IDENTIFYING, EXAMINING, AND VALIDATING A DESCRIPTION OF THE AGRICULTURE INDUSTRY

A Dissertation

by

EDWARD WAYNE ROMERO

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2008

Major Subject: Agricultural Education

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Approved by:

Chair of Committee,	Joe D. Townsend
Committee Members,	Gary E. Briers
	James R. Lindner
	Ben D. Welch
Head of Department,	David W. Reed

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ABSTRACT

Identifying, Examining, and Validating a Description of the Agriculture Industry.

(May 2008)

Edward Wayne Romero, B.S., New Mexico State University;

M.A., New Mexico State University

Chair of Advisory Committee: Dr. Joe D. Townsend

The purpose of this study was to identify, examine, and validate the various components and systems in agriculture while investigating three objectives related to Careers, Industries, and Systems using the Delphi technique over three rounds. Three similar but different instruments were used to gather information from the expert panel. The following questions were considered: 1) What are the different *Careers* associated with agriculture? 2) What are the *Industries* that play an important role in the input segment of agriculture? and 3) What are the *System* components needed to depict the industry of agriculture?

Twenty-one expert panelists from nine states with varied backgrounds such as Church/Religion, Education, Government, Insurance, Manufacturing, Natural Resources, Pharmaceutical, and Public Policy participated in this study. The expert's years of service total 370 years in their respected occupations with a mean of 17.6 years of experience.

Raw data submitted by the expert panelists in round one identified 477 Career items, 157 Industry items, and 130 System items, totaling 764 pieces of initial information. Over the course of the subsequent two rounds, duplicates were eliminated, items were categorized, and consensus was reached for 317 Careers associated with agriculture. There were 30 Industries recognized and validated to play an important role in the input segment of agriculture and 21 System components depicted in agriculture. In all, 368 items reached consensus and were confirmed in the study.

Findings indicated: 1) It is difficult to find a comprehensive diagram that visually conveys the different Careers, Industries, and Systems to assist in recruiting efforts by colleges and universities; 2) Not all websites found in the literature convey an accurate distinctiveness of what agriculture is today; 3) More research is needed regarding the impact of agriculture on career education used in agricultural literacy initiatives; and 4) The information found in this study can be used to begin further development of models to aid in the visualization of how Careers, Industries, and Systems are interconnected in order to help the public better understand the complex and diverse agricultural sector and challenges facing the agricultural industry in all its dimensions.

DEDICATION

With love and affection, this dissertation is dedicated to Naomi and Margaret, two important people in my life. Naomi, you keep me grounded and inspire me on a daily basis. Your kind words, special cards, and smile always brighten my day. I know I spent too many long nights and boring weekends on this project, but I promise I will make it up to you!

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Finally, thanks to my family, sister, and brother for their support and unconditional love as well as my uncles, aunts, and cousins for keeping "tabs" on my progress. I know you are supporting me.

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CHAPTER I

INTRODUCTION

As evidenced by the dwindling acres of farm land in production in the United States, fewer and fewer people are considering careers in contemporary agriculture due to the misconception of limited opportunities in agriculture. Today, many people still perceive that agriculture refers only to production agriculture—the raising of livestock and crops or farming—(Holz-Clause & Jost, 1995) and rarely, if ever, know about the many different segments of industry that are tied directly to contemporary agriculture, such as natural resources and the environment or know the many service industries that help our agriculturists in financial planning, lending, insurance, commodity trading, or agricultural communications to name a few. In addition, people have little knowledge about how equipment systems and chemical and pharmaceutical systems are part of the agricultural industry. While people have a sense of how the animal and plant related system is part of agriculture (Frick, Birkenholz, & Machtmes, 1995a), the population at large rarely understands the implications of how life sciences, sales and distribution services, research and development, and marketing and manufacturing play a role in agriculture. The public also rarely understands the byproducts of agricultural commodities and how we utilize the byproducts in our every day lives.

Allowing the public, parents, teachers, and students to continue to have a misconceived notion or negative perception about the true meaning of contemporary agriculture is detrimental to our industry and is inaccurate at best. For example,

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This dissertation follows the style of the *Journal of Agricultural Education*.

government leaders who make policy may underestimate the complexities of the industry, and decisions are, often times, made with severe implications to the industry by leaders who have an uninformed perception about contemporary agriculture.

NEED FOR THE STUDY

Agriculture is defined by the Merriam-Webster's Dictionary (2000) as "the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products: Farming" (p. 24). While the above definition of agriculture is true, contemporary agriculture is also inclusive of other practices and systems that more broadly define what the new agricultural industries represent. Stated broadly, plants and animals, including soil cultivation, livestock and crop management, and the activities of processing and marketing, include the entire range of technologies associated with their production and by-products. One term found in the literature to convey the technologies that interconnect the inputs and outputs of the farming sector is agribusiness (McGraw-Hill Access Science, 2007). To this degree, agriculture can include the wide range of activities in manufacturing and distribution used in farming that is closely associated with industrial inputs. In addition, farm production (crops, animals, animal products and by-products which are provided to the consumer) is all part of the agriculture cycle.

The National Research Council's definition of agriculture is broader than Merriam-Webster's Dictionary in order to include a more accurate representation of contemporary agriculture due to technological and structural changes. The National Research Council (1988) defines "agriculture" broadly as to:

> …encompass the production of agricultural commodities, including food, fiber, wood products, horticultural crops, and other plant and animals products. The terms also include the financing, processing, marketing, and distribution of agricultural products; farm production supply and service industries; health, nutrition, and food consumption; the use and conservation of land and water resources; development and maintenance of recreational resources; and related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system. (p. vi)

Despite the differences in definitions, one thing is certain, there is a vast array of systems, industries, and careers that agriculture touches or impacts on a daily basis, regardless of how it is defined.

For the last century, agriculture has been evolving and changing. In the more recent past, agriculture has been transformed because of new knowledge in science and the use of biotechnology. Calls have sounded by those in industry and academia (American Association for Agricultural Education Ad Hoc Agricultural Literacy Work Group, 1992) to educate a larger audience related to the human, food, and fiber system in agriculture. The transformation of agriculture into an industry that touches all our lives in many ways besides the food we eat and clothing we wear should be recognized and further appreciated.

Studies conducted show a lack of secondary guidance counselor support for agricultural programs in high schools (Dyer, Breja, & Ball, 2003), which translates into not encouraging high school students to consider agricultural programs in their local

schools because of the outdated perception that agricultural will lead to a life of hard work, stoop labor, harsh conditions (Holz-Clause & Jost, 1995), long hours, and low wages. While the above can be indicative of many jobs, including those outside of the agriculture realm, working in agriculture can also mean a life working in corporate America, in large metropolitan cities where international agricultural companies are headquartered. Careers in law and medicine or professional school can be obtained by pursuing a degree from many agricultural colleges in the United States. The divide is often predicated by an incorrect assumption of what degrees in these programs can provide in terms of employment and lifestyle.

The aforementioned assumptions are examples of why it is difficult to recruit potential students into agriculture. Parents, teachers, and students believe agriculture is a dead-end career where only the negative perceptions of hard work, long hours, stoop labor, low wages, and working in harsh conditions are the norm. While working in production agriculture may merit such concern, only a small percentage of the overall agricultural workforce is in production agriculture. Why then, does a majority of the public (including students) perceive agriculture as related only to production agriculture? Could the assumptions of yesteryear's agriculture still be in the minds of many when compared to our more contemporary technology-driven agricultural industry?

Agriculturists must provide the resources necessary to empower the public to better understand contemporary agriculture. In 2005, a national study was conducted by administrators in colleges and universities of agriculture and natural resources to evaluate the different factors affecting admission and matriculation of high school

students in the United States into college programs related to agriculture sciences as a career. In 2006, Jorge Gonzalez presented results of the national study to a group of Cooperative State Research, Education, and Extension Services Faculty Fellows in the United States Department of Agriculture. As cited by Gilmore, Goecker, Smith, and Smith, (2006) in Gonzalez's presentation titled *Agricultural Programs: Are They Able to Adapt for the Future?,* the statistics indicate 41 percent of the students listed the misconception or image about agricultural sciences as the number one concern; a lack of knowledge about employment opportunities was second at 33 percent; third, a lack of knowledge about fields of study, 22 percent; fourth, perceived relevance/importance to future career, 22 percent; fifth, a lack of fundamental knowledge in mathematics and sciences, 11 percent; and sixth, peer pressure/family against agricultural sciences studies, 7 percent. These disturbing data are indicative of some of the challenges faced by many colleges and land-grant universities when educating students and parents about academic and career opportunities in agriculture.

STATEMENT OF THE PROBLEM

Gonzalez's report speaks clearly as to why negative perceptions by students, parents, and the public make recruiting into universities difficult. In part, the aforementioned data justify the need for a *visual* representation model to help the public, educators, industry, prospective students, government, and parents understand the impact of agriculture. More importantly, however, is the need to identify, examine, and validate a description of the agriculture industry and to understand the impact agriculture has on our lives. Agriculture is more than just farming or the raising of livestock and crops as

Webster's definition conveys. Today, agriculture includes a web of intricate supply chain systems using state-of-the-art technology based on sound basic and applied scientific research.

There is a critical need to better convey the vast array of opportunities in agriculture, food, and life sciences by identifying systems, industries, and careers in or associated with the agricultural industry in order to help the general population better understand the impact of agriculture in our society and help affect change.

PURPOSE OF THE STUDY

Contemporary agriculture is much different than it was 30 years ago. The perception of agriculture by the general public is largely still visualized as primarily farming and ranching or linked primarily to production agriculture. The purpose of this study was to identify, examine, and validate the various components and systems in agriculture while investigating the following questions:

1. What are the different *Careers* associated with agriculture?
2. What are the *Industries* that play an important role in the input segment of agriculture?
3. What are the *System* components needed to depict the industry of agriculture?

SIGNIFICANCE OF THE STUDY

Literature is littered with research about how students perceive agriculture to be limiting and with few career opportunities outside of production agriculture leading a successful life. Today, many still perceive agriculture is only related to production

agriculture and never know about the many different segments of industry that are tied directly to contemporary agriculture.

The reason to identify, examine, and validate the agriculture industry is to help the general public, especially young people, understand and appreciate the myriad of systems, industries, and careers tied directly to, or associated with agriculture. This study will identify systems, industries, and careers that people do not realize are directly related or impacted with agriculture, which will aid in the development of a visual model that could affect change and aid in the transformation of the limited perspective agriculture currently conveys.

Much of the information available today regarding classification of occupational opportunities and understanding how occupations and agricultural systems are interconnected is through an array of intricate websites or complicated narrative text not allowing for an understanding of how these occupations are connected to agriculture. According to Montgomery (1995), (Felder & Silverman, n.d.) many of today's lectures are passive, yet 67 percent of students learn best actively; 57 percent of students are sensors; yet we teach them intuitively; many of our lectures are verbal; yet 69 percent of students are visual; and 28 percent of students are global, yet we seldom focus on the "big picture." Linking systems, industries, and careers to the agriculture industry will allow a more comprehensive visual model to be developed.

DEFINITION OF TERMS

Operational terms essential to this research are defined as follows:

Agricultural Literacy - The term is broad and constitutes general knowledge of education *about* agriculture. It includes the food and fiber system, as well as production, processing, and domestic and international marketing, in addition to its current economic, social, history, and environmental significance in America. (National Research Council, 1988)

Agricultural Education – Historically, the term refers specifically to education *in* agriculture and sometimes referred to as vocational agriculture (National Research Council, 1988). According to Baker, Shinn, and Briers (2007), agricultural education is a field of study which integrates social and behavioral sciences with the natural and applied science of agriculture, renewable natural resources, and environment.

AgForLife Map - A conceptual model which aids in the visualization of the different opportunities in agriculture, food and life sciences. It depicts the visual integration of agriculture by showing the interaction between systems and programs to provide opportunities in multiple fields.

Perception – According to the research, the public and students perceive agriculture to primarily consist of production and/or of growing crops or raising livestock without knowing the extent of opportunities in agriculture.

Agricultural System – The Oxford English Dictionary (1989) defines system as a set or assemblage of things connected, associated, or interdependent, so as to form a complex unity; a whole composed of parts in orderly arrangement according to some

scheme or plan. Because the literature only references agricultural systems with no specific definition about what an agricultural system is, the researcher is referencing and synthesizing the literature to define agricultural systems for this study. The United State's Department of Agriculture (2007) Cooperative State Research, Education, and Extension Service found the following:

> Agricultural enterprises – crop or livestock – deal with such concepts as labor supply, marketing, finances, natural resources, genetic stock, nutrition, equipment, and hazards. While it is possible to effectively manipulate each mechanism of successful farming individually, better results can often be obtained by treating the farming operation as a system. The interactions of system components may become more important than how each component functions by itself. (¶ 1)

Using the above definitions in addition to the Research Council's (1988) broad agriculture definition below was also considered.

> …encompass the production of agricultural commodities, including food, fiber, wood products, horticultural crops, and other plant and animals products. The terms also include the financing, processing, marketing, and distribution of agricultural products; farm production supply and service industries; health, nutrition, and food consumption; the use and conservation of land and water resources; development and maintenance of recreational resources; and related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system. (p. vi)

Agricultural systems are a set of intricate supply chains connected or associated with agriculture dealing with such components as services, plant, chemical, animal, labor, marketing, distribution, finances, natural resources, environment, government, and equipment.

Industry - A group of establishments that produce similar products or provide similar services in a given industry, or even a particular establishment in said industry, might have employees in dozens of occupations (U.S. Department of Labor, n.d., BLS Glossary).

Occupation - A set of activities or tasks employees are paid to perform. Employees who perform essentially the same tasks are in the same occupation, whether or not they work in the same industry (U.S. Department of Labor, n.d., BLS Glossary).

STEM – STEM has become a common acronym, particularly among policy advocates and government officials, for the fields of Science, Technology, Engineering, and Mathematics (What is a STEM, 2007).

LIMITATIONS

The limitations of this study come from the sources of information. It is impossible to forecast, estimate, or guarantee each person in the population would be represented; therefore, bias sampling is present. Individuals with known or demonstrable experience and expertise (Trochim, 2006) were required for this study. Some questions were not answered, either intentionally or unintentionally; therefore, sample estimates were biased due to non-response (Israel, 2003). The researcher's own experience in this field of study also introduces unknown levels of bias.

CHAPTER II

REVIEW OF THE LITERATURE

Relevant literature from research and public websites concerning career and industry classifications in agriculture was reviewed. In addition, an assessment of how the classifications of the agricultural industry provide and convey information to the public was also examined. This information is crucial because many students have incorrect knowledge of agriculture (Riesenberg & Lierman, 1990) due to a lack of exposure to the variety of jobs in the agricultural industry. The negative image agriculture suffers is also due to incomplete or inaccurate information (Russell, McCracken, & Miller, 1990), and compounds the lack of understanding about agricultural careers. Agriculture is changing! Agriculture's past was about maximizing production in the 20th century (U.S. Department of Agriculture, 2007). Today, it is a sophisticated set of integrated systems (Leising, 1990) where three-quarters of all agricultural output is supplied by less than 10 percent of farms generating over $250,000 per year in sales (U.S. Department of Labor, 2005). Finding ways to better understand the agricultural industry is essential in order to serve a larger segment of the population. With this objective in mind, instruments for understanding and learning about agricultural occupations and how they are classified were examined. Instruments reviewed for this study include: 1) North American Industry Classification System; 2) North American Product Classification System; 3) Dictionary of Occupational Titles; 4) O*NET Resource Center; 5) Occupational Outlook Handbook; 6) Career Guide to

Industries; 7) National FFA Organization Career Explorer; and 8) College of Agriculture and Life Sciences Cargill Career Counselor Ag Careers Database.

NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM

Established by the Central Statistical Board of the United States of America and developed by the Interdepartmental Committee on Industrial Statistics, the Standard Industrial Classification (SIC) has been in use since the 1930s. The Interdepartmental Committee on Industrial Statistics, as stated by Pierce (1957, ¶ 2), was designed "to develop a plan of classification of various types of statistical data by industries and to promote the general adoption of such classification as the standard classification of the federal government." The first Standard Industrial Classification for the United States was derived from two lists published in 1938 and 1939. They were the List of Industries for Manufacturing and the List of Industries for Nonmanufacturing, respectively (Pearce, 1957). Data collected and published by agencies within the United States government, state agencies, trade associations, and research organizations helped establish and promote uniformity and comparability by the SIC. The SIC has been revised periodically since the 1930s to reflect changes in the economic structure of the United States by adding new industries and or combining or deleting small declining industries. Since the 1930s, the SIC structure has remained essentially the same. Approximately 20 new service industries were added to the SIC in 1987, the last revision. In addition, a few new industries were added to manufacturing as well.

In 1992, the Office of Management and Budget (OMB) established the Economic Classification Policy Committee (ECPC) made up of representatives from the Bureau of

Economic Analysis, the Bureau of the Census, and the Bureau of Labor Statistics. It was this group's responsibility to determine if a new system should be developed (U.S. Census Bureau, 2001). The creation of the North American Free Trade Agreement emphasized the need for a new system to be developed with Canada and Mexico in the early 1990s.

The ECPC developed six papers for public input related to economic classifications. The papers explored the need for a new system and considered whether it would be production oriented or demand oriented. The papers also sought alternative approaches to classification systems and issues specific to coding individual industries as well as statistical measures needed to construct an SIC with up-to-date information.

In 1997, the U.S. Standard Industrial Classification (SIC) system was replaced by the North American Industry Classification System (NAICS). The United States, Canada, and Mexico jointly developed the NAICS to provide comparable statistics across North America related to business activity (U.S. Census Bureau, 2007). Access to the *North American Industry Classification System--United States, 2007* information is available using the 1,400-page manual in print or through the NAICS website. Information and NAICS codes can be searched in two ways using the manual - using 2 through 6-digit codes or strictly using the 6–digit code. The 6-digit code precedes the title used as a reference in defining each of the corresponding titles in the United States (2007 NAICS Codes and Titles, 2007). A listing of the 2007 NAICS 6-digit codes for the Agriculture, Forestry, Fishing and Hunting titles are as follows:

111110 Soybean Farming

111120	Oilseed (except Soybean) Farming
111130	Dry Pea and Bean Farming
111140	Wheat Farming
111150	Corn Farming
111160	Rice Farming
111191	Oilseed and Grain Combination Farming
111199	All Other Grain Farming
111211	Potato Farming
111219	Other Vegetable (except Potato) and Melon Farming
111310	Orange Groves
111320	Citrus (except Orange) Groves
111331	Apple Orchards
111332	Grape Vineyards
111333	Strawberry Farming
111334	Berry (except Strawberry) Farming
111335	Tree Nut Farming
111336	Fruit and Tree Nut Combination Farming
111339	Other Noncitrus Fruit Farming
111411	Mushroom Production
111419	Other Food Crops Grown Under Cover
111421	Nursery and Tree Production
111422	Floriculture Production

111910	Tobacco Farming
111920	Cotton Farming
111930	Sugarcane Farming
111940	Hay Farming
111991	Sugar Beet Farming
111992	Peanut Farming
111998	All Other Miscellaneous Crop Farming
112111	Beef Cattle Ranching and Farming
112112	Cattle Feedlots
112120	Dairy Cattle and Milk Production
112130	Dual-Purpose Cattle Ranching and Farming
112210	Hog and Pig Farming
112310	Chicken Egg Production
112320	Broilers and Other Meat Type Chicken Production
112330	Turkey Production
112340	Poultry Hatcheries
112390	Other Poultry Production
112410	Sheep Farming
112420	Goat Farming
112511	Finfish Farming and Fish Hatcheries
112512	Shellfish Farming
112519	Other Aquaculture

112910	Apiculture
112920	Horses and Other Equine Production
112930	Fur-Bearing Animal and Rabbit Production
112990	All Other Animal Production
113110	Timber Tract Operations
113210	Forest Nurseries and Gathering of Forest Products
113310	Logging
114111	Finfish Fishing
114112	Shellfish Fishing
114119	Other Marine Fishing
114210	Hunting and Trapping
115111	Cotton Ginning
115112	Soil Preparation, Planting, and Cultivating
115113	Crop Harvesting, Primarily by Machine
115114	Postharvest Crop Activities (except Cotton Ginning)
115115	Farm Labor Contractors and Crew Leaders
115116	Farm Management Services
115210	Support Activities for Animal Production
115310	Support Activities for Forestry

The NAICS defines the Agriculture, Forestry, Fishing, and Hunting sector as, "…establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from a farm, ranch, or their natural

habitats" (2007, ¶ 1). Typically, farms, ranches, dairies, greenhouses, hatcheries, orchards, or nurseries are enterprises found in this sector. The Agriculture, Forestry, Fishing and Hunting sector are distinguished by two basic activities: agricultural production and agricultural support. Farm owner-operators, tenant farm operators, and sharecroppers are typically found performing farm and ranch operations classified under agricultural production. Soil preparation, planting, harvesting, and management on a fee or contract basis are associated with the agricultural support activities. Not all of the agricultural related sectors or industries are found in this section of the classification system. Agricultural research and administrative programs for regulating and conserving land, mineral, wildlife, and forest use are excluded from the Agriculture, Forestry, Hunting and Fishing sectors. Research and Development in the Physical, Engineering, and Life Sciences and Administration of Conservation Programs, respectively, will include the previously mentioned excluded items.

