section on swine.
- The Swine Science Senior Capstone course at Oklahoma State applies the different disciplines for swine management – nutrition, reproduction, genetics, animal handling and meat science – with the aim for a graduate equipped to manage a swine unit.
- While three universities mentioned use of Swine Online, that may not be comprehensive due to the question wording and open-ended format.

9b. If not in Animal Science, what undergraduate courses do you offer that you think would best meet the future needs of swine specialists and the pork industry? *(n=13)*

- **Biosystems:** Ohio State is currently developing a course on Digital Livestock Systems for undergraduates, and they offer some controlled environment and waste management courses. Iowa State requires animal production majors to take Design of Environmental Modification Systems for Animal Housing, and Animal Structures (engineering design) is offered.
- **Ag Economics:** Kansas State offers a broad range covering finance, marketing and sales. South Dakota State offers Advanced Farm and Ranch Management, and Environmental and Resource Economics. Iowa State offers Livestock Marketing, and Futures and Marketing.
- Iowa State offers a distinctive Agricultural Business major that combines training in business, farm management, and economics with solid technical knowledge in production agriculture. This is promoted to undergraduate students planning to seek an advanced degree in a scientific field, as well as to Animal Science undergrads.

ADVANCED DEGREE COURSES AND MAJORS

Q9. For those not in Animal Science (Ag Economics, Engineering), what courses are currently offered in your department that are required, encouraged or helpful for students seeking an advanced degree with a swine/livestock specialty?

Veterinary Science

- Iowa State requires Livestock Disease Prevention and offers a dozen electives for students interested in the livestock industry including Swine Diagnostic Medicine, Applied Statistical Methods in Population Studies and Advanced Swine Production.
- University of Minnesota offers an elective, Introduction to Swine Health and Production. Food and Fiber are offered in Year 3. In Year 4, there are four targeted swine rotations: biosecurity, diagnostics/therapeutics, swine health and production, and advanced swine health and production.
- Purdue University does not offer any swine-specific courses but encourages all students to take Epidemiology and Animal Welfare.

Biosystems

- Ohio State offers graduate courses on livestock stress and mitigation of environmental problems.

Q10. What specific graduate majors are offered at your institution, related to pork production?

- None of the Animal Science departments interviewed have a specific swine graduate major. Most offer Animal Science graduate major with emphasis or concentration in swine.

Veterinary Science

- Iowa State vet school offers Masters and PhD programs that can focus on swine with study in microbiology, population sciences and veterinary pathology.
- At Purdue, students pursuing a swine specialty would study in the Food Animal or Mixed Animal track, and they can seek clinical rotations and work with off-campus practitioners.

Biosystems

- Iowa State offers Masters and PhDs in Agriculture and Biosystems Engineering and Industrial and Agricultural Technology.
- At Ohio State, those with livestock interest earn a Masters or PhD in Food, Agriculture and Biological Engineering.

Ag Economics

- Iowa State offers a Masters in Agriculture Business, with about 30% of current students interested in pork production.
- Kansas State also offers a Masters of Agribusiness degree but made no mention of how many students are focused on the pork industry.

ADVANCED STUDY DISCIPLINES

Q12. Name three disciplines of advanced study most prevalent – currently – among your graduate student body interested in swine production.

Word cloud reflects the frequency that specific disciplines are mentioned.