The 2-digit code to the left of the title is used as a reference in defining each of the corresponding titles in the United States. The NAICS includes 20 categories of industries and sectors (2007 NAICS Codes and Titles, 2007).

11 Agriculture, Forestry, Fishing and Hunting

21 Mining, Quarrying, and Oil and Gas Extraction

22 Utilities

23 Construction

31-33 Manufacturing

42 Wholesale Trade

44-45 Retail Trade

48-49 Transportation and Warehousing

51 Information

52 Finance and Insurance

53 Real Estate and Rental and Leasing

54 Professional, Scientific, and Technical Services

55 Management of Companies and Enterprises

56 Administrative and Support and Waste Management and Remediation Services

61 Educational Services

62 Health Care and Social Assistance

71 Arts, Entertainment, and Recreation

72 Accommodation and Food Services

81 Other Services (except Public Administration)

92 Public Administration

NORTH AMERICAN PRODUCT CLASSIFICATION SYSTEM

The United States, Canada, and Mexico launched a joint initiative in 1999 to develop a comprehensive product classification system, the North American Product Classification System (NAPCS) to complement the current North American Industry Classification System (NAICS). The purpose of NAPCS demand-side/market-oriented classification system was to develop a comprehensive list of products, product definitions, and product codes for goods and services. Both goods and service

producing industries use the NAPCS to collect, tabulate, and analyze data (U.S. Census Bureau, 2006) in a coordinated manner; however, the extent of the NAPCS is beyond the scope of this study because it deals primarily with products, goods, and services, unlike NAICS, which deals with industry classification.

DICTIONARY OF OCCUPATIONAL TITLES

The Dictionary of Occupational Titles, which was created by the Employment and Training Administration and last updated in 1991, was replaced by the O*NET Resource Center, (U.S. Department of Labor, Revised 1991a), the nation's source for occupation information. However, it is still used as a standard reference in cases related to labor and immigration. The Dictionary of Occupational Titles includes a multitude of different occupations, many of which are associated with agriculture. In section four, Agricultural, Fishery, Forestry, and Related Occupations, the areas listed include propagating, growing, caring for, and gathering plant and animal life products. In addition, related support service occupations such as logging timber tracts and catching, hunting, and trapping animal life are included in this section as are parks, gardens, and grounds keeping occupations. Occupations not included in this section are related to technologies such as processing, packaging, and stock checking (U.S. Department of Labor, Revised, 1991b). Additionally, some occupations related to agriculture and related sciences are listed in other non-agriculture parts of the dictionary, making it hard to determine how many of the occupations listed are agriculture related.

O*NET® RESOURCE CENTER

The O*NET Resource Center claims to be the nation's primary source for occupational information and has replaced the now defunct Dictionary of Occupational Titles. On their website, you will find O*NET products, which includes O*NET data, career exploration tools, and reports (O*NET Resource Center, n.d.) along with a variety of other information. The O*NET database is available to the public free of charge and contains tremendous amounts of standardized information. It is the basis for their Career Exploration Tool and is the heart of O*NET OnLine (About O*NET, n.d.). The Content Model is the conceptual foundation of O*NET and provides the framework for the integration of the theoretical and empirical information about work. The Content Model is organized into six major domains: Worker Characteristics, Worker Requirements, Experience Requirements, Occupational Requirements, Workforce Characteristics and Occupation-Specific Information (The O*NET Content Model, n.d.), which allows for cross-sectional information to be applied across jobs, sectors, or industries as well as within occupations.

The O*NET Career Exploration suite of assessment tools can be used for career planning, career counseling, and career exploration. With these tools, individuals can identify occupations and gain personal insight into their work-related interests as well as what attributes may be considered important for the job. People in transition between jobs can use these tools to help plan their career preparation in addition to considering different career options. Students can use these tools to explore career possibilities as well. Users can link to the O*NET database to review more than 800 occupations to

obtain information about specific labor markets which can draw a parallel to occupations in their local labor market. A distinct advantage of using this system is the opportunity to use these tools singularly, or in combination with other available instruments, to meet the needs of the individual.

O*NET OnLine service allows the users to find occupations using keywords by Job Family, High Growth Industry, STEM disciplines, or O*NET Descriptors. When searching by job family, "Agriculture" was not on the list; however, Farming, Fishing, and Forestry were listed as options. When searching the High Growth Industry section, agriculture was neither an option nor considered despite the fact there are an estimated 52,000 jobs every year projected during the 2005-2010 time-period and only 49,300 qualified graduates to fill these annual estimations (Goecker, Gilmore, Smith, & Smith, 2005). O*NET OnLine describes a High Growth Industry as one that is being transformed by technology or innovation and is economically critical to adding substantial numbers of new jobs (Find Occupations, n.d.). The six O*NET Descriptors that refer to categories of occupational information are Knowledge, Skills, Abilities, Work Activities, Interests, and Work Values. Each of the descriptors has data items or elements relevant to occupations which are rated and can be searched.

The Science, Technology, Engineering, and Mathematics (STEM) disciplines on the O*NET OnLine webpage lists Chemistry, Computer Science, Engineering, Environmental Sciences, Geosciences, Life Sciences, Mathematics, and Physics/Astronomy as disciplines. Agriculture was omitted from the STEM disciplines; however, many agricultural related disciplines were listed under Life Sciences. Some of

the occupations listed under Life Sciences disciplines are Agricultural Engineers, Agricultural Science Teachers, Agricultural Technicians, Animal Breeders, Animal Scientists, Crop and Livestock Manager, Farm and Home Management Advisors, Farmers and Ranchers, Food Science Technicians, Food Scientists and Technologists, Forest and Conservation Technicians, Forest and Conservation Workers, Foresters, and Range Managers (Browse by STEM Discipline, n.d.).

OCCUPATIONAL OUTLOOK HANDBOOK

The Bureau of Labor Statistics, housed in the United States Department of Labor, publishes an Occupational Outlook Handbook (OOH) which is revised every two years describing a wide range of occupations. Career information, including different levels of employment projections, as well as various types of data on earnings and working conditions are found in the handbook (U.S. Department of Labor, 2006). The OOH lists eleven occupations: Management, Professional, Service, Sales, Administrative, Farming, Construction, Installation, Production, Transportation, and Armed Forces (U.S. Department of Labor, n.d., Occupational Outlook Handbook).

The Farming occupation consists of Agricultural Workers, Fishers and Fishing Vessel Operators, and Forest, Conservation, and Logging Workers. Agricultural workers are described as mainly working on farms or ranches, nurseries, slaughterhouses, or ports of entry. Much of their role in this occupation includes providing a means to move agricultural products such as food and plants to market. Many agricultural workers ensure our food supply by planting and harvesting crops, delivering animals to market, and installing irrigation to water crops. The majority of

these workers (8 out of 10) are considered farm workers or laborers (U.S. Department of Labor, 2006). Many of the farm workers perform tasks considered "production agriculture," tasks related directly to the production of animals and crops. Much of this work involves long hours, stoop labor, and harsh working conditions and can have dangerous consequences. For instance, many of these laborers apply pesticides, herbicides, and fertilizers to crops. In addition, many of them perform numerous tasks related to the growing and harvesting of fruits, vegetables, grains, nuts, trees, fiber, and other crops. Some work in nurseries and greenhouses growing horticultural products; therefore, their job duties may include planting, watering, pruning, weeding, and spraying plants.

Many farm workers work on ranches and raise animals such as cattle, swine, goats, horses, sheep, and/or poultry. These farmers and ranchers produce enough food and fiber to both meet the needs of U.S. citizens and to export the products (Bureau of Labor Statistics, 2006) to foreign countries. Many of the livestock will provide products such as meat, fur, leather, feathers, eggs, milk, etc. Of course, as with all live animals, comes the responsibility of taking care of them. Depending on the breed, different tasks will be required, but for the most part, ranch hands will be feeding, watering, herding, castrating, branding, weighing, catching, and loading animals for transport (U.S. Department of Labor, 2006). Many, but not all, laborers will be responsible for maintaining health records as well as being responsible for detecting injuries and disease. In addition, they must be able to administer medications, vaccinate animals, use insecticides appropriately, and occasionally assist in delivering animals at birth.

Agricultural equipment operators run a variety of farm machinery and equipment. Agricultural inspectors, similar to graders and sorters, work to examine products and agricultural commodities to ensure safe, healthy and quality food. Animal breeders use genetics and animal science to breed animals possessing desired traits and characteristics. Examples of these characteristics can include sheep with more desirable wool, pigs with leaner meat, chickens that lay more eggs, or cows that produce more milk.

Some related occupations not found under the farming section but incorporated elsewhere in the handbook include farmers, ranchers, and agricultural managers. In addition, agricultural engineers and agricultural and food scientists are found in different sections of the book.

CAREER GUIDE TO INDUSTRIES

The Career Guide to Industries (CGI) is published by the U.S. Department of Labor and is a companion to the Occupational Outlook Handbook. This resource provides information about different occupations in industry as well as training and advancement, earnings, expected job prospects and working conditions, (U.S. Department of Labor, n.d., Career Guide to Industries). The industries included are Agriculture, Mining and Construction; Manufacturing; Trade; Transportation and Utilities; Information; Finance Activities; Professional and Business Services; Education and Health Services; Leisure and Hospitality; and Government. In addition to providing information about different occupations in the industry, it also provides information

about job markets in each state. This resource can be utilized through a "search box" on each page of the site or the user can simply browse the Industry listings alphabetically.

NATIONAL FFA ORGANIZATION CAREER EXPLORER

The National FFA Organization has over 475,000 members in more than 7,200 chapters throughout the United States, Puerto Rico, Guam, and the Virgin Islands. Many of its members are prepared for careers in agriculture through an education in science, business, and technology (National FFA Organization, 2005). The FFA website includes a Career Explorer tool to assist members in searching approximately 365 careers in Agricultural Sciences and Natural Food and Fiber opportunities. Searches can result in general job information as well as career information, requisite working conditions and locations of available job skills. Suggested coursework for high school and college (Career Explorer, 2007) can be found for those who are seriously exploring careers in agriculture. Searches can be performed via career clusters.

The twenty-three career clusters included in the search field are:

Agriculture, Food and Natural Resources

Agribusiness Systems

Animals Systems

Architecture and Construction

Arts, A/V Technology and Communications

Business, Management and Administration

Education and Training

Environmental Service Systems

Finance

Food Products and Processing Systems

Government and Public Administration

Health Science

Hospitality and Tourism

Human Services

Information Technology

Law, Public Safety and Security

Manufacturing

Marketing, Sales and Service

Natural Resource Systems

Plant Systems

Power, Structural and Technical Systems

Science, Technology, Engineering and Mathematics

Transportation, Distribution & Logistics

In optional search fields, FFA members and users can search by educational requirements as well as by industry. The 31 industry searches include:

Accounting

Agriculture Business

Agriculture Communication

Agriculture Economics

Agriculture Education

Agriculture Engineering

Agriculture General

Agriculture Environmental & Natural Resources

Agriculture Mechanics

Banking

Biotechnology

Communications

Customer Relations

Development

Education

Financial

Global Business

Government

Healthcare

Human Resources

Information Technology

Internet/News Media

Legal

Manufacturing

Marketing

Operations Management

Research/Scientist

Retail

Sales

Service

Trader/Broker

Many FFA members participate in Supervised Agricultural Experience (SAE) programs which complement the Career Explorer site because it allows the members to engage in practical activities outside of the classroom (National FFA Organization, 2005) and learn first-hand about the many career opportunities available after high school. Many of these experiences include entrepreneurship, paid or unpaid placement, and research activities, all of which are complementary to the industries and career clusters found on the site.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES CARGILL CAREER COUNSELOR AG CAREERS DATABASE

The College of Agriculture and Life Sciences Cargill Career Counselor (CCCC) Ag Careers Database was developed jointly by Texas A&M University and Cargill, Inc. to provide career counseling for students interested in food and agriculture. The Database contains a variety of different searches. There are over 40 careers in six categories (Bullock & Litzenberg, n.d.); 29 industries are linked using the Standard Industrial Classification (SIC) codes as well as the North American Industry Classification System (NAICS) codes. In addition, there are over 75 occupations referenced from the United States Department of Labor using the Career Guide to Industries resource and over 80 agricultural businesses listed in the United States.

The general agriculture careers categories in the Database are Agriculture Production Management, Agriculture Sales Consulting, Agriculture Science, Agriculture Service Management, Food Manufacturing, and Food Distribution. In addition, a list of the 29 industries using SIC and NAICS codes on the website are as follows:

Agriculture Chemicals - 287

Agriculture, Forestry, Fishing - 01, 02, 07, 08, 09

Apparel & Other Textile Products - 23

Business Services - 73

Eating & Drinking Places - 58

Farm & Garden Machinery - 352

Federal, State, & Local Government - 91, 92, 93

Finance, Insurance, & Real Estate - 60-65, 67

Food & Kindred Products - 20

Food Stores - 54

Freight Transportation - 473

Fuel Dealers - 598

Furniture & Fixtures - 25

Groceries & Related Products - 514

Leather & Leather Products - 31

Local & Urban Transportation - 412, 413, 414, 417

Lumber & Other Building Materials - 521

Lumber & Wood Products - 24

Mining - 10, 12, 13, 14

Museums, Botanical & Zoological Gardens - 84

Paper & Allied Products - 26

Petroleum & Coal Products - 29

Railroad Transportation - 40

Retail Nurseries & Garden Stores - 526

Self Employed, Primary Occupation – no codes

Textile Mill Products - 22

Tobacco Production - 21

Trucking & Warehousing - 42

Water Transportation – 44

More information can be found using the Career Guide to Industries resource; however, the CCCC Ag Careers site allows the user to find information in a more focused and concise location for searching specific food and agriculture industries.

The Occupations page on the CCCC Ag Careers Database website allows searches for a variety of occupations using hyperlinks to provide additional information. For instance, users can search through occupations categorized by six major divisions such as Scientists, Engineers, and Related Specialists; Managers and Financial Specialists; Marketing, Merchandising, and Sales Representatives; Communication and Education Specialists; Social Service Professionals; and Production Agriculture. Occupations are categorized using the above divisions and by the Occupational Information Network O*NET codes. O*NET OnLine was developed by the National

Center for O*NET Development for the U.S. Department of Labor. Many of the occupations can be found by using the Bureau of Labor Statistics published Occupational Outlook Handbook or through O*NET OnLine directly.

The CCCC Ag Careers Database includes a list of companies as well as Agribusiness Associations found in Texas and the United States. Each of the company and association websites allows for browsing through career possibilities as well.

SUMMARY OF REVIEW OF LITERATURE

The North American Industry Classification System is the most comprehensive system found in this review. It has replaced the outdated Standard Industrial Classification which was started in the 1930s and in use until the early 1990s. The impetus for NAICS was the creation of the North American Free Trade Agreement and was jointly created by the United States, Canada, and Mexico. This system provides comparable statistics across North America related to specific business activities. Some of the other reviews in this study are based upon, or use, the North American Industry Classification System.

The North American Product Classification System was launched in 1999, by the United States, Canada, and Mexico, in order to compliment the NAICS. The purpose of NAPCS demand-side/market-oriented classification system was to develop a comprehensive list of products, product definitions, and product codes for goods and services. The purpose of NAPCS goes beyond the scope of this study.

The defunct Dictionary of Occupational Titles was replaced by the O*NET Resource Center but is still used as a standard reference in cases related to labor and immigration.

The O*NET Resources Center claims to be the nation's primary source for occupational information and the website contains several products which can be used to search for occupations and careers. Some of those tools include O*NET data, career exploration tools, and reports. The database is available to the public free of charge and is the foundation of the system. Using this site will allow users to search for occupations in a variety of ways, such as by job family, high growth industry or STEM disciplines.

The Occupational Outlook Handbook, published by the Bureau of Labor Statistics every two years, provides a variety of information such as training and education needed, earnings, expected job prospects, what workers do on the job, and working conditions. The handbook includes eleven occupations by category, however, not all agricultural related occupations are found under the Farming section of the handbook.

The Career Guide to Industries is published by the U.S. Department of Labor, and is a companion to the Occupational Outlook Handbook. This resource guide provides information about different occupations in industry as well as training and advancement, earnings, expected job prospects and working conditions, plus information about job markets in each state.

The National FFA Organization's Career Explorer tool assists the FFA members in searching through 365 careers in Agricultural Sciences and Natural Food and Fiber

Opportunities. There are 23 career clusters included in the searchable database as well as 31 industry searches. Information about jobs in general, as well as career information, skills required, educational requirements, courses needed in high school and/or college, working conditions, and locations of job availability can be found using this resource tool.

The jointly developed CCCC Ag Careers Database, developed by the College of Agriculture and Life Sciences at Texas A&M University and Cargill, Inc., provides career counseling for students interested in food and agriculture. The Database contains a variety of different searches with over 40 careers in six categories; 29 industries linked using the Standard Industrial Classification (SIC) codes as well as the North American Industry Classification System (NAIC) codes; over 75 occupations referenced from the United State Department of Labor using the Career Guide to Industries resource; and over 80 agricultural businesses listed in the United States.

It is important to have a good understanding of the resources available when learning the systems, industries, and career opportunities in agriculture. How people access and use the information is only part of the formula; of greater importance is what material is currently available and how it is presented to the public. This is crucial because this information strongly influences and colors perceptions—right or wrong—of the agricultural industry. The research shows us the negative stigma about agriculture perpetuated today is largely perceived to be limiting in career opportunities; however, through this study, it is clear there is an abundance of career opportunities despite the fragmentation of agricultural career information. These false or incorrect categorizations

do nothing but further confuse and complicate what is contemporary agriculture. By identifying and developing a better understanding of the information currently available, educators will be able to develop visual models that may help convey the opportunities in agriculture in a more interconnected and visual medium. Because 69 percent of students learn visually (Montgomery, 1995), future visual development of interconnected mediums that are considered agriculture, or associated with agriculture, may be the first step in addressing a better understanding of the vast array of opportunities in agriculture, food, and life sciences.

CHAPTER III

METHODOLOGY

The purpose of this study was to identify, examine, and validate the various components and systems in agriculture, food, and life sciences. This study can influence the development of a visual model that conceptualizes and provides the framework for continued learning and understanding of contemporary agriculture through different mediums. A visual model will aid and influence a more positive image and a better understanding of careers found in the agricultural industry. Obtaining different perspectives in this study was essential therefore; the Delphi technique for gathering input from professionals with different backgrounds was chosen. This method of gathering information allows for interaction between the researcher and the panel of experts by allowing for the identification, examination, and validation of the agricultural components and systems. The Institutional Review Board at Texas A&M University approved the research protocol conducted in this study.

RESEARCH DESIGN

The Delphi technique of soliciting opinion to obtain group consensus (Dyer, Breja, & Ball, 2003) from nominated panelists (Frick, Kahler, & Miller, 1991) is an effective way to use a cross-section of professionals from different industry segments, including academia and government. By using the Delphi technique, the researcher is able to gather group input for the generation of ideas as well as problem solve without having to be face-to-face with the experts (Lindenmeier, 1996), allowing for a much

broader selection of professionals not bound by geographic location. The Delphi technique was developed by the Rand Corporation and is widely used in obtaining and refining group judgment. This method allows for anonymous response, iteration, controlled feedback, and statistical group response to minimize the bias effects of dominant individuals, irrelevant communication, and group conformity due to pressure (Dalkey, 1969).

The Delphi process begins with a carefully designed questionnaire to solicit experts based upon their experience and expertise. Once the experts have been identified, they are asked, via email or mail, a question or a series of questions to gather initial input on the problem-at-hand. Each member independently writes their response to each of the questions in the instrument and returns it to the researcher who then summarizes all of the responses, writes a feedback summary, and develops a second instrument. The second instrument, along with the feedback summary, is sent to the experts. The Delphi experts review the feedback summary and respond to the second instrument. Following receipt of responses to the second instrument, the researcher develops a third instrument, if necessary, and summarizes the feedback. This process can continue for up to seven rounds or until consensus is reached, whichever occurs first.

For this study, the cross-section of professionals from different industry segments considered and examined the following variables:

1. What are the different *Careers* associated with agriculture?
2. What are the *Industries* that play an important role in the input segment of agriculture?

3. What are the *System* components needed to depict the industry of agriculture?

POPULATION AND SAMPLE

The population in this study, which is a measurement of a specified group (Spatz, 2005), is broad and represents a cross-section of employed professionals from different industry segments, including academia and government. Because the panelists were anonymous except to the researcher who drew the sample, there was no way of forecasting, estimating, or guaranteeing that each person in the population would be represented in the sample (H. F. Aldape, personal communication, July 20, 2006), a combination sampling technique of nonprobability, purposive, expert sampling was used. This nonprobabilistic, purposive-expert sampling was necessary because individuals with known or demonstrable experience and expertise (Trochim, 2006) were required for the study. A broad range of representation from different individuals in varying industries and careers was needed in order to identify an extensive list of systems, industries and careers in agriculture in the first round of this study. Narrowing selections and building consensus of the numerous items identified in the initial rounds of the study were conducted in rounds two and three, respectively.

An email letter to solicit Delphi panel experts was sent to each individual (Appendix A) along with a form to be completed by each potential panelist. The instrument developed to identify the experts for this study included a series of questions to help identify the experts' experiences and expertise in a broad segment of industries and careers. The one-page *Personal Questionnaire for Experts* form (Appendix B) was divided into five sections: personal information, current employment, academic

credentials, industry/career information, and an open-ended, expertise-related question. The parameters and variables included in the personal information were questions regarding gender, age (by group), contact information, race/ethnicity (optional), and whether a high school diploma was received or not.

Under the current employment section, candidates were asked to provide the name of the organization where employed, number of years employed in their current position, location of employment, as well as select their specific interests and expertise from a predetermined list of 31 industry or career opportunities.

The academic credentials section allowed the candidates to provide information about advanced degrees, if any. An advanced degree was not necessary; however, in this study all potential experts who were referred had post secondary education.

The industry and career information sections listed 31 industries/careers in order to help the researcher better understand the cross-section of experts being considered. Some of the categories in similar industry and career areas were grouped together on the form in order to utilize space on the one-page form. The industries/careers listed were:

Agribusiness

Arts

Banking or Finance or Accounting

Biotechnology

Communications

Construction

Education

Engineering

Food System

Government

Industrial or Manufacturing

International

Law or Public Policy

Medicine or Healthcare

Natural Resources or Environment or Conservation

Nonprofit or Public Service

Pharmaceutical

Production Agriculture (i.e. farming, ranch mgmt., raising livestock, growing crops)

Real Estate

Research and Development

Transportation

Tourism or Recreation

Other - please specify

Candidates were asked to provide a total number of years worked next to each segment of the industry or career that applied. In addition to the above information, expert candidates were also asked to calculate total number of years in the workforce. For some of the candidates, their total number of years in the workforce and the number of years in each of the respective industry or career segments were different. The

difference was due to dual or multiple roles held simultaneously while employed. The purpose for obtaining the number of years in the workforce and the number of years in each of the respective industry or career segments was to help in determining expertise and experience in order to aid in the expert selection process.

The last section of the questionnaire was an open-ended question that allowed the candidates to elaborate in more detail on anything not previously addressed in the instrument. This section provided room for candidates to include the occupation each believed he or she were the most qualified in from the predetermined list of industries/careers provided.

Additionally, candidates had the option to select the "Yes" box at the bottom of the instrument to acknowledge interest in volunteering for the Delphi expert panel. All correspondence in the study with the Delphi experts was conducted via email, with the exception of the third round when panelists who had not responded to the initial third round were called and reminded to submit the questionnaire.

DELPHI PANEL

The 41 potential Delphi expert panelists were identified through a nomination process by academicians on the graduate faculty committee, the researcher, and professionals in the industry in order to strengthen and balance nominations. Individuals nominated were from various parts of the United States. On April 13, 2007, thirty-nine individuals in the sample population were sent the *Personal Questionnaire for Experts* form and asked to complete and return it to the researcher by April 27, 2007. Of the two individuals not mailed the questionnaire, one was familiar with the researcher's study

and in order to eliminate bias, was not considered for the study. The other individual was never contacted because an email address could not be located nor was provided by the recommender. Since the entire study was conducted via email, except as previously noted, it was critical that all experts have an active email address. Of the thirty-nine potential panelists who were sent the initial questionnaire, eighteen did not respond to the questionnaire even after a reminder was sent on April 20, 2007. Of the eighteen, the researcher received two "bounced back" emails because of incorrect email addresses. Email addresses were double-checked for researcher error, but none was noted; therefore, contact information was deemed unavailable and the two potential panelists were not contacted again. Another individual had a "full" mail-box and the email message could not be delivered. A subsequent reminder message was sent on April 20, 2007, and the message again bounced back due to a "full" mailbox. No additional effort was made to contact the potential panelist. The remaining fifteen potential panelists failed to submit their questionnaire for unknown reasons.

Initially, twenty experts from the recommended population were selected to serve on the panel based on years of experience in their respective industry or occupation. One questionnaire was submitted to the researcher after the deadline; however, since the industry was not previously represented and the expert had substantial experience, the researcher believed inclusion of the panelist would provide a more comprehensive representation from the industry/career list. Overrepresentation in some industries/careers would have resulted in individuals with fewer years of employment or experience being selected to participate on the panel. None was denied because an

adequate number of panelists from varied backgrounds who submitted the questionnaire were deemed satisfactory for this study. This brought the total Delphi panel to twenty-one experts.

On May 11, 2007, twenty-one experts were notified that they had been selected to participate in this study (Appendix C). The Delphi expert sample (panel) consisted of panelists from varied backgrounds such as Church/Religion, Education, Government, Insurance, Manufacturing, Natural Resources, Pharmaceutical, and Public Policy with the majority coming from Education. They were selected from nine different geographic areas of the United States with the majority from Texas. The experts resided in Arizona, California, District of Columbia, Kansas, Michigan, New Mexico, New York, Pennsylvania, and Texas. Fifteen males and six females were on the panel with an ethnic makeup of thirteen White and eight Hispanic. There were no other minority groups represented, because either none were nominated, or they failed to submit their questionnaire for consideration. The expert sample consisted of three experts who were in the 34 and under age group; seven in the 35-44 age group; three in the 45-54 age group; and eight in the 55-64 age group. The experts' years of service range from a low of four to a high of thirty-eight, totaling 370 years of service in their respected industries or careers with a mean of 17.6 years.

INSTRUMENTATION AND DATA COLLECTION PROCEDURES

The Delphi technique used a slightly different instrument for each round of the study. Results of each of the three rounds will be discussed in more detail in Chapter IV. The validity of the study is dependent on the consistency of each round; therefore, an

unusually persistent and consistent systematic process (G. E. Briers, personal communication, June 11, 2007) is crucial to achieve validity in the instrumentation used and to the extent to which the instrument measures what it purports to measure. Careful attention to maintaining a consistent process throughout the data collection was used by the researcher and the information submitted in the initial round was carefully analyzed, reformatted, and sent out for further inquiry in each round. According to Dalkey (1969) and Baker, Shinn, & Briers (2007), a .90 coefficient of reliability using the Delphi technique was concluded when a group of 13 experts is truly represented and is actively engaged.

Round One

For round one, an email cover letter (Appendix D) explaining the tentative schedule and an anticipated timeline of the study was mailed to the expert panelists on May 23, 2007. Included in the cover letter were tentative dates outlining the transmission of each round along with an anticipated response timeline and an overall summary for planning purposes. Attached to the email was the instrument for round one. The instrument developed for round one consisted of three questions (Appendix E), the instructions, as well as a deadline date of June 6, 2007. On June 4, 2007, two days prior to the deadline, a reminder was sent to the panelists who had not responded. On June 11, 2007, a second reminder was also mailed to the panelists because enough experts had not responded to make the data reliable.

In order to provide some broad perspective about the study, a brief explanation was provided to all panelists in order to stimulate discussion about each topic at hand.

The researcher used the following comments to stimulate thought about the three questions in the initial round of the study.

> "In the agriculture process there is usually a set of steps taken that helps goods and products reach the consumer. This process is called a supply chain. Each supply chain can include an Input, Process, and Output. In each Input there are broad and varied agricultural systems."

Experts were then asked three questions. For this study, the cross-section of professionals from different industry segments considered and examined the following:

1. What are the different *Careers* associated with agriculture?
2. What are the *Industries* that play an important role in the input segment of agriculture?
3. What are the *System* components needed to depict the industry of agriculture?

Since the perception about agriculture by the public is still primarily farming and ranching or linked primarily to production agriculture, the initial effort was to gather a broad interpretation from the experts about which careers, industries and systems are part of the agriculture industry. Experts were encouraged to list all of the careers, industries, and system components they believed applied to each question respectively. Including duplicates and without sorting, there were 477 item responses for question one (careers), 157 items for question two (industries), and 130 item responses for question three (system components). In all, 764 item responses were returned to the researcher in round one by nineteen experts.

After receiving the above responses, the researcher carefully analyzed the data and began to sort through careers, industries, and systems components. After careful analysis and evaluation of the information submitted by the panelists, it was concluded many of the responses for the specific questions were intermingled with other questions and duplicates were also evident. The researcher, to the best of his ability and in consultation with the graduate committee, used his knowledge as well as the literature review to develop the second instrument.

Round Two

The instrument in round two (Appendix F) was mailed to the expert panelists on June 27, 2007 and was due back to the researcher by July 11, 2007. Round two began to build consensus among the expert panelists. In round two, duplicate responses were eliminated for each of the questions in round one, sorted, and purged individually then collectively. Due to the categorization, duplication, and intermingling of career, industry, and system responses in round one, the researcher methodically categorized and organized the information from round one into different sections in order to develop the instrument used in round two. For the instrument used in round two, sections I and II dealt with *Systems* and *Industry*, respectively, and section III dealt with *Careers*. Section I and II were combined in the instrument with System responses identified by gray boxes and left-handed justification and Industry responses were light-blue boxes centered in each cell. The System and Industry portions were copied into section III, but only as a reference point to better visualize how each career was categorized under each corresponding Industry and System. Section III Careers were white boxes and right

justified in each cell. For each section a question relevant to each analogous item found in the instrument. For section I, the system question was: *Do you agree that the "system" components listed below (far left – gray cells) depict the broad agricultural field?* For section II, the industry section, the question was: *Do you agree that the "industries" listed below (center – light blue cells) play an important role in the agricultural segment?* For section III, the careers portion of the study, the question was: *Do you agree that the "careers" listed below are associated with agriculture?* For each item, panelists could choose, "Yes," "No," or "Unsure." In addition, a "Comment" section was provided for panelists to share comments with the researcher for any item if they desired. The researcher made few changes to the original responses when developing the instrument for round two in order to keep the creative intent and integrity of the expert panelists' responses as true as possible. For clarity, the researcher added comments in brackets and questions in red ink. In round two, panelists were encouraged to use the comment areas to clarify any of the responses they provided in round one which were noted as being unclear to the researcher. Two different formats, Microsoft Word and Microsoft Excel, were sent to the panelists with each version containing the same content and similar look. Panelists were instructed to use only one version based on their comfort level with the software. Microsoft Excel was the preferred method of working with the data.

As before, round two included an email outlining the researchers' methodology, deadline date, and the attached Word and Excel versions of the instrument. Panelists were given two weeks to complete the survey. A reminder was sent after one week on

July 6, 2007. Second and third email reminders were needed in this round and were sent on July 18, 2007 and July 27, 2007, respectively. After sorting, eliminating duplication, and categorizing were completed, there were 21 system component categories, 31 industry categories and 433 careers identified for 485 total responses in round two. Eighteen panelists responded to round two.

After receiving round two responses, the researcher analyzed the data of all items in every section of the instrument which reached majority (over 50 percent favorable), but did not reach consensus (less than 75 percent favorable response). Items not reaching consensus were mailed back to the panelists for round three.

Round Three

The instrument used in round three was similar to round two. On September 17, 2007, as with the previous two rounds, an email cover letter (Appendix H) was sent to the panelists summarizing the process completed up to that point.

Again, two formats, Microsoft Word and Microsoft Excel, each containing the same content and similar look, were sent to the panelists. Panelists were instructed to use only one version based on comfort level with the software. Microsoft Excel remained the preferred method for working with the data.

The anticipated deadline for returning the instrument was September 26, 2007, yet on the deadline date, the researcher did not have an adequate number of responses in order for the data to be reliable; therefore, a reminder was mailed on October 1, 2007. It was anticipated, since the round two instrument changed only slightly, panelists would be familiar with the instrument and responsive to this round in a shorter period, thus,

only nine days were given to the experts to complete this portion of the study as opposed to the fourteen days given in the two preceding rounds. Because the researcher was striving for a 100 percent response rate in round three, the researcher called and spoke to the experts or left messages on their voicemail on October 5, 2007, reminding them to submit the questionnaires. The phone calls were successful as only one expert failed to submit the survey in this round.

The instrument used in round three was similar to the format used in round two. Round three required the expert panel to "agree" or "disagree" with each item in each section of the instrument by checking a "Yes" or "No" box for each item in each section that reached a majority affirmative response but less than a 75 percent affirmative response. A comment section was also provided for experts to offer comments in round three. Section I, the system portion of the instrument, did not have any items requiring consensus, however, Section I (systems) was included as a reference point relating to industry and careers falling under each system category. Section II, the industry section, and Section III, the careers portion of the survey, did include items and questions for consideration. Formatting for industry and career questions were similar to the instrument used in round two. Since the systems portion (gray boxes and left justification) of round three did not have any items requiring consensus, no response was needed. Section II, the industry question, (light blue boxes and centered) was: *Do you agree that the "industries" listed below play an important role in the agricultural segment?* Section III, the careers question (white boxes, right justified) was: *Do you agree that the "careers" listed below are associated with agriculture?* The word

"associated" in question three was underlined to stress the importance of the word and to note that items in Section III did not have to be directly involved in agriculture, but rather associated with agriculture. Not all of the system categories were listed because only industry and career items needing further consideration for consensus building were included in round three.

Comments from previous rounds were included next to each industry or career item requiring a response in this round. Panelists were able to make their decisions based on personal experience or knowledge on each item, or draw from other experts' comments and opinions to reach consensus, for or against, each item.

After the researcher analyzed the information, a final list comprised of system, industry, and career categories was prepared. A complete list and a more detailed explanation of the outcome as well as data analysis procedures employed in this study can be found in Chapter IV, Results.

CHAPTER IV

FINDINGS

In order to better understand and appreciate the numerous systems, industries, and careers tied directly to, or associated with agriculture, it is important to be able to identify and examine a holistic picture of the agriculture industry. This holistic picture will help the general public and young people to better understand agriculture is not limited to production agriculture, but is tied to many other occupations and industries in our society. Today, many students (and the public) still perceive agriculture to be limiting and with few career opportunities outside of production agriculture. Identifying systems, industries, and careers directly related or impacted by agriculture can assist in the development of visual models that will affect change in the agricultural industry and through these models, aid in the transformation of the limited perspective agriculture currently conveys. In addition, educators will be able to develop visual models to communicate the opportunities in agriculture in a more interconnected and visual way.

This study was conducted using the Delphi technique over a series of three rounds with 21 expert panelists to arrive at a consensus for identifying different Career, Industry, and Systems in agriculture. Each round has an appendix to augment the text as well as relevant tables found in this chapter. At the end of each round, a list of Career, Industry, and System findings emerge. The final round results in a refined list of consensual items for each System, Industry, and Careers question originally asked of the

experts. For each of the three rounds, the response rate was 94.48 percent, 85.71 percent, and 95.24 percent respectively.

The purpose of this study was to identify, examine, and validate the various components and systems in agriculture, food, and life sciences while investigating the following research questions:

1. What are the different *Careers* associated with agriculture?
2. What are the *Industries* that play an important role in the input segment of agriculture?
3. What are the *System* components needed to depict the industry of agriculture?

Twenty-one experts from varied backgrounds were selected to serve as part of the sample population based on years of experience in their respective industry or occupation. The Delphi expert sample (panel) represented varied backgrounds such as Church/Religion, Education, Government, Insurance, Manufacturing, Natural Resources, Pharmaceutical, and Public Policy with the plurality coming from Education. They were selected from nine geographic areas of the United States with the plurality from Texas. The experts reside in Arizona, California, District of Columbia, Kansas, Michigan, New Mexico, New York, Pennsylvania, and Texas. Fifteen males and six females were on the panel with an ethnic makeup of thirteen White and eight Hispanic. There were no other minority groups represented. The expert sample varied in age with three who were in the 34 and under age group; seven in the 35-44 age group; three in the 45-54 age group; and eight in the 55-64 age group. The expert's years of service range from a low of four to a high of thirty-eight, totaling 370 years of service in their respected industries

or careers with a mean of 17.6 years of experience. As was evident, many of the experts were intentionally considered from outside the traditional agricultural industry in order to bring a broad and varied perspective and experience to the study. It was determined that an expert panel from varied backgrounds was essential in order to explore the variety of careers and occupations in different industries and systems that are involved in agriculture directly or are impacted by agriculture.

DATA ANALYSIS

Due to the large number of duplicates in the responses within each and between questions, the researcher sorted the data and, using existing literature categorized each response, as a System, Industry, or Career question (Appendix G) after eliminating obvious duplicates. Similar items, though not identical nor clear, were not omitted at this point. The researcher intentionally did as little interpretation of the data as possible in order to maintain the integrity of the responses from the experts. These "questionable" responses would be addressed in later rounds by the experts. Selecting from the experts' responses, the researcher made a concerted effort to use as many of the responses from each of the initial questions as possible. Once obvious duplicates were eliminated and responses were categorized, the responses were used only once in each section of the subsequent instruments. No new items were introduced while using the literature review to categorize the data. Only responses provided by the experts were used to categorize and develop the questionnaires for the subsequent rounds.

The purpose of this analysis in round one was to obtain a questionnaire that could be further examined by the experts in subsequent rounds in a useable and understandable manner.

Results - Round One

The three questions were sent to each of the 21 expert panelists. Question one: *What are the different "careers" associated with agriculture?* generated 477 responses. Question two: *What are the "industries" that play an important role in the input segment of agriculture?* generated 157 responses, and question three: *What are the "system" components needed to depict the industry of agriculture?* generated 130 responses. Nineteen experts mailed back the questionnaire for a response rate of 90.48 percent. In all, 764 responses were submitted by the panelists. These raw numbers reflect a large number of duplicates within each question as well as duplicates intermingled within other questions. For a complete list of the items submitted in their raw form, see Appendix J.

After the duplicates were removed and the remainder were categorized, the System category contained 21 items, the Industry category contained 31 items, and the Careers category contained 433 items for a total of 485 items. Duplicates found in the original document were removed primarily from the raw responses under the Industries and System questions.

A complete, alphabetized list of the items in the System, Industry, and Career category after sorting and removing obvious duplicates is shown below.

System Category Responses

Animal System (breeders etc.)

Diplomacy/Trade System

Educational Components

Engineering System

Equipment

Financial System

Government

Hydrologic System

Labor (workers, management, immigration issues, protection and safety issues, regulatory)

Logistic System (warehouse, trucking, delivery)

Manufacturing System (takes production inputs and processes to consumable goods)

Marketing System (creating demand for products)

Natural Resources

Operational System (internal stakeholders that keep the system operating i.e. finance, HR, payables, customer service, IT, BT, etc)

Plant System (breeders of seed etc.)

Production System (basic component input that provide raw materials)

Research and Development System (improvement to manufacturing or production), Subcategory: Science Systems

Retail Brokers

Sales System (getting goods/services to consumers)

Service System (services that keep the system operating)

Transportation System

Industry Category Responses

Ag Production

Agronomy

Animal Industries

Business

Community and Social Infrastructure

Conservation Components (environmental inputs like land, water, wildlife, & environmental regulations)

Consultants

Delivery/Distribution Systems

Energy

Engineering/Equipment

Equipment Manufacturing (manufacturers of hard goods - handling equipment, tractors, etc.)