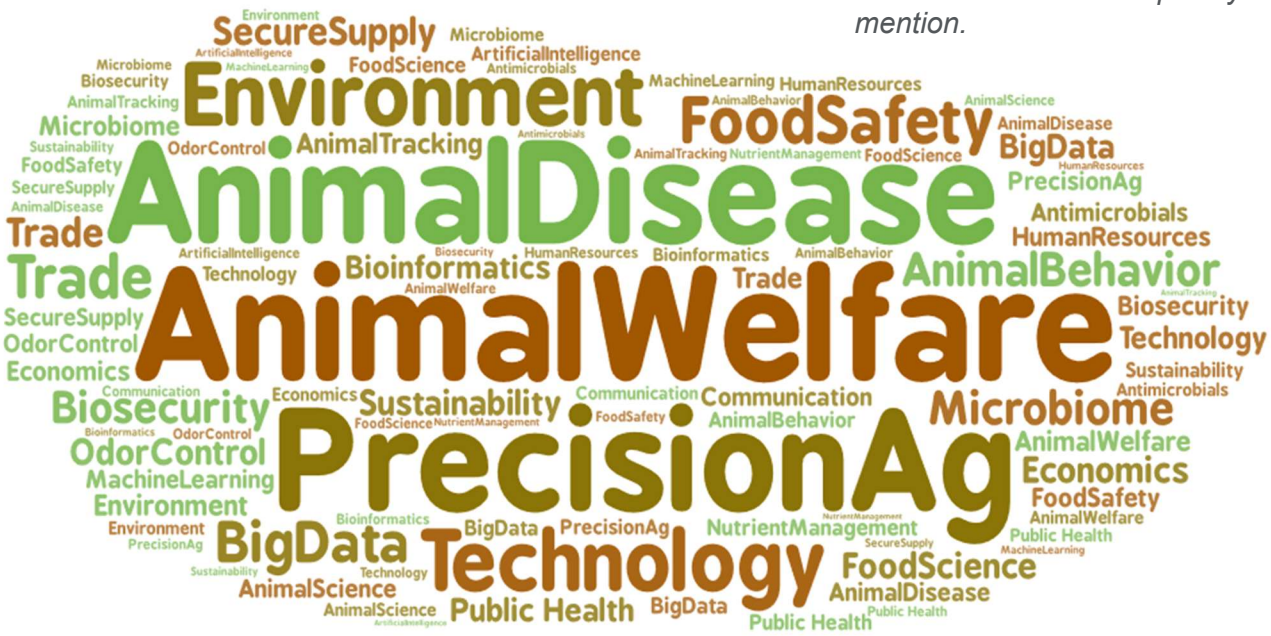
Number of Responses

Nutrition (13) *
Veterinary medicine (8) *
Animal science (7) *
Agriculture economics (7)
Reproduction, physiology (7)
Genetics (6) *
Animal welfare, well-being, behavior (4)
Environmental science (2) *
Infectious disease epidemiology, pathology (2)
Ag engineering (2)
Production management, technical skills (2) *
Population science, animal health (1)
Microbiology (1)
Animal facility design (1)

** Identified as prominent need by producers*

Q13. Looking to 2030, name three <u>emerging advanced study disciplines</u> gaining interest for veterinary and technical consulting roles – specific to pork and animal agriculture.

Word cloud reflects frequency of mention.



- Leading emerging disciplines identified by academics are animal welfare, zoonotic disease and impacts, environmental science, precision ag and data. This is a significant shift from current disciplines (listed in the previous question).

<u>Number of Responses</u>

Animal welfare (8)
Zoonotic disease/FAD, biosecurity, secure supply planning, public health (8)
Environmental science, odor reduction (6)*
Precision animal agriculture technologies (6)
Bioinformatics, big data, artificial intelligence (5)
Economics (trade, feed costs) (3)
Preharvest food safety, food science (3)
Microbiome (2)
Animal science (1) *
Human resources (1)*
Antimicrobials, pharmacology(1)
Animal ID, tracking (1)
Communications (1)*

**Identified as prominent need by producers*

INTERDEPARTMENTAL GRADUATE MAJORS

Q11. Does your program participate in interdepartmental graduate majors that would relate to pork production? If yes, what specific interdepartmental majors are offered? *(n=19)*

- Six of the respondents named a related interdepartmental graduate major that they currently offer, and two others are considering an addition of an interdepartmental major. Several respondents mentioned interdepartmental committees and encouragement for graduate students to take courses in other departments.
- Specific programs are listed to the right.

Interdepartmental Majors Offered

Iowa State Ag Biosystems Engineering: Professional Agriculture, Sustainable Agriculture, Environmental Sciences

Iowa State Vet Med: Toxicology, Microbiology and Pharmacology with swine focus

Minnesota Vet Med: Interdisciplinary Nutrition program, Animal Well-Being and Public Health

NC State Animal Science: Nutrition, Bioinformatics, Physiology, Feed Science

Penn State Huck Institutes of Life Sciences: Bioinformatics and microbiome programs

South Dakota State: Biological Sciences, Agriculture Economics

Interdepartmental Majors Being Considered

Iowa State Ag Econ: Professional Masters

Nebraska: Biosystems Engineering and Swine Production/Animal Science

INTERDEPARTMENTAL COURSEWORK

Phase 1 identified top skills that producers desired for advanced degree specialists, and their input informed the options presented in the academia questionnaire.