Farmer/Farming

Fertilizer Industry (potash)

Food Industries

Government (all levels)

Grain Industry

Land / Real Estate

Legislation, Policy, and Regulation

Management

Marketing

Packaging

Processing

Ranching

Sales

Science

Shipping

Support

Technology

Tourism

Trade Relations

Veterinary Industry

Career Category Responses

Academia - Professor

Accountant

Advertising (influences input decisions)

Aerial Spray Applicator

Ag Chemical Supplier

Ag Chemical Supply

Ag Commodity Coordinator

Ag Credit Specialist

Ag Credit/Financial Operations

Ag Equipment Sales

Ag Equipment Supply

Ag Hauling

Ag Journalist - Writer

Ag Journalist - Editor

Ag Journalist - Photographer

Ag Literacy Promotion

Ag Lobbyist

Ag Science

Ag Scientist

Ag Systems Coordinator (shipping and distribution)

Ag Teacher

Agencies – Farm Bureau, NCBA, etc

Agri-business

Agricultural Engineer

Agricultural Products

Agricultural Recruiter

Agriculture Leadership

Agriculture/Growing "production"

Agri-marketing

Agri-science - Horticulture Teacher

Agri-tainment - Environmental Education and Tourism

Agronomist

Aircraft Maintenance

Aircraft Operation

Analyst

Animal Health Care Sales

Animal Inspector

Animal Nutrition Consultant

Animal Production

Animal Production/Husbandry

Animal Sciences (husbandry)

Animal Scientist

Animal Sellers

Applicator

Aquaculture

Arborist

Artificial Insemination Technician

Auction House Employees

Automotive

Banking

Banking Manager

Beekeeper

Beverages

Biochemist

Biological and Chemical Industries

Biologist

Biometrician (analyze data for trends and underlying relationships)

Biosciences

Botanist

Breeder

Brokers

Business Entrepreneur

Business Management

Buyer (grain)

Capital

Capital Investment

Cattle Farmer

Certification

Chemical Sales

Chemical Sciences

Chemical Supply Sales

Chemist

Climate

Clothing

College Recruiter

Colleges of Agriculture

Commission Buyers

Commission Sellers

Commodity Associations

Commodity Trader/Broker (i.e. grain, citrus, cattle)

Computer Science

Computer Systems Analyst

Computer Technology

Construction

Consumer

Container Design/Supply

Contract Marketing Firms

Coop Manager

Cooperative Manager

Cotton for Fabric

Cotton Processing

Cowboy

Credit and Banking

Credit Manager

Crop Chemical - Dow

Crop Consultant

Crop Farmer

Crop Insurance

Crop Management (genetics, ag chemicals, fertilizers, scouting, equipment, precision ag)

Crop Protection

Dairy Farmer

Development

Direct Marketing

Distribution

Ditch Rider

Ecologist

Economic Analysis (profit/loss, taxation, optimization of scale, debt management)

Economics

Educational Instructors

Educator (college level)

Educator (high school level)

Elevator Workers

Engineering - Ag

Engineering - Chemical

Engineering - Civil

Engineering - Computer

Engineering – Electrical

Engineering - Ergonomics

Engineering - Hydrological

Engineering - Mechanical

Entomologist

Environment

Environmental Consultant

Environmentalist

Equine

Equipment Dealers

Equipment Operator

Equipment Repair

Equipment Sales

Equipment Service

Equipment Supplier

Event Planner/Coordinator

Executive Level Management – Country Manager

Executive Level Management - Finance

Executive Level Management - Sales

Executive Level Management - VP Operations

Experiment Station Work

Extension Education/Agent

Extension Home Economist

Extension Specialist

Extension/Outreach

Factory Worker (manufacturer's hard goods)

Faculty at Tech School

Faculty at University

Farm Equipment Supplier

Farm Laborer

Farm Manager

Farm Supply Sales Rep

Farrier

Federal Agency Staff

Federal Government Agency Employee

Federal Legislators (staff)

Federal Regulatory Agencies

Feed Distributors

Feed Grower

Feed Seller

Feed Supplier

Feed/Seed Companies

Feed/Supplemental Sales

Feedlots

Feedstuffs

Fertilizer Application

Fertilizer Dealers

Fertilizer Production

Fertilizer Sales

Fertilizer Supplier

Fertilizer/Pesticide Handlers

Field Hands

Finance

Finance Consultant

Financial (financing for operations)

Financial Advisors

Financial Analyst

Financial Industries

Financial Planner

Financial Planning (hedging, protection from commodity price changes)

Financial Services

Financial Trading

Finishing Manager

Florist

Food Category Manager

Food Processors

Food Scientist

Foreman

Forest Ranger

Forester

Forestry

Formal Education- teaching all levels

Fruit Farms/Orchard

Fuel Industry

Fuel Suppliers

Garden Center Employee

Garden Center Manager

Garden Center Sales

Geneticist

Genetics Companies

Geography

Geology

Golf Course Greens Manager

Golf Course Horticulturist

Golf Course Superintendent

Government (local)

Government (state)

Government Policy (Farm Bill, USDA, BLM, Forrest Service, etc)

Government Relations

Government Researcher

Graders

Grain Graders

Grain Handlers

Greenhouse Grower

Greenhouse Operator

Grocery Retail Chains

Grocery Store Workers

Grounds Keeper

Grounds/Turf

Grower

Grower Supply Sales Rep

Hard Goods Supplier

Health

Health Research

Herbicide Sales

Herdsman

Hired Hands

Horticulturist

Hothouses for Sprouts

Human Resource Management

Individuals in Government Agencies

Information Systems/Technology

Inputs

Inside and Outside Sales

Inspectors

Insurance

Internal Affairs Manager

International Business Manager

Irrigation Installer

Irrigation Maintenance

Irrigation Management (Hydrology)

Irrigation System Designer

Irrigator

Journalism

Labor Contractor

Labor Supervisor (team leader)

Laborer

Land Acquisition Preparation

Land Appraiser

Landscape Contractor

Landscape Contractor Crew Chief

Landscape Contractor Laborer

Landscape Design Sales

Landscape Designer

Landscape Maintenance Crew Chief

Landscape Maintenance Laborer

Landscape Maintenance Manager

Landscaping

Law

Learning and Development Manager

Legal Services

Lending Institutions – Banks

Lending/Finance

Livestock Auction Workers

Livestock Production

Lobbyist

Lumber and Sawmill Operators

Machinery

Machinery Dealers and Handlers

Machinery Operator

Machinist

Majordomo [Foreman]

Management Consultants

Manager

Market Research Manager (providing market share data)

Marketing Communications Manager

Marketing Director

Marketing Manager

Marketing Products

Marketing Promotion

Marketing Specialists

Meat

Meat Cutter

Meat Graders

Meat Inspector

Meat Packing Plant Crew Leader

Meat Packing Plant Manager

Meat Scientist

Mechanic

Media

Meteorology

Migrant

Milk Graders

Milk Handlers

Municipal Arborist

Nanotechnology

Natural Resource Management Assistance

Natural Resources Positions

Negotiations

Nursery

Nursery Propagator

Nurseryman

Nutritionist

Nuts

Office Manager

Operation Accountant

Operations Director

Organizational & Communication Skills

Packers

Packing and Value-added

Packing Shed Manager

Pathology

Pest Scout

Pesticide Applicator

Pharmaceutical - Pfizer

Pharmaceutical Sales

Plant Breeding

Plant Inspector

Plant Manager

Plant Pathologists

Plant Production/Husbandry

Plant Scientist

Planting/Growing/Harvesting

Positive Resources (such as advertisement)

Poultry

Preparation

Private Food Firms

Processing Facilities

Processing Gins for Cotton

Processing Mills for Grains

Processing Plants - Food

Processing Plants - Meat

Processing Plants - Milk

Processor Elevators

Processors Packaging Facilities

Product Distribution

Production Agriculture Employees

Production Agriculture Managers

Production Farm Owners

Production Food Processing - Drivers

Production Food Processing - Sales

Production Food Processing Management

Production Manager

Quality Assurance

Ranch Hand

Ranch Manager

Ranchers

Range Management Specialist

Real Estate Agent

Refining/Processing

Regulatory (i.e. TDA, EPA, TCEQ)

Regulatory/Policy

Research and Technology with Animal Genetics

Research and Technology with Bio-engineering

Research and Technology with Plant Genetics

Research Specialist

Research/Development - University Community

Researcher

Restaurant Industry

Retail Florist

Retailer

Row Crop

Safety

Sales of Product to Wholesale

Sales Representative

Sanjero [Ditch Digger]

Science Researcher

Seamstress

Secondary Agricultural Education Programs

Seed Developers

Seed for Plants & Vegetables

Seed Production

Seed Supplier

Seed/Genetics Firms

Short and Long-term Planning

Silviculturist

Slaughter Work

Sociology

Soil Conservation Specialist

Soil Scientist

Soils

State Agency Staff

State Government Agency Employees

State Legislator (staff)

Statistician

Stock Supplier

Stockbroker

Storage

Synthetics for Fabrics

Tailor

Teaching

Technical Support (either field or phone bases support network for goods and service)

Telemetry Data Systems

Telesales

Tissue Culturist

Toxicologist

Tractor Dealer/Salesman

Tractor Driver

Tractor Mechanic

Train Operator

Trainer

Transportation

Transportation - Ports

Transportation - Railroad

Transportation - Railroad Engineer

Transportation - Sea Freight Firms

Transportation - Truck Driver

Transportation - Warehouse Man

Trucking Companies

Turf – Golf Courses

Turf – stadiums

University Researcher

USDA – (i.e. Forest Service, NRCS, FDA, etc.)

USDA Inspectors

Utilization of Agricultural Product – Dairies, etc

Value-added Processes

Various Types of Scientists

Vegetable Farms

Veterinarian

Veterinary Assistant

Veterinary Consultant

Veterinary Medicine

Veterinary Services

Virology

Warehousing

Water

Water Delivery Systems/Operation - flood irrigation

Water Management Entities

Wholesale Brokers

Wholesale Florist

Wholesale Sales to Retail

Wholesaler

Wildlife

Wildlife Advisor

Wildlife Management

Wildlife Specialist

Wool Processing

Results – Round Two

Round two began to build consensus among the expert panelists. According to Dalkey, (1969) a .90 coefficient of reliability using the Delphi technique was achieved when a group of 13 experts is truly represented and is actively engaged. In round two, eighteen experts returned the questionnaire for a response rate of 85.71 percent; however, not all respondents answered every question in the questionnaire. Items that reached majority (over 50 percent favorable) but did not reach consensus (less than 75 percent favorable response) were determined using Table 1.

Table 1
Minimum Responses by Expert Panelists to Achieve Majority and Consensus

	Majority	Consensus
Number of Experts	> .50	= or > .75
21	11	16
20	11	15
19	10	15
18	10	14
17	9	13
16	9	12
15	8	12
14	8	11
13	7	10

Note: A .90 coefficient of reliability is achieved when a minimum of 13 experts is represented and is actively engaged using the Delphi technique.

A set of three questions similar to those used in round one was sent to each of the 21 expert panelists. Questions used in this round were as follows:

1. Do you agree that the *System* components listed below depict the broad agricultural fields? [System]
2. Do you agree that the *Industries* listed below play an important role in the agricultural segment? [Industry]
3. Do you agree that the *Careers* listed below are associated with agriculture? [Career]

For the results of the responses to round two, see Tables 2, 3, and 4 to address the System, Industry, and Career categories, respectively. For a copy of the instrument used in this round, see Appendix G.

Table 2

Alphabetized List of Results from Round Two, Systems Category

Systems Category	Yes	No	Unsure	Panel Respondents[a] Total
Animal System (breeders etc.)	17	0	1	18
Diplomacy/Trade System	16	1	0	17
Educational Components [System]	15	2	1	18
Engineering System	16	2	0	18
Equipment	17	1	0	18
Financial System	14	2	0	16
Government	16	2	0	18
Hydrologic System	14	1	3	18
Labor(workers, management, immigration issues, protection and safety issues, regulatory)	15	1	2	18
Logistic System (warehouse, trucking, delivery)	15	2	1	18
Manufacturing System (takes production inputs and processes to consumable goods)	16	2	0	18
Marketing System (creating demand for products)	15	2	0	17
Natural Resources	14	1	2	17
Operational System (internal stakeholders that keep the system operating i.e. finance, HR, payables, customer service, IT, BT [biotechnology?], etc)	15	3	0	18
Plant System (breeders of seed etc.)	18	0	0	18
Production System (basic component input that provide raw materials)	17	0	1	18
Research and Development System (improvement to manufacturing or production), Subcategory: Science Systems	16	1	1	18
Retail Brokers	12	3	3	18
Sales System (getting goods/services to consumers)	16	2	0	18
Service System (services that keep the system operating)	16	1	0	17
Transportation System	15	1	1	17

Note: The results were in response to the following System question: Do you agree that the system components listed below depict the broad agricultural field?
All Brackets are comments made by the researcher. Question marks in brackets are questions the researcher had in interpreting the context of the expert's response. No further clarification was provided by the panel.
[a]Not all 18 panel respondents answered every question. Refer to Table 1 to reference minimum response requirements by expert panelists to reach majority and consensus.

Table 3

Alphabetized List of Results from Round Two, Industry Category

Industry Category	Yes	No	Unsure	Panel Respondents[a] Total
Ag Production	18	0	0	18
Agronomy	18	0	0	18
Animal Industries	17	0	1	18
Business	16	2	0	18
Community and Social Infrastructure	12	2	4	18
Conservation Components - environmental inputs (land, water, wildlife, environmental regulations)	18	0	0	18
Consultants	15	2	1	18
Delivery/Distribution Systems	14	2	2	18
Energy	12	3	2	17
Engineering/Equipment	16	2	0	18
Equipment Manufacturing (Manufacturers of hard goods – handling equipment, tractors, etc)	17	1	0	18
Farmer/Farming	18	0	0	18
Fertilizer industry (potash)	18	0	0	18
Food Industries	15	1	2	18
Government (all levels)	16	2	0	18
Grain Industry	18	0	0	18
Land / Real Estate	15	3	0	18
Legislation, Policy, and Regulation	16	2	0	18
Management	16	2	0	18
Marketing	16	2	0	18
Packaging	15	2	1	18
Processing	16	2	0	18
Ranching	18	0	0	18
Sales	16	2	0	18
Science	17	1	0	18
Shipping	15	1	1	17
Support	13	2	2	17
Technology	15	2	1	18
Tourism	8	6	3	17
Trade Relations	15	2	0	17
Veterinary industry	18	0	0	18

Note: The comments were in response to the following Industry question: Do you agree that the industries listed below play an important role in the agricultural segment?

[a]Not all 18 panel respondents answered every question. Refer to Table 1 to reference minimum response requirements by expert panelists to reach majority and consensus.

Table 4

Alphabetized List of Results from Round Two, Career Category

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Academia - professor	18	0	0	18
Accountant	15	2	1	18
Advertising (influences input decisions)	13	2	3	18
Aerial Spray Applicator	17	0	1	18
Ag Chemical Supplier	18	0	0	18
Ag Chemical Supply	17	0	1	18
Ag Commodity Coordinator	18	0	0	18
Ag Credit Specialist	18	0	0	18
Ag Credit/Financial Operations	18	0	0	18
Ag Equipment Sales	18	0	0	18
Ag Equipment Supply	17	0	1	18
Ag Hauling	16	1	1	18
Ag Journalist - writer	17	0	1	18
Ag Journalist – editor	17	0	1	18
Ag Journalist - photographer	17	0	1	18
Ag Literacy Promotion	18	0	0	18
Ag Lobbyist	18	0	0	18
Ag Science	18	0	0	18
Ag Scientist	18	0	0	18
Ag Systems Coordinator (shipping and distribution)	16	0	2	18
Ag Teacher	18	0	0	18
Agencies – Farm Bureau, NCBA, etc	17	0	1	18
Agri-business	18	0	0	18
Agricultural Engineer	18	0	0	18
Agricultural Products	17	0	1	18
Agricultural Recruiter	18	0	0	18
Agriculture Leadership	17	0	1	18
Agriculture/Growing "production"	18	0	0	18
Agri-marketing	18	0	0	18
Agri-science - horticulture teacher	18	0	0	18
Agri-tainment - environmental education and tourism	17	0	1	18
Agronomist	18	0	0	18
Aircraft Maintenance	10	7	1	18
Aircraft Operation	9	7	2	18
Analyst	13	3	2	18
Animal Health Care Sales	18	0	0	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Animal Inspector	18	0	0	18
Animal Nutrition Consultant	18	0	0	18
Animal Production	17	1	0	18
Animal Production/Husbandry	18	0	0	18
Animal Sciences - Husbandry	18	0	0	18
Animal Scientist	18	0	0	18
Animal Sellers	16	1	1	18
Applicator	16	1	1	18
Aquaculture	18	0	0	18
Arborist	16	1	1	18
Artificial Insemination Technician	18	0	0	18
Auction House Employees	14	2	2	18
Automotive	4	11	3	18
Banking	14	3	1	18
Banking Manager	14	3	1	18
Beekeeper	18	0	0	18
Beverages	12	5	0	17
Biochemist	15	0	3	18
Biological and Chemical Industries	17	0	1	18
Biologist	15	0	3	18
Biometrician (analyze data for trends and underlying relationships)	13	2	3	18
Biosciences	15	0	3	18
Botanist	16	0	2	18
Breeder	18	0	0	18
Brokers	14	3	1	18
Business Entrepreneur	13	1	4	18
Business Management	13	3	2	18
Buyer – grain	18	0	0	18
Capital	11	2	5	18
Capital Investment	12	2	4	18
Cattle Farmer	18	0	0	18
Certification	14	0	3	17
Chemical Sales	15	2	1	18
Chemical Sciences	13	1	4	18
Chemical Supply Sales	14	2	2	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Chemist	13	1	4	18
Climate	14	0	4	18
Clothing	12	5	1	18
College Recruiter	10	8	0	18
Colleges of Agriculture	15	1	2	18
Commission Buyers	13	1	4	18
Commission Sellers	14	2	2	18
Commodity Associations	18	0	0	18
Commodity Trader/Broker – (i.e. grain, citrus, cattle)	17	0	1	18
Computer Science	10	5	3	18
Computer Systems Analyst	10	6	2	18
Computer Technology	10	5	3	18
Construction	11	6	0	17
Consumer	12	3	3	18
Container Design/Supply	13	3	2	18
Contract Marketing Firms	12	2	4	18
Coop Manager	16	1	1	18
Cooperative Manager	16	1	1	18
Cotton for Fabric	17	0	1	18
Cotton Processing	18	0	0	18
Cowboy	18	0	0	18
Credit and Banking	13	2	3	18
Credit Manager	13	2	3	18
Crop Chemical - Dow	16	0	2	18
Crop Consultant	18	0	0	18
Crop Farmer	18	0	0	18
Crop Insurance	18	0	0	18
Crop Management (genetics, ag chemicals, fertilizers, scouting, equipment, precision ag)	17	0	0	17
Crop Protection	18	0	0	18
Dairy Farmer	18	0	0	18
Development	8	1	9	18
Direct Marketing	13	2	3	18
Distribution	13	2	3	18
Ditch Rider	9	5	3	17
Ecologist	17	0	1	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Economic Analysis (profit/loss, taxation, optimization of scale, debt management)	14	1	3	18
Economics	12	1	5	18
Educational Instructors	17	0	1	18
Educator - college level	17	0	1	18
Educator – high school level	17	0	1	18
Elevator Workers	18	0	0	18
Engineering - Ag	17	0	1	18
Engineering - chemical	14	2	2	18
Engineering - civil	10	6	2	18
Engineering - computer	8	7	3	18
Engineering – electrical	9	7	2	18
Engineering - ergonomics	9	7	2	18
Engineering - hydrological	14	2	2	18
Engineering - mechanical	13	4	1	18
Entomologist	18	0	0	18
Environment	14	1	3	18
Environmental Consultant	17	0	1	18
Environmentalist	13	2	3	18
Equine	18	0	0	18
Equipment Dealers	16	2	0	18
Equipment Operator	16	1	1	18
Equipment Repair	16	2	0	18
Equipment Sales	15	2	1	18
Equipment Service	16	2	0	18
Equipment Supplier	16	2	0	18
Event Planner/Coordinator	9	6	3	18
Executive Level Management – country manager	13	3	2	18
Executive Level Management - finance	11	4	3	18
Executive Level Management - sales	11	4	3	18
Executive Level Management - VP operations	11	4	3	18
Experiment Station Work	17	0	1	18
Extension Education/Agent	18	0	0	18
Extension Home Economist	14	3	1	18
Extension Specialist	18	0	0	18
Extension/Outreach	18	0	0	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Factory Worker (manufacturer's hard goods)	12	5	1	18
Faculty at Tech School	16	1	1	18
Faculty at University	17	0	1	18
Farm Equipment Supplier	18	0	0	18
Farm Laborer	18	0	0	18
Farm Manager	18	0	0	18
Farm Supply Sales Rep	18	0	0	18
Farrier	14	1	3	18
Federal Agency Staff	15	2	1	18
Federal Government Agency Employee	15	2	1	18
Federal Legislators (staff)	12	6	0	18
Federal Regulatory Agencies	15	1	2	18
Feed Distributors	18	0	0	18
Feed Grower	17	1	0	18
Feed Seller	17	0	1	18
Feed Supplier	18	0	0	18
Feed/Seed Companies	18	0	0	18
Feed/Supplemental Sales	18	0	0	18
Feedlots	18	0	0	18
Feedstuffs	17	0	1	18
Fertilizer Application	18	0	0	18
Fertilizer Dealers	18	0	0	18
Fertilizer Production	18	0	0	18
Fertilizer Sales	18	0	0	18
Fertilizer Supplier	18	0	0	18
Fertilizer/Pesticide Handlers	18	0	0	18
Field Hands	17	0	1	18
Finance	14	3	1	18
Finance Consultant	13	3	2	18
Financial (financing for operations)	14	2	2	18
Financial Advisors	13	3	2	18
Financial Analyst	13	3	2	18
Financial Industries	12	3	3	18
Financial Planner	12	2	3	17
Financial Planning (hedging, protection from commodity price changes)	13	2	2	17

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Financial Services	14	3	1	18
Financial Trading	13	2	3	18
Finishing Manager	12	1	5	18
Florist	13	3	2	18
Food Category Manager	15	1	2	18
Food Processors	18	0	0	18
Food Scientist	18	0	0	18
Foreman	15	1	2	18
Forest Ranger	15	2	1	18
Forester	16	1	1	18
Forestry	16	1	1	18
Formal Education- teaching all levels	16	1	1	18
Fruit Farms/Orchard	18	0	0	18
Fuel Industry	10	6	2	18
Fuel Suppliers	9	6	3	18
Garden Center Employee	13	3	2	18
Garden Center Manager	16	2	0	18
Garden Center Sales	15	3	0	18
Geneticist	16	0	2	18
Genetics Companies	15	0	3	18
Geography	13	1	4	18
Geology	13	2	3	18
Golf Course Greens Manager	13	4	1	18
Golf Course Horticulturist	13	4	1	18
Golf Course Superintendent	12	4	2	18
Government - local	12	5	1	18
Government - state	13	4	1	18
Government Policy (Farm Bill, USDA, BLM, Forrest Service, etc.)	18	0	0	18
Government Relations	15	3	0	18
Government Researcher	15	0	3	18
Graders	15	2	1	18
Grain Graders	18	0	0	18
Grain Handlers	18	0	0	18
Greenhouse Grower	18	0	0	18
Greenhouse Operator	18	0	0	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Grocery Retail Chains	11	4	3	18
Grocery Store Workers	11	6	1	18
Grounds Keeper	15	2	1	18
Grounds/Turf	15	2	1	18
Grower	18	0	0	18
Grower Supply Sales Rep	18	0	0	18
Hard Goods Supplier	15	1	2	18
Health	10	3	5	18
Health Research	13	1	4	18
Herbicide Sales	18	0	0	18
Herdsman	18	0	0	18
Hired Hands	17	0	1	18
Horticulturist	16	1	1	18
Hothouses for Sprouts	17	0	1	18
Human Resource Management	13	5	0	18
Individuals in Government Agencies	14	2	2	18
Information Systems/Technology	12	4	2	18
Inputs	3	3	11	17
Inside and Outside Sales	8	2	8	18
Inspectors	16	1	1	18
Insurance	13	4	1	18
Internal Affairs Manager	12	4	2	18
International Business Manager	11	4	3	18
Irrigation Installer	18	0	0	18
Irrigation Maintenance	18	0	0	18
Irrigation Management (Hydrology)	18	0	0	18
Irrigation System Designer	18	0	0	18
Irrigator	18	0	0	18
Journalism	10	5	3	18
Labor Contractor	17	0	1	18
Labor Supervisor - team leader	14	1	3	18
Laborer	17	1	0	18
Land Acquisition Preparation	13	3	2	18
Land Appraiser	14	3	1	18
Landscape Contractor	13	3	2	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Landscape Contractor Crew Chief	15	3	0	18
Landscape Contractor Laborer	14	3	1	18
Landscape Design Sales	13	3	2	18
Landscape Designer	13	3	2	18
Landscape Maintenance Crew Chief	15	3	0	18
Landscape Maintenance Laborer	15	3	0	18
Landscape Maintenance Manager	15	3	0	18
Landscaping	16	1	1	18
Law	13	4	1	18
Learning and Development Manager	9	2	7	18
Legal Services	13	4	1	18
Lending Institutions – banks	12	2	3	17
Lending/Finance	14	3	1	18
Livestock Auction Workers	18	0	0	18
Livestock Production	18	0	0	18
Lobbyist	15	2	1	18
Lumber and Sawmill Operators	16	2	0	18
Machinery	16	1	1	18
Machinery Dealers and Handlers	16	1	1	18
Machinery Operator	16	0	2	18
Machinist	14	3	1	18
Majordomo [foreman]	13	2	3	18
Management Consultants	13	2	3	18
Manager	13	2	3	18
Market Research Manager (providing market share data)	13	2	3	18
Marketing Communications Manager	13	2	3	18
Marketing Director	13	2	3	18
Marketing Manager	12	2	4	18
Marketing Products	14	1	2	17
Marketing Promotion	14	2	2	18
Marketing Specialists	13	2	3	18
Meat	17	0	1	18
Meat Cutter	18	0	0	18
Meat Graders	18	0	0	18
Meat Inspector	18	0	0	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Meat Packing Plant Crew Leader	17	0	1	18
Meat Packing Plant Manager	18	0	0	18
Meat Scientist	18	0	0	18
Mechanic	15	3	0	18
Media	12	4	2	18
Meteorology	13	2	3	18
Migrant	17	0	1	18
Milk Graders	18	0	0	18
Milk Handlers	18	0	0	18
Municipal Arborist	14	2	2	18
Nanotechnology	7	7	4	18
Natural Resource Management Assistance	17	0	1	18
Natural Resources Positions	13	0	5	18
Negotiations	14	2	2	18
Nursery	18	0	0	18
Nursery Propagator	17	0	1	18
Nurseryman	18	0	0	18
Nutritionist	15	0	3	18
Nuts	16	0	2	18
Office Manager	14	3	1	18
Operation Accountant	13	2	3	18
Operations Director	13	3	2	18
Organizational & Communication Skills	12	4	2	18
Packers	11	4	2	17
Packing and Value-added	13	3	2	18
Packing Shed Manager	14	1	3	18
Pathology	15	2	1	18
Pest Scout	18	0	0	18
Pesticide Applicator	18	0	0	18
Pharmaceutical - Pfizer	11	6	1	18
Pharmaceutical Sales	10	8	0	18
Plant Breeding	18	0	0	18
Plant Inspector	16	1	1	18
Plant Manager	13	3	2	18
Plant Pathologists	18	0	0	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Plant Production/Husbandry	17	0	1	18
Plant Scientist	18	0	0	18
Planting/Growing/Harvesting	18	0	0	18
Positive Resources (such as advertisement)	12	2	4	18
Poultry	17	0	0	17
Preparation	15	1	2	18
Private Food Firms	15	3	0	18
Processing Facilities	18	0	0	18
Processing Gins for Cotton	18	0	0	18
Processing Mills for Grains	18	0	0	18
Processing Plants - food	18	0	0	18
Processing Plants - meat	18	0	0	18
Processing Plants - milk	18	0	0	18
Processor Elevators	17	0	1	18
Processors Packaging Facilities	18	0	0	18
Product Distribution	13	2	3	18
Production Agriculture Employees	18	0	0	18
Production Agriculture Managers	17	0	1	18
Production Farm Owners	17	0	0	17
Production Food Processing - drivers	14	3	1	18
Production Food Processing - sales	18	0	0	18
Production Food Processing Management	16	1	1	18
Production Manager	13	3	2	18
Quality Assurance	16	1	1	18
Ranch Hand	17	0	1	18
Ranch Manager	18	0	0	18
Ranchers	17	0	0	17
Range Management Specialist	18	0	0	18
Real Estate Agent	12	5	1	18
Refining/Processing	17	0	1	18
Regulatory (i.e. TDA, EPA, TCEQ)	15	1	2	18
Regulatory/Policy	16	1	1	18
Research and Technology with Animal Genetics	18	0	0	18
Research and Technology with Bio-engineering	16	0	2	18
Research and Technology with Plant Genetics	18	0	0	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Research Specialist	15	0	3	18
Research/Development - university community	16	0	2	18
Researcher	14	0	4	18
Restaurant Industry	13	5	0	18
Retail Florist	14	4	0	18
Retailer	13	4	0	17
Row Crop	18	0	0	18
Safety	15	2	1	18
Sales of Product to Wholesale	16	1	1	18
Sales Representative	12	3	3	18
Sanjero [ditch digger]	13	3	2	18
Science Researcher	14	0	4	18
Seamstress	7	9	2	18
Secondary Agricultural Education Programs	18	0	0	18
Seed Developers	18	0	0	18
Seed for Plants & Vegetables	18	0	0	18
Seed Production	18	0	0	18
Seed Supplier	18	0	0	18
Seed/Genetics Firms	18	0	0	18
Short and Long-term Planning	11	4	3	18
Silviculturist	10	1	7	18
Slaughter Work	17	0	1	18
Sociology	11	3	4	18
Soil Conservation Specialist	17	0	1	18
Soil Scientist	18	0	0	18
Soils	17	0	1	18
State Agency Staff	15	2	1	18
State Government Agency Employees	15	2	1	18
State Legislator (staff)	11	5	2	18
Statistician	12	4	2	18
Stock Supplier	16	2	0	18
Stockbroker	10	5	2	17
Storage	14	2	2	18
Synthetics for Fabrics	8	7	3	18
Tailor	7	9	2	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Teaching	16	2	0	18
Technical Support (either field or phone bases support network for goods and service)	12	2	4	18
Telemetry Data Systems	9	5	4	18
Telesales	8	6	4	18
Tissue Culturist	15	0	3	18
Toxicologist	16	0	2	18
Tractor Dealer/Salesman	17	0	1	18
Tractor Driver	17	1	0	18
Tractor Mechanic	17	1	0	18
Train Operator	10	7	1	18
Trainer	13	2	3	18
Transportation	13	5	0	18
Transportation - ports	12	5	1	18
Transportation - railroad	12	5	1	18
Transportation - railroad engineer	9	7	2	18
Transportation - sea freight firms	12	5	1	18
Transportation - truck driver	13	5	0	18
Transportation - warehouse man	12	5	1	18
Trucking Companies	12	5	1	18
Turf – golf courses	13	3	2	18
Turf – stadiums	13	3	2	18
University Researcher	14	0	4	18
USDA – (i.e. forest service, NRCS, FDA, etc.)	18	0	0	18
USDA Inspectors	18	0	0	18
Utilization of Agricultural Product – dairies, etc.	16	0	2	18
Value-added Processes	15	1	2	18
Various Types of Scientists	10	2	6	18
Vegetable Farms	18	0	0	18
Veterinarian	18	0	0	18
Veterinary Assistant	18	0	0	18
Veterinary Consultant	18	0	0	18
Veterinary Medicine	17	0	1	18
Veterinary Services	17	0	1	18
Virology	13	0	5	18
Warehousing	14	2	2	18

Table 4
Continued

Career Category	Yes	No	Unsure	Panel Respondents[a] Total
Water	15	2	1	18
Water Delivery Systems/Operation - flood irrigation	18	0	0	18
Water Management Entities	14	2	1	17
Wholesale Brokers	13	3	2	18
Wholesale Florist	16	1	1	18
Wholesale Sales to Retail	14	3	1	18
Wholesaler	13	3	2	18
Wildlife	13	2	3	18
Wildlife Advisor	13	2	3	18
Wildlife Management	16	1	1	18
Wildlife Specialist	14	2	2	18
Wool Processing	17	0	1	18

Note: The results were in response to the following Career question: Do you agree that the careers listed below are associated with agriculture?
All Brackets are comments made by the researcher. Question marks in brackets are questions the researcher had in interpreting the context of the expert's response. No further clarification was provided by the panel.
[a]Not all 18 panel respondents answered every question. Refer to Table 1 to reference minimum response requirements by expert panelists to reach majority and consensus.

Part of the consensus building process required eliminating items that did not reach majority in round two of the study. All of the items in the System category reached majority and consensus in round two. One item did not reach majority in the Industry category and 18 items did not reach majority in the Career category. Items not reaching majority in round two are in Table 5.

After analyzing the data in the System, Industry, and Career categories reaching majority (over 50 percent favorable), but not consensus (less than 75 percent favorable response), the remaining items were identified and sent back to the experts in round three for further consensus building.

Table 5

Alphabetized Items Not Reaching Majority in Round Two by Category

System Category	Yes	No	Unsure	Panel Respondents[a] Total
None				
Industry Category				
Tourism	8	6	3	17
Career Category				
Aircraft Operation	9	7	2	18
Automotive	4	11	3	18
Development	8	1	9	18
Engineering - computer	8	7	3	18
Engineering – electrical	9	7	2	18
Engineering - ergonomics	9	7	2	18
Event Planner/Coordinator	9	6	3	18
Fuel Suppliers	9	6	3	18
Inputs	3	3	11	17
Inside and Outside Sales	8	2	8	18
Learning and Development Manager	9	2	7	18
Nanotechnology	7	7	4	18
Seamstress	7	9	2	18
Synthetics for Fabrics	8	7	3	18
Tailor	7	9	2	18
Telemetry Data Systems	9	5	4	18
Telesales	8	6	4	18
Transportation - railroad engineer	9	7	2	18

Note: All Brackets are comments made by the researcher. Question marks in brackets are questions the researcher had in interpreting the context of the expert's response. No further clarification was provided by the panel.

[a]Not all 18 panel respondents answered every question in round two. Refer to Table 1 to reference minimum response requirements by expert panelists to reach majority and consensus.

Results – Round Three

Items not reaching consensus were returned to the panelists for round three. As in round two, round three continued to build consensus on items in each of the categories. Based upon the same questions used for creating round two, the questionnaire for round three was similar to the one used in round two. A copy of the questionnaire used in round three can be found in Appendix I.

In round three, 20 experts returned the questionnaire for a response rate of 95.24 percent; however, not all respondents answered every question in the questionnaire. Two experts failed to complete many of the items that reached consensus. Items in round three that reached majority but did not reach consensus were determined using Table 1, *Minimum Responses by Expert Panelists to Achieve Majority and Consensus*.

The System category had all items reach consensus in round two; therefore, no further consensus building was required for the System category. Three items in the Industry category reached majority but not consensus and 120 items in the Career category reached majority but not consensus. All other items in the questionnaire, in all categories, reached consensus by the end of round two and no further analysis of those was required.

Upon receiving the questionnaire and analyzing the data, two Industry categories and 23 Career categories reached consensus. For a complete list of the items reaching consensus in round three, see Table 6.

Table 6

Alphabetized Items Reaching Consensus in Round Three by Category

System Category	Yes	No	Panel Respondent[a] Total
All the items in this category reached consensus in round two.			
Industry Category			
Community and Social Infrastructure	16	3	19
Support	10	3	13
Career Category			
Analyst	14	4	18
Business Management	13	4	17
Chemist	14	4	18
Commission Buyers	14	4	18
Credit and Banking	15	3	18
Credit Manager	14	4	18
Economics	15	3	18
Environmentalist	15	3	18
Financial Advisors	14	4	18
Florist	16	2	18
Golf Course Greens Manager	14	4	18
Golf Course Horticulturist	15	3	18
Lending Institutions – banks	13	4	17
Media	14	4	18
Natural Resources Positions	14	3	17
Production Manager	13	4	17
Silviculturist	14	4	18
Turf – golf courses	14	3	17
Turf – stadiums	14	3	17
Wholesale Brokers	13	3	16
Wholesaler	15	3	18
Wildlife	14	4	18
Wildlife Advisor	15	3	18

Note: Question marks in brackets are questions the researcher had in interpreting the context of the expert's response. No further clarification was provided by the panel.

[a]Not all 20 panel respondents answered every question in round three. Refer to Table 1 to reference minimum response requirements by expert panelists to reach majority and consensus.

KEY FINDINGS

In round three, there were three Industry items and 120 Career items considered for further consensus building by the experts. After final analysis of the data at the end of round three, there were no changes in the System category.

Tourism, in the Industry category did not reach majority at the end of round two, therefore it was eliminated. The single Career item under this category was *Agri-tainment* (environmental education and tourism) and was elevated to an Industry category in the final list at the end of round three. It is likely this Industry category can realize other Career items which may fall under *Agri-tainment* in future studies.

After eliminating 97 Career items not reaching consensus at the end of round three from the 120 originally considered, there were no additional changes in the Career category items.

The purpose of this study was to identify, examine, and validate the various components and systems in agriculture. The findings of this research conclude the following objectives.

Objective 1: What are the different *Careers* associated with agriculture?

After identifying 477 raw responses in the initial round of this Delphi study, conducting further examination through eliminating duplicates, categorizing items, and building consensus over rounds two and three, there were 317 Careers validated to be associated with agriculture in this study.

Objective 2: What are the *Industries* that play an important role in the input segment of agriculture?

After identifying 157 raw responses in the initial round of this Delphi study, conducting further examination through eliminating duplicates, categorizing items, and building consensus over rounds two and three, 30 Industries were recognized and validated to play an important role in the input segment of agriculture in this study.

Objective 3: What are the *System* components needed to depict the industry of agriculture?

After identifying 130 raw responses in the initial round of this Delphi study, conducting further examination through eliminating duplicates, categorizing items, and building consensus over rounds two and three, 21 System components were validated and accepted to depict the industry of agriculture in this study.

In all, 368 items in this study were validated as components and systems in agriculture.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

SUMMARY

Statement of the Problem

Gilmore, Goecker, Smith, and Smith (2006), as cited in Gonzalez's presentation titled: *Agricultural Programs: Are They Able to Adapt for the Future?,* speak clearly, as to why negative perceptions by students, parents, and the public make recruiting into universities difficult. The needs to identify, examine, and validate a description of the agriculture industry and to understand the impact agriculture has in our lives is critically important. Agriculture is more than just farming or raising livestock and crops. Agriculture includes a web of intricate supply chain systems using state of the art technology based on sound basic and applied scientific research.

There is a critical need to better convey the vast array of opportunities in agriculture, food, and life sciences by identifying systems, industries, and careers in, or associated with, the agricultural industry in order to help the general population better understand the impact of agriculture in our society.

Purpose

Contemporary agriculture is much different than it was 30 years ago. The perception of agriculture by the general public is largely still visualized as primarily farming and ranching or linked to production agriculture. The purpose of this study was

to identify, examine and validate the various components and systems in agriculture, food, and life sciences while investigating the following questions:

1. What are the different careers associated with agriculture?
2. What are the industries that play an important role in the input segment of agriculture?
3. What are the system components needed to depict the industry of agriculture?

Review of Literature

Relevant literature from research and public websites concerning career and industry classifications in agriculture were reviewed. According to Riesenberg and Lierman (1990), many students have an incorrect or inadequate knowledge of agriculture due to a lack of exposure to the variety of jobs in the agricultural industry. The problem of a negative image that agriculture suffers is due to incomplete or inaccurate information (Russell, McCracken, & Miller, 1990), and compounds the lack of understanding about agricultural careers. It is essential to find better ways to understand the agricultural industry in order to serve a larger segment of the population. With this objective in mind, websites for understanding and learning about agricultural occupations and how they are classified were examined. Websites reviewed for this study include: 1) North American Industry Classification System; 2) North American Product Classification System; 3) Dictionary of Occupational Titles; 4) O*NET Resource Center; 5) Occupational Outlook Handbook; 6) Career Guide to Industries; 7) National FFA Organization Career Explorer; and 8) College of Agriculture and Life Sciences Cargill Career Counselor Ag Careers Database.

The North American Industry Classification System is the most comprehensive system found in this review. It has replaced the outdated Standard Industrial Classification which was started in 1930 and in use until the early 1990s. The impetus for NAICS was the creation of the North American Free Trade Agreement and was jointly created by the United States, Canada, and Mexico. This system provides comparable statistics across North America related to specific business activities. Some of the other reviews in this study are based upon, or use, the North American Industry Classification System.

While the North American Product Classification System launched in 1999 by the United States, Canada, and Mexico goes beyond the scope of this study, it is important to mention because it does compliment the NAPCS and is available as a resource when considering products, product definitions, and product codes for goods and services.

Although now defunct, the Dictionary of Occupational Titles was replaced by the O*NET Resource Center but is still used as a standard reference in cases related to labor and immigration; therefore, it merited further consideration.

The O*NET Resources Center claims to be the nation's primary source for occupational information and the website contains several products which can be used to search for occupations and careers. The database used in this website is free to the public and is the foundation of the system. Some of those tools include O*NET data, career exploration tools, and reports. Users can search for occupations in a variety of ways such as by job family, high growth industry or STEM disciplines.

The Occupational Outlook Handbook is published every two years by the Bureau of Labor Statistics. This handbook provides a variety of information about training and education requirements, earnings, expected job prospects, on-the-job employment, and working conditions. The handbook includes eleven occupations by category; however, not all agricultural related occupations are found under the Farming section of the handbook.

A companion to the Occupational Outlook Handbook is the Career Guide to Industries which is published by the U.S. Department of Labor. Information about different occupations in industry as well as training and advancement, earnings, expected job prospects and working conditions, plus information about job markets in each state are covered in this guide.

The FFA members have immediate access to searching 365 careers in Agricultural Sciences and Natural Food and Fiber Opportunities through the National FFA Organizations' Career Explorer tool. There are 23 career clusters included in the searchable database as well as 31 industry searches. Information about jobs in general, career information, skills required, educational requirements, courses needed in high school and/or college, working conditions, and locations of job availability can be found using this resource tool.

The jointly developed College of Agriculture and Life Sciences Cargill Career Counselor Ag Careers Database, was developed by the College of Agriculture and Life Sciences at Texas A&M University and Cargill, Inc. This database provides career counseling for students interested in food and agriculture and contains a variety of

different searches with over 40 careers in six categories. Some of the 29 industries are linked using the Standard Industrial Classification (SIC) codes as well as the North American Industry Classification System (NAICS) codes. There are over 75 occupations referenced from the United State Department of Labor using the Career Guide to Industries resource previously mentioned; and over 80 agricultural businesses listed in the United States.

It is important to have a good understanding of the resources available when learning about systems, industries and career opportunities in agriculture. How people access and use the information is only part of the formula; of greater importance is what material is currently available and how it is presented to the public. This is crucial because this information strongly influences and colors perceptions. Negative stigma about agriculture is largely perceived to be limiting in career opportunities; however, following this study, it is clear there are an abundance of career opportunities though, not conveyed in a manner easy for the public to understand and use. The false or incorrect categorizations found in some literature today further confuse the public and make matters worse by obscuring the truth regarding the professions available in contemporary agriculture. Developing a better understanding of the information in a holistic manner is critical so educators are able to develop accurate visual models to help convey the immense opportunities in agriculture in a more interconnected and visual way.