Q14. Which of the following areas of coursework are currently included in your swine-related curriculums? *(Answer for degree(s) for which you are familiar.)*

This results summary provides the insights about coursework expectations, beyond specific disciplines.

	AAS Degree n=5			Bachelor's Degree n=15			Masters or PhD n=11			DVM n=3		
	R	E	NO	R	E	NO	R	E	NO	R	E	NO
Foreign Language	1	2	2	4	9	2	0	8	3	0	**3**	0
Business Management	**3**	2	0	**11**	**4**	0	1	9	1	1	2	0
Facility Management	2	2	1	4	8	3	0	**10**	1	0	1	2
Financial and Risk Management	2	3	0	**9**	**5**	1	**3**	8	1	0	1	2
Human Resources and Personnel Management	**3**	2	0	3	**10**	2	1	**10**	1	0	0	1
Technology Management/Computer Science	**3**	2	0	3	**10**	2	**3**	9	0	0	**3**	0
Interpersonal Communication	**4**	**1**	0	**12**	2	1	**3**	9	0	**2**	1	0

Key: R = Required, E = Encouraged, NO = Not Offered

- Interpersonal communication is the skill most frequently required in bachelor's programs, and it is less frequently required in advanced degree programs. Producers identified this among the most desired soft skill for their current and future advanced degree specialists. Additional conversations are needed to determine:
    - What are producers seeking, beyond what institutions are presently doing?
    - What specific training or activity at educational institutions is needed to close the gap that producers are reporting?
- Business, financial and risk management coursework is required in most undergraduate programs, which is a positive foundational step for the business acumen that producers expect. Human resources and technology management are encouraged for most bachelor's degree programs.
- For Masters, PhD and DVM programs, most of these skill areas are encouraged, but few institutions have requirements. Production needs may be better served through increased requirements for advanced degree students to further competence in interpersonal communication, business, human resources and foreign language.
- Foreign language and facility management present the largest gaps between producer-identified needs and academic program requirements.
- Only 4 of the 15 responding institutions require foreign language coursework for a bachelor's degree. While several universities (8-9) encourage foreign language for bachelor's or advanced degrees, stronger motivation or requirements for foreign language coursework would better align with production needs.

FACULTY NUMBERS AND TRENDS

Q7. Provide numbers reflecting the faculty at your institution. *(n=20)*

- The current faculty employment, vacancies and anticipated retirements (in five years) are presented below for participating institutions.
- The proportion of vacancies for swine specialists appear higher than overall animal science faculty, (recognizing a statistically-small data set).
- Current vacancies for Animal Science faculty average 10% (relative to employed faculty) and 5% for Vet Med faculty.
- Among reporting institutions, ~17% of current Animal Science faculty and ~6% of Vet Med faculty are expected to retire in the next five years.

	# Faculty Employed, Current		# Vacancies at Present		# Retirements in Next 5 Yrs	
	Avg # Faculty per program (range)	# of programs providing data	Avg # Faculty per program (range)	# of programs providing data	Avg # Faculty per program (range)	# of programs providing data
Animal Science (all)	**29** (4-51)	**13**	**3** (0-11)	**11**	**5** (0-9)	**11**
Swine Emphasis	**6** (0-15)	**10**	**2** (0-11)	**10**	**1** (0-2)	**10**
Veterinary Medicine	**140** (120-160)	**3**	**7** (2-11)	**3**	**9** (1-15)	**3**
Ag Economics	**22** (12-35)	**3**	**2** (1-2)	**3**	**3** (1-4)	**3**

Animal Science, institutions providing data: Iowa State, Michigan State, Minnesota, Missouri, Nebraska, North Carolina State, Ohio State, Oklahoma State, Penn State, Purdue, South Dakota State, *Des Moines Area Community College, *Kirkwood Community College (*Community colleges did not provide vacancy and retirement data.)