Limitations

The limitations of this study come from the sources of information. It is impossible to forecast, estimate, or guarantee each person in the population would be represented; therefore, bias sampling is present. Individuals with known or demonstrable experience and expertise (Trochim, 2006) were required for this study. Non-response bias was present due to questions not answered, intentionally or unintentionally, by some experts. The researcher's own experience in this field of study also introduces unknown levels of bias.

Research Design

Obtaining different perspectives for this study was essential; therefore, the Delphi technique for gathering input from professionals with varied backgrounds was chosen. This method of gathering information allows for interaction between the researcher and the panel of experts by requesting the identification, examination, and validation of the agricultural components and systems. According to Frick, Kahler, & Miller, (1991), nominating panelists is an effective way to acquire a cross-section of professionals from different industry segments, including academia and government in order to solicit opinion and obtain group consensus (Dyer, Breja, & Ball, 2003). The Delphi technique was developed by the Rand Corporation and is widely used in obtaining and refining group judgment. This method allows for anonymous response, iteration, controlled feedback, and statistical group response to minimize the bias effects

of dominant individuals, irrelevant communication, and group conformity due to pressure (Dalkey, 1969).

Population and Sample

Twenty-one experts from varied backgrounds such as Church/Religion, Education, Government, Insurance, Manufacturing, Natural Resources, Pharmaceutical, and Public Policy participated in this study. The experts were selected from nine different geographic areas of the United States with the majority from Texas. The experts reside in Arizona, California, District of Columbia, Kansas, Michigan, New Mexico, New York, Pennsylvania, and Texas. Fifteen males and six females were on the panel with an ethnic makeup of thirteen White and eight Hispanic. The consisted of three who were in the 34 and under age group; seven in the 35-44 age group; three in the 45-54 age group; and eight in the 55-64 age group, while their years of service range from a low of four to a high of thirty-eight, totaling 370 years of service.

A combination sampling technique of nonprobability, purposive, and expert sampling was used. This sampling was necessary because individuals with known or demonstrable experience and expertise (Trochim, 2006) were required for this study. A broad range of representation from individuals in varying industries and careers was needed in order to identify an extensive list of systems, industries and careers in agriculture in the first round of this study.

Instrumentation and Data Collection

The Delphi technique used a slightly different instrument for each round of the study. The validity of the study is dependent on the consistency of each round;

therefore, an unusually persistent and consistent systematic process (G. E. Briers, personal communication, June 11, 2007) is crucial to achieve validity in the instrumentation used and to the extent to which the instrument measures what it purports to measure. Careful attention to maintaining a consistent process throughout the data collection was used and the information submitted in the initial round was carefully analyzed, reformatted and sent out for further inquiry in each round. According to Dalkey, (1969) and Baker, Shinn, & Briers (2007), a .90 coefficient of reliability using the Delphi technique was concluded when a group of 13 experts is truly represented and is actively engaged.

Round One

For round one, an email cover letter explaining the tentative schedule and an anticipated timeline of the study was mailed to the expert panelists along with the instrument for round one. The instrument developed for round one consisted of three questions to consider the following:

1. What are the different careers associated with agriculture?
2. What are the industries that play an important role in the input segment of agriculture?
3. What are the system components needed to depict the industry of agriculture?

Since the public perception about agriculture is still primarily farming and ranching or linked to production agriculture, the initial effort was to gather a broad interpretation from the experts about which Careers, Industries and Systems are part of the agriculture industry. There were 477 item responses for question one (careers), 157 items for

question two (industries), and 130 item responses for question three (system components). In all, 764 item responses were returned to the researcher in round one by nineteen experts for a 94.48 percent response rate.

Round Two

The instrument in round two began to build consensus among the expert panelists. In round two, duplicate responses were eliminated and then categorized. The instrument used in round two, sections I and II dealt with *Systems* and *Industry*, respectively, and section III dealt with *Careers*. For section I, the system question was: *Do you agree that the "system" components listed below (far left – gray cells) depict the broad agricultural field?* For section II, the industry section, the question was: *Do you agree that the "industries" listed below (center – light blue cells) play an important role in the agricultural segment?* For section III, the careers portion of the study, the question was: *Do you agree that the "careers" listed below are associated with agriculture?*

After sorting, eliminating duplication, and categorizing were completed, there were 21 System component categories, 31 Industry categories and 433 Careers identified for 485 total responses in round two. Eighteen panelists responded to round two for a response rate of 85.71 percent.

Round Three

After receiving round two responses, the researcher analyzed the data of all items in every section of the instrument that reached majority (over 50 percent favorable), but did not reach consensus (less than 75 percent favorable response). Items not reaching

consensus were returned the panelists for round three. The instrument used in round three was similar to round two with 20 expert panelists responding or 95.24 percent.

Key Findings

The purpose of this study was to identify, examine and validate the various components and systems in agriculture while investigating the following questions:

1. What are the different *Careers* associated with agriculture?
2. What are the *Industries* that play an important role in the input segment of agriculture?
3. What are the *System* components needed to depict the industry of agriculture?

After analysis of the data, there were 317 Careers associated with agriculture, 30 Industries that play an important role in the input agricultural segment, and 21 System components in agriculture. Combined categories include 368 total items validated in this study.

CONCLUSIONS

"Recruitment of quality students has been, and continues to be, one of the most important and complex problems facing both secondary and university agricultural education programs today." (Dyer & Breja, 2003, p. 76) Many of today's youth are influenced by rewards associated with career alternatives but many adolescents' career decisions are impacted by the mass media, (Conroy, Scanlon, & Kelsey, 1998). According to Jones & Larke, (2005) "…Hispanic youth often possessed negative perceptions about careers in agriculture-related fields. Traditionally, the term *agriculture* created a negative image among high school and college students, particularly among students of color. (Zoldoske, D.F.1996)" (p. 11)

Given many of these challenges, it is not surprising that despite an increased demand from the agricultural sector, there continues to be an annual shortage of college graduates, (Goecker, et al., 2005). What is the agricultural industry doing to combat this shortage of qualified students to fill many of the agricultural jobs available today and the future? It is obvious there are many students who are not initially interested in agriculture due to the negative perception. According to Frick, Birkenholz, & Machtmes (1995b), there are many young and old Americans who have limited knowledge about agriculture and food production. The assumption that there are not many opportunities in the agricultural industry is further exacerbated by the limited illustrations and diagrams available to *visualize* how careers are interconnected with the agricultural industry in a holistic manner. Considering that 69 percent of students learn visually and 28 percent of the students are global thinkers, we seldom focus on the big picture

(Montgomery, 1995), (Felder & Silverman, n.d.), and this lack of visual media is a problem.

In 1988, the National Research Council published the concept of "agricultural literacy" and its meaning. Simply, the term means education *about* agriculture. In 1992, the American Association for Agricultural Education provided strategies to promote agricultural literacy to help the Agricultural Education profession direct attention toward the agricultural literacy concept. It is through these efforts and more research the public will become better informed about opportunities in contemporary agriculture.

Contemporary agriculture is much different than it was 30 years ago. The perception of agriculture by the general public is largely still perceived as primarily farming and ranching or linked largely to production agriculture. Given our dilemma of image and limited opportunities in agriculture, this study attempted to address the following objectives:

1. What are the different *Careers* associated with agriculture?
2. What are the *Industries* that play an important role in the input segment of agriculture?
3. What are the *System* components needed to depict the industry of agriculture?

After analysis of the data, there were 317 Careers associated with agriculture, 30 Industries that play an important role in the input agricultural segment, and 21 System components in agriculture. Combined categories include 368 total items validated in this study. For a complete and final list of the items identified in this study, see Table 7.

Based on the analysis of this study, several conclusions can be made:

1. It is difficult to find a comprehensive diagram that visually conveys the different Careers, Industries, and Systems to assist in recruiting efforts by colleges and universities.
2. Not all websites found in the literature convey an accurate distinctiveness of what agriculture is today.
3. The items identified in this study are not a comprehensive list of all of the Careers, Industries, and Systems found in the agricultural sector.
4. Not all Industries categorized in this study included Careers that reached consensus.
5. Some categories considered part of agriculture did not reach consensus by the panel of experts in this study.
6. The information found in this study can be used to begin further development of models to aid in the visualization of how Careers, Industries, and Systems are interconnected in order to help the public better understand the complex and diverse agricultural sector.
7. More research is needed regarding the impact of agriculture on career education used in agricultural literacy initiatives.
8. None of the technology careers identified in the first round reached consensus in the subsequent rounds, which was surprising considering agriculture uses technology in everyday use and research.

Table 7

Final List - Identifying, Examining, and Validating a Description of the Agriculture Industry

System Category	*Industry Category*	Career Category
Educational Components [System]		
		Agriculture Leadership
		Ag Literacy Promotion
		Certification
		Academia - professor
		Ag Science
		Ag Teacher
		Agri-science - horticulture teacher
		Colleges of Agriculture [education]
		Educational Instructors
		Educator - college level
		Educator – high school level
		Extension Education/Agent
		Extension Home Economist
		Extension Specialist
		Extension/Outreach
		Faculty at Tech School
		Faculty at University
		Formal Education- teaching all levels
		Secondary Agricultural Education Programs
		Teaching
	Community and Social Infrastructure	
		No careers reached consensus
Production System *(basic component input that provide raw materials)*		
	Ag Production	
		Landscaping
		Agriculture/Growing "Production"
		Aquaculture
		Beekeeper
		Cowboy
		Dairy Farmer
		Elevator Workers
		Feedlots

Table 7
Continued

System Category	Industry Category	Career Category
		Grain Handlers
		Irrigator
		Milk Handlers
		Pest scout
		Pesticide Applicator
		Poultry
		Production Farm Owners
		Utilization of Agricultural Product – dairies, etc
	Farmer/Farming	
		Vegetable Farms
		Tractor Driver
		Grower
		Fruit Farms/Orchard
		Feed Grower
		Crop Farmer
	Ranching	
		Cattle Farmer
		Stock Supplier [livestock]
		Ranch Hand
		Ranchers
Animal System *(breeders etc.)*		
	Animal Industries	
		Livestock Production
		Meat
		Herdsman
		Animal Production
		Animal Production/Husbandry
		Animal Sciences - husbandry
		Animal Sellers
Plant System *(breeders of seed etc.)*		
		Seed Production
		Plant Production/Husbandry
		Planting/Growing/Harvesting
		Wholesale Florist

Table 7
Continued

System Category	*Industry Category*	Career Category
		Crop Management *(genetics, ag chemicals, fertilizers, scouting, equipment, precision ag)*
		Crop Protection
		Florist
		Greenhouse Grower
		Greenhouse Operator
		Horticulturist
		Hothouses for Sprouts [greenhouse]
		Nursery
		Nurseryman
		Nuts
		Row Crop
	Agronomy	
		Agronomist
		Golf Course Horticulturist
		Grounds Keeper
		Grounds/Turf
		Turf – golf courses
		Turf – stadiums
	Fertilizer industry (potash)	
		Fertilizer Production
		Ag Chemical Supplier
		Ag Chemical Supply
		Biological and Chemical Industries
		Crop Chemical
		Fertilizer Application
		Fertilizer Dealers
		Fertilizer Supplier
		Fertilizer/Pesticide Handlers
	Grain Industry	
		Buyer – grain
		Feed Seller
		Feed Supplier
		Feed/Seed Companies
		Feedstuffs

Table 7
Continued

System Category	Industry Category	Career Category
		Seed for Plants & Vegetables
		Seed Supplier
		Seed/Genetics Firms
Labor		
(workers, management, immigration issues, protection and safety issues, regulatory)		
		Production Agriculture Employees
		Field Hands
		Migrant
		Hired Hands
		Farm Laborer
		Labor Contractor
		Laborer
		Landscape Contractor Laborer
		Landscape Maintenance Laborer
Natural Resources		
	Conservation	
	(Environmental inputs such as land, water, wildlife, environmental regulations, etc)	
		Ecologist
		Environment
		Environmentalist
		Forest Ranger
		Forester
		Forestry
		Municipal Arborist
		Natural Resources Positions
		Silviculturist
		Soil Conservation Specialist
		Wildlife
		Wildlife Advisor
		Wildlife Specialist
Manufacturing System		
(takes production inputs and processes to consumable goods)		
	Processing	
		Agricultural Products
		Cotton for Fabric
		Cotton Processing

Table 7
Continued

System Category	*Industry Category*	Career Category
		Food Processors
		Lumber and Sawmill Operators
		Machinery Operator
		Meat Cutter
		Preparation
		Processing Facilities
		Processing Gins for Cotton
		Processing Mills for Grains
		Processing Plants - food
		Processing Plants - meat
		Processing Plants - milk
		Processor Elevators
		Processors Packaging Facilities
		Refining/Processing
		Slaughter Work
		Wool Processing
Research and Development System *(improvement to manufacturing or production)* Subcategory: Science Systems	*Science*	Tissue Culturist
		Ag Scientist
		Animal Scientist
		Arborist
		Artificial Insemination Technician
		Biochemist
		Biologist
		Biosciences
		Botanist
		Breeder
		Chemist
		Climate
		Entomologist
		Equine
		Experiment Station Work

Table 7
Continued

System Category	Industry Category	Career Category
		Food Scientist
		Geneticist
		Genetics Companies
		Government Researcher
		Meat Scientist
		Nursery Propagator
		Nutritionist
		Pathology
		Plant Breeding
		Plant Pathologists
		Plant Scientist
		Research and Technology - animal genetics
		Research and Technology - plant genetics
		Research and Technology - bio-engineering
		Research Specialist
		Research/Development - university community
		Researcher
		Science Researcher
		Seed Developers
		Soil Scientist
		Soils
		Toxicologist
		University Researcher
	Veterinary Industry	
		Veterinarian
		Veterinary Assistant
		Veterinary Medicine
		Veterinary Services
Financial System		
	Business	
		Economic Analysis *(profit/loss, taxation, optimization of scale, debt management)*
		Economics
		Commission Buyers
		Ag Commodity Coordinator

Table 7
Continued

System Category
Industry Category
Career Category
Agri-business
Financial Services
Accountant
Ag Credit Specialist
Ag Credit/Financial Operations
Analyst
Banking
Banking Manager
Brokers
Commodity Trader/Broker - *(i.e. grain, citrus, cattle, etc)*
Credit and Banking
Credit Manager
Crop Insurance
Finance
Financial *(financing for operations)*
Financial Advisors
Financial Planning (*hedging, protection from commodity price changes*)
Lending Institutions – banks
Lending/Finance
Management
Cooperative Manager
Production Agriculture Managers
Business Management
Coop Manager
Farm Manager
Food Category Manager
Foreman
Garden Center Manager
Golf Course Greens Manager
Irrigation Management *(Hydrology)*
Labor Supervisor - team leader
Landscape Contractor Crew Chief
Landscape Maintenance Crew Chief
Landscape Maintenance Manager
Meat Packing Plant Crew Leader

Table 7
Continued

System Category	Industry Category	Career Category
		Meat Packing Plant Manager
		Natural Resource Management Assistance
		Office Manager
		Production Food Processing Management
		Production Manager
		Ranch Manager
		Range Management Specialist
		Wildlife Management
	Land / Real Estate	
		Land Appraiser
Engineering System		
	Engineering/Equipment	
		Agricultural Engineer
		Engineering - chemical
		Engineering - hydrological
		Irrigation System Designer
Equipment		
	Equipment Manufacturing (Manufacturers of hard goods – handling equipment, tractors, etc)	
		Ag Equipment Supply
		Equipment Dealers
		Equipment Operator
		Equipment Repair
		Equipment Service
		Equipment Supplier
		Farm Equipment Supplier
		Hard Goods Supplier
		Machinery
		Machinery Dealers and Handlers
Hydrologic System		
		Water
		Water Delivery Systems/Operation - flood irrigation
		Water Management Entities

Table 7
Continued

System Category	Industry Category	Career Category
Marketing System *(creating demand for products)*	*Marketing*	Agri-marketing
		Ag Journalist - writer
		Ag Journalist – editor
		Ag journalist - photographer
		Marketing Products
		Marketing Promotion
		Media
	Packaging	Packing Shed Manager
Sales System *(getting goods/services to consumers)*	*Sales*	Farm Supply Sales Rep
		Ag Equipment Sales
		Animal Health Care Sales
		Chemical Sales
		Chemical Supply Sales
		Commission Sellers
		Equipment Sales
		Feed/Supplemental Sales
		Fertilizer Sales
		Garden Center Sales
		Grower Supply Sales Rep
		Herbicide Sales
		Production Food Processing - sales
		Sales of Product to Wholesale
		Tractor Dealer/Salesman
		Retail Florist
		Wholesale Sales to Retail
Logistic System *(warehouse, trucking, delivery)*	*Delivery/Distribution Systems*	Feed Distributors

Table 7
Continued

System Category	Industry Category	Career Category
		Storage
		Warehousing
Transportation System		
	Shipping	
		Ag Systems Coordinator *(shipping and distribution)*
		Ag Hauling
		Production Food Processing - drivers
		Transportation - railroad engineer
Retail brokers		
	Food Industries	
		Private Food Firms
		Retailer
Government		
	Government (all levels)	
		USDA – *(i.e. forest service, NRCS, FDA, etc.)*
		Federal Agency Staff
		Federal Government Agency Employee
		Government Relations
		Individuals in Government Agencies
		State Agency Staff
		State Government Agency Employees
Diplomacy/Trade System		
	Legislation, Policy, and Regulation	
		Government Policy *(Farm Bill, USDA, BLM, Forrest Service, etc)*
		Federal Regulatory Agencies
		Negotiations
		Regulatory *(i.e. TDA, EPA, TCEQ)*
		Regulatory/Policy
	Trade Relations	
		Wholesaler
		Wholesale Brokers

Table 7
Continued

System Category	*Industry Category*	Career Category
Service System (*services that keep the system operating)*	*Support*	Agencies – Farm Bureau, NCBA, etc
		Commodity Associations
		Ag Lobbyist
		Aerial Spray Applicator
		Agricultural Recruiter
		Animal Inspector
		Applicator
		Auction House Employees
		Farrier
		Graders
		Grain Graders
		Inspectors
		Irrigation Installer
		Irrigation Maintenance
		Livestock Auction Workers
		Lobbyist
		Machinist
		Meat Graders
		Meat Inspector
		Mechanic
		Milk Graders
		Plant Inspector
		Quality Assurance
		Safety
		Tractor Mechanic
		USDA Inspectors
		Value-added Processes
	Consultants	
		Animal Nutrition Consultant
		Crop Consultant
		Environmental Consultant
		Veterinary Consultant

Table 7
Continued

System Category
Industry Category
Career Category
Agri-tainment (environmental education and tourism)
Technology
No career items reached consensus
Operational systems *(internal stakeholders keep system operating i.e. finance, HR, payables, customer service, IT, BT [biotechnology], etc)*
No career items reached consensus

Note: Left justified text pertains to the System, centered text pertains to the Industry, and right justified text pertains to Careers.

IMPLICATIONS

Identifying and validating a list of items is one strategy used to help address awareness of the broad and diverse careers found in agriculture. Another possibility is to create a visual model or diagram that illustrates the variety of Careers, Industries, and Systems in such a way to help the public understand the interconnectedness of each in aiding educators in promoting agricultural literacy.

The research and findings of this study can improve the AgForLife concept. AgForLife is used to help educate the general public about the various opportunities related to, but not limited to, occupational and career opportunities in agriculture, food and life sciences. In an effort to reveal the diverse opportunities represented by the various sectors, the two-dimensional AgForLife Map aides in the visualization of different employment opportunities and careers. This comprehensive map will better assist students by providing knowledge of multiple career paths and opportunities in the agriculture, food, and life sciences (Romero & Ramirez, personal communication, 2004).

When comparing items reaching consensus to those websites reviewed in the literature, it is apparent the items categorized in this study could help strengthen as well as complement the information found in the websites.

RECOMMENDATIONS

1. More research is needed in categorizing the different Careers, Industries, and Systems and should be refined in future studies.

2. Future studies should consider expanding the list of each category in this study to develop an awareness of the broad diversity of agricultural opportunities in its current structure.
3. More research is needed in order to create accurate illustrations and diagrams of the entire agricultural sector.
4. More research is needed to further eliminate any similarities between items in this study.
5. Future studies should validate the categorization of the items found in this study.
6. Conduct similar studies with a large number of minority experts to help ascertain whether minority populations have a limited perspective about careers in agriculture.
7. A similar study should be conducted using experts from traditional fields in the agricultural sector. Comparing the two studies could further identify and validate additional careers, industries and systems.

Overall, the research in this study conveys the impact of agriculture on society but more research is needed to improve upon these findings. As evident by this study, developing an awareness of the broad agricultural Careers, Industries, and Systems in agriculture can prove helpful in addressing the negative image and challenges facing the agricultural industry in all its dimensions.