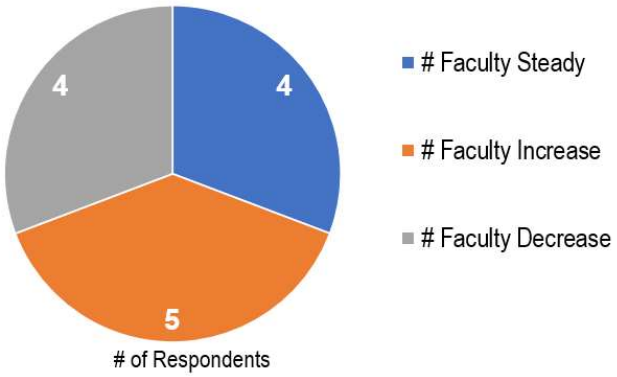
Swine Emphasis, institutions providing data: Iowa State, Michigan State, Minnesota, Missouri, Nebraska, North Carolina State, Ohio State, Oklahoma State, Penn State, Purdue, South Dakota State

Veterinary Medicine, institutions providing data: Iowa State, Minnesota, Purdue

Ag Economics, institutions providing data: Iowa State, Kansas State, South Dakota State

7a. Has faculty size in these areas trended up or down in the last 5 years? *(n=13)*

- Five institutions indicated faculty size has trended up, four reported a downward trend, and four reported that faculty size has remained steady in the last 5 years.



7b. Do you expect the trends to continue in the next 5 years?

- Of the 7 who responded, 5 expect to see their current trend continue and 2 anticipate a shift.

> *"Because of the AGRETT program (Agricultural Research Extension Technology Transfer) we've been able to capture a number of faculty focused on swine activities. The Minnesota Pork Board was instrumental in lobbying our legislature for this program." University of Minnesota*

- Veterinary colleges report concern about future availability of swine-focused DVMs for faculty positions. Although 70% of producers surveyed report DVM availability as "Very Good" or "Excellent" at present, this could be a future expertise gap considering retirements, fewer swine vet students and the likelihood that producers will hire DVMs (as reported in the Phase 1 survey).
- In biosystems and ag engineering, student numbers are increasing, resulting in need for additional faculty. With emerging focus on environmental systems, facility technology and precision agriculture, it appears there will be increased demand for such specialists to be employed by production systems and universities. This is an area for further exploration in Phase 3 with the allied industry.
- Ag Econ faculty from two universities stated that recent vacancies have not been filled, and future vacancies will likely be left open, due to budget constraints and reduced student enrollment.

> *"The trend will depend on the state of the economy. The university is moving away from positions like mine, which involve research and teaching. There's more concentration on teaching because those positions are far less expensive" Iowa State University*

FACULTY APPOINTMENTS

Q8. Among the faculty with swine specialty at your institution, describe the proportion of teaching, extension and research appointments. *(Asked only of land-grant institutions.)*

- Accumulated responses from the 10 Animal Science departments show that research FTEs are double that of teaching or extension. Cumulatively, FTE allocation between swine teaching and extension are similar, with significant variance in allocations among institutions.
- Some academics predict a shift toward more teaching appointments and fewer research positions, due to budget restrictions and relative salary expectations.
- Vet colleges report their swine specialists primarily have combined teaching, research and extension appointments, with an additional set of specialists employed in diagnostics and clinical work.

HANDS-ON PRODUCTION EXPERIENCE

- Pork producers surveyed in Phase 1 overwhelmingly shared that hands-on experience in production facilities is important to the effectiveness of advanced degree specialists and vets.
- Academia agree hands-on experience is important today, and this will increase as the future workforce is less likely to have an ag background.

> *"Around 30% of Purdue's ag students are from farms – the largest east of the Mississippi. If I'm a commodity group, I'd prefer students with hands-on experience and not just "book smarts." These are becoming increasingly hard to find – at least at the Baccalaureate level. We need to be preemptive on this."*
> *Dr. Marcus Fernandez, retired Associate Dean/Director of Academic Programs in Animal Sciences, Purdue*

Q15. Does your institution have a swine farm where students can get hands-on experience (through coursework, part-time employment, etc.)? If yes, how many farms with how many hogs? What type of research is conducted at the farms? *(n=16)*

- All 16 of the responding institutions indicated at least one swine farm that offers student experience. Both community colleges have swine farms but do not conduct research.
- In total, the 16 institutions have nearly 30 facilities with hogs, considering on-campus and outreach sites. Per site capacity varies from 20 to 300 sows and up to 4500 finished hogs annually.
- For 18 of the facilities, descriptions were provided for swine research being conducted. Human medical research is also being conducted at 4 facilities.
- Faculty descriptions indicate Iowa State, Minnesota and North Carolina State have the most robust swine farm operations. North Carolina State and Purdue have feed mills. Iowa State has a new swine facility and feed mill in the works.

Areas of swine research conducted at university farms:

- Nutrition, digestive health, feed (9)
- Environment (7), i.e. ventilation, air quality, energy utilization, manure management, odor mitigation, heating and cooling
- Animal welfare, behavior, handling (4)
- Reproductive physiology (3)
- Swine health (3)
- Food safety (2)
- Genetics (2)
- Neo-natal work
- Infectious disease, pathology
- Pasture system

BARN-LEVEL EXPERIENCE

Q16. Describe the opportunities <u>undergraduate</u> students have for barn-level experience.

- Several institutions reported undergraduate requirements for internships/externships and coursework on university farms.
- Of the 12 institutions that provided detail, they cited part-time jobs on university farms (8), undergraduate courses on-farm (7), internships with producers (5), and undergraduate research projects/support (3)
- Examples of production opportunities include:
  - Pipestone has five, 5000-sow units within 15 miles of SDSU where students hold part-time jobs.
  - Oklahoma State cites student internships with The Maschhoffs and Tyson.

Q17. Describe the opportunities graduate students have for barn-level experience.

- No Animal Science graduate program cited a requirement for barn-level experience.
- Seven of 9 Animal Science faculty suggested that graduate student research projects are the main source of hands-on experience. Two also mentioned industry internships.

> *"All grad students would have an expectation of gaining hands on experience as part of their research project." South Dakota State University*

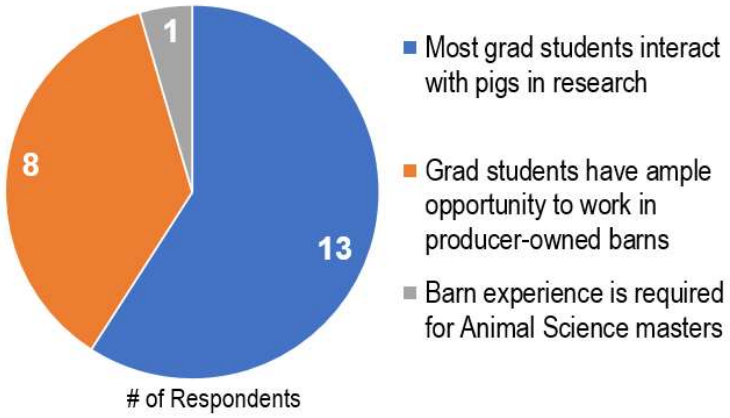
- Reports from 2 universities indicated minimal, if any, barn-level experience for graduate students.
- All three Veterinary Medicine programs stated students would have barn-level experience through on-farm projects, university research facilities and/or clinical work on farms.

> *"Our Swine Medicine Education Center (SMEC) is a cooperative program with a large swine focus. Our students use the clinics as a living laboratory. It gives our students "real world" experience in swine management." Iowa State University*

Q18. What statement(s) describe barn-level experience that graduate students receive at your institution (choose all that apply). *(n=23)*

a. Most graduate students would not have any barn-level experience while at our institution. = 0
b. Most graduate students interact with pigs in their research, but not in other capacities. = 13
c. Graduate students have ample opportunities to visit or work in barns owned by pork production companies or farmers. = 8
d. Barn-level experience is required in masters-level animal science program = 1
e. If none apply, describe your institution's programs for barn-level experience = 1

- Because producers list barn-level experience as the most desired skill of new advanced degree specialists and veterinarians, there is a need for increased requirements and opportunities. Several faculty expressed willingness to collaborate and openness to industry input.
- Some faculty express frustration that university farms are moving further from campus which limits student access and opportunity.



ADDITIONAL RESEARCH ON LABOR NEEDS

Q4. Has your institution conducted or published any research or white papers about the current and future needs for swine technical experts and/or swine veterinarians? Are you aware of any research outside your university?