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APPENDIX A

EMAIL LETTER TO SOLICIT DELPHI PANEL EXPERTS

SUBJECT: Delphi Study in Agriculture, Food, and Life Sciences

Dear _____:

Greetings! My name is Edward W. Romero, a part-time doctoral graduate student at Texas A&M University in the Department of Agricultural Leadership, Education and Communications. I am identifying experts in various career fields for my study and you were selected to be a possible participant by someone who is familiar with you and or knows of your career interests and experiences. A total of 20 experts will be identified to participate in this study.

Contemporary agriculture is much different than it was 30 years ago. The perception about agriculture by the general public is largely still visualized as primarily farming and ranching, or linked primarily to production agriculture. The purpose of this study is to identify, examine and validate the various components and systems in agriculture, food, and life sciences.

This study will employ the Delphi technique of obtaining group consensus which may consist of several rounds of questions sent to experts over a period of two to four months (depending on panel's responses). Validating this study will assist us in beginning to depict accurately the agricultural industry in a holistic way, which translates into helping educate the public and provide awareness about opportunities in agriculture, food, and life sciences.

Attached to this email, you will find a one-page Microsoft Word document called a *Personal Questionnaire for Experts* form. Please take 10-15 minutes to complete the form by **Friday, April 27, 2007**, whether taking part or declining to participate in the study. Once you have completed the form, save the document to your desktop, attach the file, and return back to me at ewromero@tamu.edu. If you need the file in a different format, please let me know.

You will receive no monetary compensation for participating in this study should you decide to participate.

This study is confidential and any personal information that identifies you from the survey will be coded to further protect your privacy. The records of this study will be kept private. Research records will be stored securely and only Edward W. Romero, principal investigator will have access to the records. Your decision whether or not to participate will not affect your current or future relations with Texas A&M University. You can contact Edward Romero at 979-845-3712 or ewromero@tamu.edu and Dr. Joe Townsend, committee chairman at 979-845-3712 or jtownsend@tamu.edu with any questions about this study.

Once all of the *Personal Questionnaire for Experts* forms are received, a final selection of Delphi panel experts will be conducted and you will be notified whether you were selected to participate in this study.

A copy of the findings can be sent to you upon request once the research has been conducted and the final data has been analyzed.

Thank you in advance for your consideration in assisting with this study.

Sincerely,

Edward W. Romero
Principal Investigator

APPENDIX B

PERSONAL QUESTIONNAIRE FOR EXPERTS FORM

Personal Questionnaire for Experts

Identifying, Examining, and Validating a Description of the Industry in Agriculture, Food, and Life Sciences

Delphi Study

Edward W. Romero, PhD Candidate, Texas A&M University

Name: **Gender:** **M** ☐ **F** ☐ **Age Group:** **Drop Down - select one**

Mail Address: **City:** **State:** **Zip:**

Work Phone: **"Other" Contact Phone:** **Race/Ethnicity** *(optional)*: **Drop Down - select one**

Email: **High School Diploma:** **Yes** ☐ **No** ☐

Current Employment:
Name of Organization Where You Work:

Industry or Career (*use reference list below*)

Position/Title: **Years:** **Months:**

Location of Work: (**City**) (**State**)

Academic Credentials (Please list your **major(s)** if applicable**):**

Bachelors:

Masters:

Doctorate:

Other:

Please break down the number of years in the following industries/careers (choose all that apply**):**
"Years" do not have to add up to total number of years in the workforce (see below) if you have had "dual/multiple roles" simultaneously.

	Agribusiness		Law **or** Public Policy
	Arts		Medicine **or** Healthcare
	Banking **or** Finance **or** Accounting		Natural Resources **or** Environment **or** Conservation
	Biotechnology		Nonprofit **or** Public Service
	Communications		Pharmaceutical
	Construction		Production Agriculture
	Education		*(i.e. farming, ranch mgmt., raising livestock, growing crops)*
	Engineering		Real Estate
	Food System		Research and Development
	Government		Transportation
	Industrial **or** Manufacturing		Tourism **or** Recreation
	International		Other - please specify

Total number of years you have been employed and in the workforce:

Expertise-Related Question *(Limited up to 500 characters if needed)*
Please describe or explain the area you feel **MOST** qualified as your area of expertise from the industries/careers above, including "other" if relevant. Elaborate extensively and clarification of any of the above questions is encouraged in this area. A cross-section of experts are needed for this research.

☐ Yes, I am willing to PARTICIPATE in this study. Checking the box constitutes my signature and approval to be considered as an expert in your study.

☐ No, I DECLINE to participate as an expert in this study.

Date:

Thank you for completing this form.

APPENDIX C

ACCEPTANCE NOTIFICATION LETTER TO EXPERTS

Subject: Delphi Study

Dear _____:

Greetings from Texas A&M University!

As promised, I am responding to let you know that you have been selected to participate in my Delphi study titled*; Identifying, Examining, and Validating a Description of the Industry in Agriculture, Food, and Life Sciences.*

This study will employ the Delphi technique of obtaining group consensus which consists of several rounds of questions sent to experts over a period of several months, depending on the panel's responses. Validating this study will assist us in beginning to depict accurately the agricultural industry in a holistic way, which translates into helping educate the public and provide awareness about opportunities in agriculture, food, and life sciences.

In approximately one week, I will be sending you the first round of questions with further instructions on what you will need to do to complete the first round of questions. In the meantime, please be sure to allow any emails sent from me to be able to pass any filters that may be set by you or your email provider. All correspondence from me will be using the ewromero@tamu.edu email address.

Again, thank you for willing to assist me with my study. I look forward to beginning my research.

Regards,

Edward W. Romero
Principal Investigator

APPENDIX D

ROUND ONE - EMAIL COVER LETTER

Subject: Romero Delphi Study – First Round

Dear _____:

As promised, attached you will find the first set of questions along with brief instructions. Listed below is a tentative schedule of how I anticipate the study to proceed. In order to give you an idea of what kind of timeline we are anticipating, I have included some tentative dates to help in the process. ***Please keep in mind these dates are not firm and can change because much of how we proceed will be determined by a variety of factors, including the information received.*** Nonetheless, you may find a timeline useful and can provide guidance as we move into the research process.

1. Transmission of the first round of questions to the panelists
    a. Mailed May 23, 2007 - Due back to PI, **June, 6, 2007** (two weeks).

2. Analysis of the first round responses and prepares round two
    a. Approximately one week

3. Transmission of the second round of questions to the panelists
    a. Mail out around June 14, 2007 – Due back to PI **June 28, 2007** (two weeks)

4. Analysis of the second round responses (approximately one week to analyze responses)
    a. Steps 3 and 4 are reiterated as long as desired or necessary to achieve stability in the results

5. Consensus and agreement (***assumed for the sake of timeline*** – can change)
    a. Mailed out around July 5, 2007 – Due back to PI **July 12, 2007** (one week)
    NOTE: For this timeline it is assumed at the end of round three consensus is reached. If not, further rounds will need to be used and dates will be provided accordingly.

6. Preparation of the report and conclude the exercise

Again, thank you for willing to assist me in this study. The information you provide will be critical to arrive at consensus on what our agricultural industry may represent.

Sincerely,

Edward W. Romero
Principal Investigator (PI)

APPENDIX E

FIRST ROUND QUESTIONS

Identifying, Examining, and Validating a Description of the Agriculture Industry

Edward W. Romero
Doctoral Student

Instructions

Please answer the following questions below. Once you have answered the questions to your satisfaction, please save the file to your desktop, attach to your email and send to ewromero@tamu.edu by **Wednesday, June 6, 2007.**

In the agriculture process there is usually a set of steps taken that helps goods and products reach the consumer. This process is called a supply chain. Each supply chain can include an Input, Process, and Output. In each input there are broad and varied agricultural systems.

1. What are the different careers associated with agriculture? ***List all that apply.***

2. What are the industries that play an important role in the Input segment of agriculture? ***List all that apply.***

3. What are the system components needed to depict the industry of agriculture? ***List all that apply.***

APPENDIX F

ROUND TWO – EMAIL COVER LETTER

Subject: Round Two – Romero Delphi Study

Dear Delphi Expert:

Wow, how time flies! It seems it was just yesterday that I was getting started with round one. Four weeks later, we are beginning the next round.

As we begin with Round Two, let me briefly summarize Round One. After receiving all of your information (and there were lots of items as you can tell from the documents) I eliminated duplicates, sorted, then purged the three questions individually then collectively. I then proceeded to categorize your responses as a point of reference for round two.

In this round, you will find in the documents Section I & II, which is dealing with Systems and Industry and Section III is dealing with Careers. I have attached two different formats (Word and Excel) for your use. Completing either one is fine, however, if you are comfortable using Excel, this method is preferred. Both documents are very similar (same content) so choose which method best suites your comfort level. I painstakingly have organized the information for you to be able to "agree" or "disagree" with each of the item responses as this is the round we begin to build consensus. In addition, you are provided a "comments" section for each item in order for you to share your comments for any particular item if desired.

As you scroll through the items, please note I have carefully made as little changes as possible to your original responses in order to keep the creative intent and integrity of your answer. For those items with brackets, I have added my comments. In addition, items with a red question mark are items that were unclear to me and therefore, I interpreted based on my knowledge. Perhaps if you recognize your response and would like to clarify, please do so at this time using the comments section.

Instructions and directions should be clear, but as always, if you have any questions, please do not hesitate to let me know. Please return your responses (one document) back to me on or before **Wednesday, July 11, 2007**, to ewromero@tamu.edu. Do not let the number of pages scare you when you open the documents, but because of formatting, the task may seem daunting; however, once you get started I am confident you will have no problem in completing this round.

I cannot say it enough, but "thank you" for helping me with this study. Your involvement in this study will provide us with valuable information as we look for ways to improve how we communicate with the general public about agriculture.

Appreciatively,

Edward W. Romero
Principal Investigator

APPENDIX G

SECOND ROUND QUESTIONS

Round Two – Romero Delphi Study

Identifying, Examining, and Validating a Description of the Agriculture Industry

Return by: **Monday, July 9, 2007**

SECTION I & II - System and Industry: The purpose of this part of the study is to begin to build consensus based on the two questions below. Please note that not all systems (gray boxes) have a corresponding industry (light blue box) listed below each system.

Instructions: For each gray box, apply the "System Question" below and place your answer to the right for each item. For each light blue box, apply the "Industry Question" below and place your answer to the right of each item. Place an "x" under the corresponding field (i.e. Yes, No, Unsure) for each item. For any "NO" answers, a COMMENT field has been provided for you to share comments if needed.

SYSTEM QUESTION: *Do you agree that the system components listed below (far left - gray cells) depict the broad agricultural field?*

INDUSTRY QUESTION: *Do you agree that the industries listed below (center - light blue cells) play an important role in the agricultural segment?*

	Yes	No	Unsure	Comments
Educational Components [System]				
Community and Social Infrastructure				
Production System (basic component input that provide raw materials)				
Ag Production				
Farmer/Farming				
Ranching				
Animal System (breeders etc.)				
Animal Industries				
Plant System (breeders of seed etc.)				
Agronomy				
Fertilizer industry (potash)				
Grain Industry				
Labor (workers, management, immigration issues, protection and safety issues, regulatory)				
Natural Resources				
Conservation components				
environmental inputs (land, water, wildlife, environmental regulations)				
Manufacturing System (takes production inputs and processes to consumable goods)				
Processing				
Energy				
Research and Development System (improvement to manufacturing or production)				

Science Systems				
Science				
Veterinary industry				
Financial System				
Business				
Management				
Land / Real Estate				
Engineering System				
Engineering/Equipment				
Equipment				
Equipment Manufacturing				
Manufacturers of hard goods – handling equipment, tractors, etc				
Hydrologic System				
Marketing System (creating demand for products)				
Marketing				
Packaging				
Sales System (getting goods/services to consumers)				
Sales				
Logistic System (warehouse, trucking, delivery)				
Delivery/Distribution Systems				
Transportation System				
Shipping				
Retail Brokers				
Food Industries				
Government				
Government (all levels)				
Diplomacy/Trade System				
Legislation, Policy, and Regulation				
Trade Relations				
Service System (services that keep the system operating)				
Support [?]				
Consultants				
Tourism				
Technology				
Operational System (internal stakeholders that keep the system operating i.e. finance, HR, payables, customer service, IT, BT [biotechnology?], etc)				

SECTION III - Careers The purpose of this part of the study is to begin to build consensus based on the career question below. This section focuses only on the careers portion of the study. The System and Industry are only included in this part of the study as a point of reference related to careers. Only consider the question below for each career related item. For any "NO" answers, a COMMENT field has been provided for you to share comments.

Instructions: Please mark your answer to the right of each "career" with an "x" under the corresponding field for each just as you did in Section I & II.

CAREER QUESTION: *Do you agree that the careers listed below (far right – white cells) are associated with agriculture?*

	Yes	No	Unsure	Comments
Educational Components [System]				
agriculture leadership				
ag literacy promotion				
certification				
academia - professor				
ag science				
ag teacher				
agriscience-hort teacher				
colleges of agriculture [education ?]				
educational instructors				
educator - college level				
educator – high school level				
extension education/agent				
extension home economist				
extension specialist				
extension/outreach				
faculty at tech school				
faculty at university				
formal education- teaching all levels				
secondary agricultural education programs				
teaching				
Community and Social Infrastructure				
consumer				
development [?]				
health				
sociology				
Production System (basic component input that provide raw materials)				

Ag Production				
landscaping				
sanjero *(ditch digger)*				
agriculture/growing "production"				
aquaculture				
beekeeper				
cowboy				
dairy farmer				
elevator workers				
feedlots				
grain handlers				
irrigator				
milk handlers				
pest scout				
pesticide applicator				
poultry				
production farm owners				
utilization of agricultural product – dairies, etc [?]				
Farmer/Farming				
veg farms				
tractor driver				
grower				
fruit farms/orchard				
feed grower				
crop farmer				
Ranching				
cattle farmer				
stock supplier [livestock ?]				
ranch hand				
ranchers				
Animal System (breeders etc.)				
Animal Industries				
livestock production				
meat				
herdsman				
animal production				
animal production/husbandry				
animal sciences - husbandry				
animal sellers				

Plant System (breeders of seed etc.)				
seed production				
plant production/husbandry				
planting/growing/harvesting				
wholesale florist				
crop management *(genetics, ag chemicals, fertilizers, scouting, equipment, precision ag)*				
crop protection				
florist				
greenhouse grower				
greenhouse operator				
horticulturist				
hothouses for sprouts [greenhouse?]				
nursery				
nurseryman				
nuts				
row crop				
Agronomy				
agronomist				
golf course horticulturist				
ground's keeper				
grounds/turf				
turf – golf courses				
turf – stadiums				
Fertilizer industry (potash)				
fertilizer production				
ag chemical supplier				
ag chemical supply				
biological and chemical industries				
crop chemical - Dow				
fertilizer application				
fertilizer dealers				
fertilizer supplier				
fertilizer/pesticide handlers				
Grain Industry				
buyer – grain				
feed seller				
feed supplier				
feed/seed companies				

feedstuffs				
seed for plants & vegetables				
seed supplier				
seed/genetics firms				
Labor (workers, management, immigration issues, protection and safety issues, regulatory)				
production agriculture employees				
field hands				
migrant				
hired hands				
farm laborer				
labor contractor				
Laborer				
landscape contractor laborer				
landscape maintenance laborer				
Natural Resources				
Conservation components environmental inputs (land, water, wildlife, environmental regulations)				
ecologist				
environment				
environmentalist				
forest ranger				
forester				
forestry				
municipal arborist				
natural resources positions [?]				
Silviculturist				
soil conservation specialist				
wildlife				
wildlife advisor				
wildlife specialist				
Manufacturing System (takes production inputs and processes to consumable goods)				
Processing				
pharmaceutical - Pfizer				
agricultural products				
clothing				
cotton for fabric				
cotton processing				

food processors				
lumber and sawmill operators				
machinery operator				
meat cutter				
preparation				
processing facilities				
processing gins for cotton				
processing mills for grains				
processing plants - food				
processing plants - meat				
processing plants - milk				
processor elevators				
processors packaging facilitites				
refining/processing				
slaughter work				
synthetics for fabrics				
wool processing				
Energy				
fuel industry				
fuel suppliers				
Research and Development System (improvement to manufacturing or production) **Science Systems [?]**				
Science				
tissue Culturist				
ag scientist				
animal scientist				
arborist				
artificial insemination technician				
biochemist				
biologist				
biosciences				
botanist				
breeder				
chemical sciences				
chemist				
climate				
entomologist				
equine				

experiment station work				
food scientist				
geneticist				
genetics companies				
geography				
geology				
government researcher				
health research				
meat scientist				
meteorology				
nursery propagator				
nutritionist				
pathology				
plant breeding				
plant pathologists				
plant scientist				
research and technology associated with animal genetics				
research and technology associated with plant genetics				
research and technology associatged with bio-engineering				
research specialist				
research/development - university community				
researcher				
science researcher				
seed developers				
soil scientist				
soils				
toxicologist				
university researcher				
various types of scientists				
virology				
Veterinary industry				
veterinarian				
veterinary assistant				
veterinary medicine				
veterinary services				
Financial System				
Business				
inputs [?]				

economic analysis *(profit/loss, taxation, optimization of scale, debt management)*				
economics				
commission buyers				
business entrepreneur				
ag commodity coordinator				
agri-business				
financial services				
accountant				
ag credit specialist				
ag credit/financial operations				
analyst				
banking				
banking manager				
brokers				
commodity trader/broker – *(i.e. grain, citrus, cattle, etc)*				
credit and banking				
credit manager				
crop insurance				
finance				
Financial *(financing for operations)*				
financial advisors				
Financial Analyst				
Financial industries				
financial planner				
Financial planning (*hedging, protection from commodity price changes*)				
Financial trading				
insurance				
Lending institutions – Banks				
Lending/Finance				
operation accountant				
stockbroker				
Management				
cooperative manager				
golf course superintendent				
production agriculture managers				
business management				
coop manager				
executive level management – country manager				

executive level management - finance				
executive level management - sales				
executive level management - VP operations				
farm manager				
finishing manager [feedlot?]				
food category manager				
foreman				
garden center manager				
golf course greens manager				
internal affairs manager				
international business manager				
irrigation management *(Hydrology)*				
labor supervisor - team leader				
landscape contractor crew chief				
landscape maintenance crew chief				
landscape maintenance manager				
majordomo *[foreman]*				
manager				
market research manager *(providing market share data)*				
marketing communications manager				
marketing director				
marketing manager				
meat packing plant crew leader				
meat packing plant manager				
natural resource management assistance				
office manager				
operations director				
plant manager				
production food processing management				
production manager				
ranch manager				
range management specialist				
wildlife management				
Land / Real Estate				
capital investment				
capital				
land acquisition preparation				
land appraiser				
real estate agent				

Engineering System				
Engineering/Equipment				
agricultural engineer				
engineering - ag				
engineering - chemical				
engineering - civil				
engineering - computer				
engineering – electrical				
engineering - ergonomics				
engineering - hydrological				
engineering - mechanical				
irrigation system designer				
Equipment				
Equipment Manufacturing *Manufacturers of hard goods – handling equipment, tractors, etc*				
ag equipment supply				
equipment dealers				
equipment operator				
equipment repair				
equipment service				
equipment supplier				
factory worker *(manufacturers hard goods)*				
farm equipment supplier				
hard goods supplier				
machinery				
machinery dealers and handlers				
Hydrologic System				
water				
water delivery systems/operation especially flood irrigation				
water management entities				
Marketing System (creating demand for products)				
Marketing				
agri-marketing				
contract marketing firms				
advertising *(influences input decisions)*				
ag journalist - writer				
ag Journalist – editor				
ag journalist - photographer				

journalism				
marketing products				
marketing promotion				
marketing specialists				
direct marketing				
media				
positive resources *(such as advertisement)*				
Packaging				
container design/supply				
packers				
packing and value-added				
packing shed manager				
Sales System (getting goods/services to consumers)				
Sales				
farm supply sales rep				
ag equipment sales				
animal health care sales				
chemical sales				
chemical supply sales				
commission sellers				
equipment sales				
feed/supplemental sales				
fertilizer sales				
garden center sales				
grower supply sales rep				
herbicide sales				
inside and outside sales [?]				
landscape design sales				
pharmaceutical sales				
production food processing - sales				
sales of product to wholesale				
sales representative				
telesales				
tractor dealer/salesman				
retail florist				
wholesale sales to retail				
Logistic System (warehouse, trucking, delivery)				
Delivery/Distribution Systems				
feed distributors				

distribution				
product distribution				
storage				
warehousing				
Transportation System				
Shipping				
transportation				
ag systems coordinator *(shipping and distribution)*				
ag hauling				
production food processing - drivers				
train operator				
transportation - ports				
transportation - railroad				
transportation - railroad engineer				
transportation - sea freight firms				
transportation - truck driver				
transportation - warehouse man				
trucking companies				
Retail brokers				
Food Industries				
beverages				
private food firms				
restaurant industry				
retailer				
Government				
Government (all levels)				
USDA – *(i.e. forest service, NRCS, FDA, etc.)*				
federal agency staff				
federal government agency employee				
federal legislators *(staff)*				
government - local				
government - state				
government relations				
individuals in government agencies				
state agency staff				
state government agency employees				
state legislator *(staff)*				
Diplomacy/Trade System				
Legislation, Policy, and Regulation				

government policy *(Farm Bill, USDA, BLM, Forrest Service, etc)*				
federal regulatory agencies				
negotiations				
regulatory *(ie. TDA, EPA, TCEQ)*				
regulatory/policy				
Trade Relations				
automotive				
grocery retail chains				
wholesaler				
wholesale brokers				
Service System (services that keep the system operating)				
Support [?]				
landscape contractor				
garden center employee				
landscape designer				
agencies – farm bureau, NCBA [?], etc				
commodity associations				
college recruiter				
ag lobbyist				
aerial spray applicator				
agricultural recruiter				
aircraft maintenance				
aircraft operation				
animal inspector				
applicator				
auction house employees				
biometrician *(analyze data for trends and underlying relationships)*				
construction				
ditch rider				
event planner/coordinator				
farrier				
graders				
grain graders				
grocery store workers				
human resource management				
inspectors				
irrigation installer				

irrigation maintenance				
law				
learning and development manager [trainer?]				
legal services				
livestock auction workers				
lobbyist				
machinist				
meat graders				
meat inspector				
mechanic				
milk graders				
plant inspector				
quality assurance				
safety				
seamstress				
statistician				
tailor				
tractor mechanic				
trainer				
USDA inspectors				
value-added processes				
Consultants				
animal nutrition consultant				
crop consultant				
environmental consultant				
finance consultant				
management consultants				
veterinary consultant				
Tourism				
agritainment - environmental education and tourism				
Technology				
computer systems analyst				
computer science				
computer technology				
information systems/technology				
nanotechnology				
telemetry data systems				
Operational systems (internal stakeholders keep system operating i.e. finance, HR, payables, customer service, IT, BT [biotechnology?], etc)				

short and long-term planning				
technical support *(either field or phone bases support network for goods and service)*				
organizational & communication skills				

This concludes this portion of the study. Please save the document to your computer and email your document to Edward at ewromero@tamu.edu on or before, **Monday, July 9, 2007**.