- Published by Purdue researchers: "Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, UA 2015-2020." Authors Goecker, A; Smith, E; Fernandez, M; Ali, R; Theller, R.
- Another respondent suggested this report expressed concern about the job market favoring the fundamental scientist rather than applied production and asked how we will replace retirees who understand hog production.
- Iowa State's Dr. Alex Ramirez worked with CAST on a new paper on recruitment of food animal veterinarians.
- Dr. Locke Karriker of Iowa State presented on the Future of Swine Medicine Education at the American Association of Swine Veterinarians Annual Meeting in March 2020. Conference proceedings are available to AASV members; see https://www.aasv.org.
- University of Minnesota swine division is currently examining the competencies for swine vets' success; students use an app to identify competencies they need to improve.
- A group at South Dakota State headed by Dr. Jane Hennings, Veterinary and Biomedical Sciences, reviewed future veterinarian needs and identified the need to increase food animal veterinarians.
- American Association of Swine Veterinarians (AASV) or Association of American Veterinary Medical Colleges (AAVMC) were suggested; no specific papers were cited.

APPENDIX A: INTERVIEWEE NAMES, ROLES AND INSTITUTIONS

Institution	Individual	Title	Department
Michigan State University	Dale Rozeboom	Professor, Extension Pork Specialist	Animal Science
University of Minnesota	Mike Schutz	Department Head	Animal Science
University of Missouri	William	Director	Animal Sciences
University of Nebraska	Clinton Krehbiel	Head	Animal Science
North Carolina State University	Todd See	Head	Animal Science
The Ohio State University	John Foltz	Chair	Animal Science
Oklahoma State University	Clint Rusk	Head	Animal and Food Science
Penn State University	Terry Etherton	Head	Animal Science
Purdue University	Alan Mathew	Head	Animal Sciences
South Dakota State University	Joe Cassady	Dept Head/Professor	Animal Science
Iowa State University	Dan Grooms	Dean	College of Veterinary Medicine
University of Minnesota	Thomas Molitor	Chair	Veterinary Population
Purdue University	Willie Reed	Dean	College of Veterinary Medicine
Iowa State University	Dermot Hayes	Chair	Agribusiness
Iowa State University	Lee Schulz	Associate Professor	Economics
Kansas State University	Allen	Head	Agricultural Economics
South Dakota State University	Eluned Jones	Director	Management & Economics
Iowa State University	Steve Mickelson	Chair	Ag Biosystems Engineering
The Ohio State University	Scott Shearer	Chair	Food, Agriculture and Biological Engineering
Purdue University	Marcos	Retired Associate	Animal Sciences
South Dakota State University	Donald Marshall	Associate Dean-Academic Programs	College of Agriculture, Food, Environmental Sciences
Des Moines Area Community College	Dwayne Faidley	Co-Chair	Agribusiness
Kirkwood Community College (IA)	Scott Ermer	Dean	Agriculture Sciences

APPENDIX B: SURVEY INSTRUMENT

Respondent Details

Name
Title
Department
Area of Specialty
Institution

Introduction

Thanks for making time for an interview today about the future human capital needs of the pork industry. This should take about 20 minutes. Your insights will help the National Pork Board's educational work group as they work to develop scholarship and fellowship programs to help fulfill the needs for advanced degree specialists in the future.

1. In your experience and opinion, how would you describe the current needs (supply and demand) for swine veterinarians and/or swine technical experts (individuals holding advanced degrees in nutrition, genetics, reproduction, environmental science, etc.)?

2. How would you describe the expected need 10 years from now, for swine veterinarians and/or technical experts?

3. If you were responsible to design a new advanced degree program to develop talent to meet the needs of pork production in 2030, what areas or coursework would you include?
   3a. For this new advanced degree vision, how would your faculty needs and areas of expertise change compared to today?

4. Has your institution conducted or published any research or white papers about the current and future needs for swine technical experts and/or swine veterinarians?
   4a. Are you aware of any such work outside your institution?

5. How do you see requirements of specialist roles emerging in academic institutions (choose 1)?
   - Complete focus on one specialty area
   - More need for combined scientific specialties (e.g. genetics and biostatistics, animal science and environmental studies)
   - More need for scientific specialty expertise and business (e.g. animal science and MBA)
   - Other (please explain)

6. **For Animal Science faculty:**
Please provide numbers reflecting the student body at your institution:
For those not in Animal Science:
Do you have a feel for how many swine/livestock students you have in your department?

	# Students in AAS Degree program (2-yr)	# Students in Bachelor's Degree program	# Students in Graduate/DVM Level
Animal Science (all)			
Animal Science, Swine Emphasis			
Veterinary Medicine			

6a. Has student enrollment in these areas trended up or down in the last 5 years?

6b. How do you expect the trends to continue in the next 5 years?
   a. Will continue to trend the same
   b. Will likely see shifts in the trends
      (note specific areas that are mentioned)

7. **For Animal Science Interviews:**
Please provide numbers reflecting the faculty at your institution:

Department	# Faculty Currently Employed	# Faculty Vacancies at Present	# Retirements Anticipated in Next 5 Years
Animal Science (all)			
Animal Science, Swine Emphasis			
Veterinary Medicine			

For those not in Animal Science:
Please provide numbers reflecting the faculty in your department:

Department (i.e. Ag Economics)	# Faculty Currently Employed	# Faculty Vacancies at Present	# Retirements Anticipated in Next 5 Years

7a. Has faculty size in these areas trended up or down in the last 5 years?

7b. How do you expect the trends to continue in the next 5 years?
   a. Will continue to trend the same
   b. Will likely see shifts in the trends
      (note specific areas that are mentioned)

Interview Note: Ask this question only to respondents with Land Grant Institutions.

8. Among the faculty with swine specialty at your institution, describe the proportion of teaching, extension and research appointments.

Interview Note: There are two versions of this question depending on the area of study/department of the interview respondent.

9. **For Animal Science:**
   How many swine-specific **undergraduate** courses are taught at your institution?

   9a. What are the topics of these courses?

   For those not in Animal Science (i.e. Ag Economics, Ag Engineering):

   Are there currently courses offered in your department that are required or encouraged for students seeking an advanced degree with a swine/livestock specialty?

   9a. If yes, what are they?

   9b. If no, what **undergraduate courses** do you offer that you think would best meet the future needs of swine specialists and the pork industry?

   9c. If no, what **graduate courses** do you offer that you think would best meet the future needs of swine specialists and the pork industry?

Interview Note: Use examples like the majors listed we see on Iowa State Animal Science page

10. What are the specific **graduate majors** offered at your institution, related to pork production?

11. Does your program participate in **interdepartmental graduate majors** that would relate to pork production (i.e. bioinformatics, microbiology, environmental sciences)? If yes, what specific interdepartmental majors do you offer?

12. Name three disciplines of advanced study you feel are most prevalent – currently - among your graduate student body interested in swine production.(i.e.- Nutrition, Genetics, Animal Science, Veterinary Medicine, Agricultural Economics, Environmental Science, Reproduction)

13. Looking forward to 2030, name three emerging advanced study disciplines gaining interest for veterinary and technical consulting roles – specific to pork and animal agriculture.

14. Which of the following areas of coursework are currently included in your swine-related curriculums? (answer for degree(s) for which you are familiar)
    Key (R = required, E = encouraged, NO = not offered)

	AAS Degree			Bachelor's Degree			Masters or PhD			DVM		
	R	E	NO	R	E	NO	R	E	NO	R	E	NO
Foreign Language												
Business Management												
Facility Management												
Financial and Risk Management												
Human Resources and Personnel Management												
Technology Management/Computer Science												
Interpersonal Communication												

15. Does your institution have a swine farm where students can get hands-on experience (through coursework, part-time employment, etc.)? (Yes or No)

    15a. If yes, how many farms with how many hogs?

    15b. If yes, what type of research is conducted at the farms?

16. Describe the opportunities **undergraduate students** have to gain barn-level experience in pork production (i.e. internships, coursework requirements).

17. Describe the opportunities **graduate students** have to gain barn-level experience.

18. What statement(s) describe barn-level experience that **graduate students** receive at your institution (choose all that apply):
    a. Most graduate students would not have any barn-level experience while at our institution.
    b. Most graduate students interact with pigs in their research project, but not in other capacities.
    c. Graduate students have ample opportunities to visit or work in barns owned by pork production companies or farmers.
    d. Barn-level experience is required in masters-level animal science program

    If none of these apply, please describe your institution's programs for barn-level experience.