Thank you!

APPENDIX H

ROUND THREE - EMAIL COVER LETTER

Subject: Romero Delphi – Third and Final Round

Dear Delphi Experts:

The last and final (third) round in this study is upon us. Before I give you the instructions prior to the last round, let me summarize how we arrived where are.

Initially, the Delphi experts (you) provided me with a list of answers to a set of three questions dealing specifically with systems, industry, and careers. Once I received the first round of responses from you, I painstakingly categorized the responses into system categories (gray boxes), industries (light blue boxes), and finally careers (white boxes). In all, over 500 responses were provided by you once duplicates to the three questions were removed.

The second round was sent out categorized by system, industry, and careers as mentioned above. The choices for answers were yes, no, and unsure. In addition, the second round began to build consensus. After receiving all of the responses in round two, tabulations and analysis were conducted and those that did not meet majority were no longer considered. Consensus responses were set aside and will be used in the final report. *Responses that reached majority (over 50% favorable), but less than 75% favorable responses, were separated from the initial responses and are being sent as part of round three.*

In short, round three is addressing the questions which received a majority (51% or more) of favorable responses, but consensus was not reached (less than 75% favorable response) in round two.

Instructions for Round Three
Attached are two documents - an Excel and Word document. Both have the same content but are formatted differently due to software limitations. You are welcome to use either format, but using Excel is preferred. Please be diligent in answering all of the questions in the study in round three as this helps to improve the quality of the study. The deadline for round three is **Wednesday, September 26, 2007.**

In round three, the only response you will have is to mark either a YES or NO box to determine whether you agree or disagree with each of the responding questions. I have attached comments from the Delphi experts from previous rounds in order to help you determine your answer. In addition, there is a box for any general comments you wish to provide.

Please note I have included a number of system and industry categories that have already reached consensus as identified by a green **CONSENSUS** label next to them and have blocked out the YES and NO boxes – so no response is needed for those. My reason for including them is strictly for your reference and to help you better understand where some of the careers that did not reach consensus fall in the area under system and industry.

There are no system category questions that require a response; however, there are three (3) industry categories that have not reached consensus. They are identified by red **CONSENSUS NEEDED** text next to that category requiring your response. The majority of the responses required in this round fall under career categories.

While you are answering either the industry or career questions, please read their corresponding question (see below) carefully and apply it to their respective category prior to providing your answer. These questions are also included in your questionnaires.

Questions:

1. **SYSTEM QUESTON (Gray boxes):** *No responses needed in this round.*
2. **INDUSTRY QUESTION (Light-blue boxes):** *Do you agree that the industries listed below play an important role in the agricultural segment?*
3. **CAREER QUESTION:** *Do you agree that the careers listed below are associated with agriculture?*

This round of the study will be the shortest and will take you the least amount of time to complete. I anticipate it will take you approximately 15 to 20 minutes to complete. My goal for this last round is to achieve 100% response rate.

As always, if something is not clear or you have any questions, please do not hesitate to let me know and I will be happy to provide more information.

In closing - thank you for taking the time from your busy schedule to assist me with this study. I know you are busy but I have valued your responses and appreciate your comments and suggestions. Obviously, without your support and involvement I would not be where I am today with this research. I am optimistic that this study will contribute to the continued effort to showcase agriculture as a diverse industry with many opportunities. In our own way, we have all contributed to this effort.

I look forward to receiving your responses very soon.

Sincerely,

Edward W. Romero
Principal Investigator
979-845-6465
ewromero@tamu.edu

APPENDIX I

ROUND THREE – CONSENSUS BUILDING QUESTIONNAIRE

Round Three – Romero Delphi Study

Identifying, Examining, and Validating a Description of the Agriculture Industry

Return by: **Wednesday, September 26, 2007**

The purpose of this part of the study is to build consensus based on the questions below for the pending questions. The *System* and *Industry* section are included in this part of the study as a point of reference related to *Careers* (with the exception of the three Industry questions needing your response). Consider the appropriate question for each related item.

INSTRUCTIONS: Please mark your answer to the right of each question with an "x" under the corresponding field.

While you are answering either the industry or career portion of the survey, please read the corresponding question below carefully and apply it to their respective category of the survey prior to providing your final answer.

SYSTEM QUESTON (Gray boxes): *No responses needed in this round.*

INDUSTRY QUESTION (Light-blue boxes): *Do you agree that the industries listed below play an important role in the agricultural segment?*

CAREER QUESTION (White boxes): *Do you agree that the careers listed below are <u>associated</u> with agriculture?*

	All Comments From Previous Rounds		Yes	No	Comments
Educational Components [System] ***CONSENSUS***					
Community and Social Infrastructure ***CONSENSUS NEEDED***	• Education is different than social infrastructure. • Without the community support and understanding, these systems will not be as successful.				
consumer	Not sure what this means…consumer education?				
health	• Medicine and nutrition • Indirectly related • not sure what this means				

sociology	• If their content area deals with agricultural issues broadly speaking • This is much broader than ag; while a good sociologist might consider ag systems, a number of other factors are included in this profession as well. • A separate field of study/practice				
Production System (basic component input that provide raw materials) ***CONSENSUS***					
Ag Production ***CONSENSUS***					
sanjero *(ditch digger)*	• If their content area deals with agricultural issues broadly speaking • Assuming ag related • Ditch rider is correct • Not production related				
Plant System (breeders of seed etc.) ***CONSENSUS***					
florist	Part of retail system				
Agronomy ***CONSENSUS***					
golf course horticulturist	Although these are agronomy-related				
turf – golf courses					
turf – stadiums					
Natural Resources ***CONSENSUS***					
Conservation components ***CONSENSUS*** environmental inputs (land, water, wildlife, environmental regulations)					
environmentalist	• If their content area deals with agricultural issues broadly speaking • Usually outside of ag!!				
natural resources positions [?]	Too broad…				
silviculturist	Don't know what this term means.				

finalmentewildlife	These careers are beyond the area of ag in the sense that ag seems to be related to "production" of some kind.				
wildlife advisor					
Manufacturing System (takes production inputs and processes to consumable goods) ***CONSENSUS***					
Processing ***CONSENSUS***					
pharmaceutical - Pfizer	• If their content area deals with agricultural issues broadly speaking • Not all pharmaceuticals are ag-based; this might need to be a bit more focused • Don't see as related directly to ag				
clothing					
Energy ***CONSENSUS NEEDED***	• If those areas are connected to the agricultural systems • Should reduce rate for elec to run pivot pumps • A separate field of study/practice				
fuel industry	• If their content area deals with agricultural issues broadly speaking • Inspectors & feedstock producers • Bio fuels • I might encourage classification of "bio-fuels" • Don't see as related directly to ag				
Research and Development System (improvement to manufacturing or production) ***CONSENSUS*** *Science Systems*					
Science ***CONSENSUS***					
chemical sciences	• If their content area deals with agricultural issues broadly speaking • Too generic				

chemist	• If their content area deals with agricultural issues broadly speaking • Too generic				
geography	• If their content area deals with agricultural issues broadly speaking • GI specialists • Too generic				
geology	• If their content area deals with agricultural issues broadly speaking • Too generic				
health research	• If their content area deals with agricultural issues broadly speaking • Too generic				
meteorology	• If their content area deals with agricultural issues broadly speaking • Too generic				
various types of scientists	• If their content area deals with agricultural issues broadly speaking • Assuming ag related • Lacks specificity • Too generic				
virology	• If their content area deals with agricultural issues broadly speaking • Assuming ag related • Too generic				
Financial System *CONSENSUS*					
*Business **CONSENSUS***					
economics	• If their content area deals with agricultural issues broadly speaking • Assuming ag related • Too generic				

commission buyers	• If their content area deals with agricultural issues broadly speaking • Too generic				
business entrepreneur	• If their content area deals with agricultural issues broadly speaking • Assuming ag related • Too generic				
analyst	• If their content area deals with agricultural issues broadly speaking • Lacks specificity • Too generic				
credit and banking	• If their content area deals with agricultural issues broadly speaking • Too generic				
credit manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
financial advisors	• If their content area deals with agricultural issues broadly speaking • Too generic				
Financial Analyst	• If their content area deals with agricultural issues broadly speaking • Too generic				
Financial industries	• If their content area deals with agricultural issues broadly speaking • Too generic				
financial planner	• If their content area deals with agricultural issues broadly speaking • Too generic				
Financial trading	• If their content area deals with agricultural issues broadly speaking • Too generic				

insurance	• If their content area deals with agricultural issues broadly speaking • Too generic				
Lending institutions – Banks	• If their content area deals with agricultural issues broadly speaking • Too generic				
operation accountant	• If their content area deals with agricultural issues broadly speaking • Too generic				
stockbroker	• If their content area deals with agricultural issues broadly speaking • Too generic				
Management ***CONSENSUS***					
golf course superintendent					
business management	• If their content area deals with agricultural issues broadly speaking • Too generic				
executive level management – country manager	If their content area deals with agricultural issues broadly speaking				
executive level management - finance	• If their content area deals with agricultural issues broadly speaking • Too generic				
executive level management - sales	• If their content area deals with agricultural issues broadly speaking • Too generic				
executive level management - VP operations	• If their content area deals with agricultural issues broadly speaking • Too generic				
Finishing manager [feedlot?]	If their content area deals with agricultural issues broadly speaking				

golf course greens manager					
internal affairs manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
international business manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
majordomo *[foreman]*	• If their content area deals with agricultural issues broadly speaking • Too generic				
manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
market research manager *(providing market share data)*	• If their content area deals with agricultural issues broadly speaking • Too generic				
marketing communications manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
marketing director	• If their content area deals with agricultural issues broadly speaking • Too generic				
marketing manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
operations director	• If their content area deals with agricultural issues broadly speaking • Too generic				
plant manager	• If their content area deals with agricultural issues broadly speaking • Too generic				

production manager	• If their content area deals with agricultural issues broadly speaking • Too generic				
*Land / Real Estate **CONSENSUS***					
capital investment	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
capital	• If their content area deals with agricultural issues broadly speaking • Financial system? • Not directly related to ag				
land acquisition preparation	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
real estate agent	• If their content area deals with agricultural issues broadly speaking • not directly engaged in agriculture • Not directly related to ag				
Engineering System *CONSENSUS*					
*Engineering/Equipment **CONSENSUS***					
engineering - civil	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				
engineering - mechanical	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				
Equipment *CONSENSUS*					
*Equipment Manufacturing **CONSENSUS*** Manufacturers of hard goods – handling equipment, tractors, etc					

factory worker *(manufacturers hard goods)*	Appears to be a separate category				
Marketing System (creating demand for products) ***CONSENSUS***					
Marketing ***CONSENSUS***					
contract marketing firms	• If their content area deals with agricultural issues broadly speaking • May be related but can be totally distinct				
advertising *(influences input decisions)*	• If their content area deals with agricultural issues broadly speaking • May be related but can be totally distinct				
journalism	• If their content area deals with agricultural issues broadly speaking • I think only ag-specific writers should be included in ag industry • Not related, totally distinct				
marketing specialists	• If their content area deals with agricultural issues broadly speaking • May be related but can be totally distinct				
direct marketing	• If their content area deals with agricultural issues broadly speaking • May be related but can be totally distinct				
media	• If their content area deals with agricultural issues broadly speaking • only ag-media should be included in this sector • Not related, totally distinct				
positive resources *(such as advertisement)*	• If their content area deals with agricultural issues broadly speaking • What the heck is a "positive" resource? • May be related but can be totally distinct				
Packaging ***CONSENSUS***					

container design/supply	May be related but can be totally distinct				
packers	May be related but can be totally distinct				
packing and value-added	May be related but can be totally distinct				
Sales System (getting goods/services to consumers) ***CONSENSUS***					
Sales ***CONSENSUS***					
landscape design sales	Too generic				
pharmaceutical sales	• If their content area deals with agricultural issues broadly speaking • Only on the ag chemical/derivative side of pharmaceuticals • Don't see as related directly to ag				
sales representative	• If their content area deals with agricultural issues broadly speaking • Don't see as related directly to ag				
Logistic System (warehouse, trucking, delivery) ***CONSENSUS***					
Delivery/Distribution Systems ***CONSENSUS***					
distribution	Too generic				
product distribution	Too generic				
Transportation System ***CONSENSUS***					
Shipping ***CONSENSUS***					
transportation	Separate category				
train operator	Separate category				
transportation - ports	Separate category				
transportation - railroad	Separate category				
transportation - sea freight firms	Separate category				

transportation - truck driver	Separate category				
transportation - warehouse man	Separate category				
trucking companies	Separate category				
Retail brokers *CONSENSUS*					
*Food Industries **CONSENSUS***					
beverages	• Gatorade has nothing to do with Ag. • Separate industry				
restaurant industry	Not directly related to ag				
Government *CONSENSUS*					
*Government (all levels) **CONSENSUS***					
federal legislators *(staff)*	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
government - local	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
government - state	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
state legislator *(staff)*	• If their content area deals with agricultural issues broadly speaking • Too generic				
*Trade Relations **CONSENSUS***					
grocery retail chains	• If their content area deals with agricultural issues broadly speaking • Not sure how these fit here • Not directly related to ag				
wholesaler	• If their content area deals with agricultural issues broadly speaking • Not sure how these fit here				

	• Not directly related to ag				
wholesale brokers	• If their content area deals with agricultural issues broadly speaking • Not sure how these fit here • Not directly related to ag				
Service System (services that keep the system operating) ***CONSENSUS***					
Support ***CONSENSUS NEEDED***	• If those areas are connected to the agricultural systems • A separate field of study/practice				
landscape contractor	Not sure how these fit here				
garden center employee	Not sure how these fit here				
landscape designer	Not sure how these fit here				
college recruiter	• If their content area deals with agricultural issues broadly speaking • Not directly related to the industry • Not directly related to ag				
aircraft maintenance	Not directly related to ag				
biometrician *(analyze data for trends and underlying relationships)*	• If their content area deals with agricultural issues broadly speaking • Too generic				
construction	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
ditch rider	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
grocery store workers	Not directly related to ag				
human resource management	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				

law	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				
legal services	• If their content area deals with agricultural issues broadly speaking • Too generic				
statistician	• If their content area deals with agricultural issues broadly speaking • Not directly related to ag				
trainer	• If their content area deals with agricultural issues broadly speaking • Too generic				
Consultants ***CONSENSUS***					
finance consultant	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				
management consultants	• If their content area deals with agricultural issues broadly speaking • Too generic				
Technology ***CONSENSUS***					
computer systems analyst	• If their content area deals with agricultural issues broadly speaking • not directly related to the industry • A separate field of study/practice				
computer science	• If their content area deals with agricultural issues broadly speaking • Not directly related to the industry • A separate field of study/practice				
computer technology	• If their content area deals with agricultural issues broadly speaking • Not directly related to the industry • A separate field of study/practice				

information systems/technology	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				
Operational systems (internal stakeholders keep system operating i.e. finance, HR, payables, customer service, IT, BT [biotechnology?], etc) ***CONSENSUS***					
short and long-term planning	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				
technical support *(either field or phone bases support network for goods and service)*	• If their content area deals with agricultural issues broadly speaking • Too generic				
organizational & communication skills	• If their content area deals with agricultural issues broadly speaking • A separate field of study/practice				

APPENDIX J

RAW DATA – ROUND ONE

Round One - Raw Data Responses Including Duplicates and No Sorting

1. What are the different careers associated with agriculture?

Academia - professor
Accountant
Accountant
Aerial Applicator
Aerial Spray Application
Ag Chemical Supplier
Ag Commodity Coordinator
Ag Credit Specialist
Ag Engineer
Ag Equipment Sales
Ag Hauling
Ag Journalist - writer
Ag Journalist – editor
Ag Journalist - photographer
Ag Lobbyist
Ag Marketing
Ag Production
Ag Production
Ag Science
Ag Scientist
Ag Systems Coordinator – shipping and distribution
Ag Teacher
Agri-business
Agricultural Engineer
Agricultural Recruiter
Agriculture Engineer
Agriculture Leadership
Agriculture/Growing "production"
Agri-marketing
Agri-science - horticulture teacher
Agri-tainment - environmental education and tourism
Agronomist
Agronomist
Agronomist
Agronomy
Aircraft Maintenance
Aircraft Operation

Animal Health Care Sales
Animal Nutrition Consultant
Animal Production
Animal Science
Animal Sciences - husbandry
Animal Sellers
Applicator
Arborist
Artificial Insemination Technician
Banking
Banking
Banking
Beekeeper
Biochemist
Biology
Biology
Biometrician (analyze data for trends and underlying relationships)
Biosciences
Botanist
Breeder
Business - accounting
Business - banking
Business - insurance
Business - sales
Business Entrepreneur
Business Management
Buyer – grain
Cattle Farmer
Chemical Sciences
Chemical Supply Sales
Chemist
Chemistry
Chemistry
Colleges of Agriculture
Commission Buyers
Commission Sellers
Commodity Trader/Broker – (i.e. grain, citrus, cattle, etc)
Communication
Communications - internal affairs manager
Communications - marketing communications manager

Communications – public relation specialist
Computer Science
Computer Systems Analyst
Computer Technology
Consultant – crop consultant
Consultant - finance consultant
Consultant - veterinary consultant
Coop Manager
Cooperative Manager
Cotton Processing
County Extension Agent
Cowboy
Crop Farmer
Customer Service – telesales
Dairy Farmer
Diplomacy – negotiations
Diplomacy – trade relations
Ditch Rider
Ecologist
Ecologists
Economics
Economics
Economics
Education
Education
Education - extension
Education - teaching
Educational Instructors
Educator - college level
Educator – high school level
Elevator Workers
Engineering - mechanical
Engineering
Engineering - ag
Engineering - chemical
Engineering - civil
Engineering - computer
Engineering – electrical
Engineering - ergonomics
Engineering - hydrological

Engineering - mechanical
Engineering - mechanical
Entomologist
Entomologist
Entomologist
Environmental
Environmental Consultant
Environmentalist
Equipment Manufacturing
Equipment Operator
Equipment Repair
Equipment Sales
Equipment Service
Event Planner/Coordinator
Executive Level Management – country manager
Executive Level Management - finance
Executive Level Management - sales
Executive Level Management - VP operations
Experiment Station Work
Extension - extension agent
Extension Agent
Extension Agent
Extension Education
Extension Home Economist
Extension Specialist
Extension Specialists
Extension Work
Factory Worker – manufacturers hard goods
Faculty at Tech School
Faculty at University
Farm Equipment Supplier
Farm Laborer
Farm/Ranch Manager
Farmer
Farmer
Farmer
Farmer
Farming
Farming
Farming Itself

Farm Supply Sales Rep
Feed Distributors
Feed Grower
Feed Seller
Feed Supplier
Feed/Supplemental Sales
Ferrier
Fertilizer Application
Fertilizer Sales
Fertilizer Seller
Fertilizer Supplier
Fertilizer/Pesticide Handlers
Field hands
Fields
Finance
Finance
Finance - banking manager
Finance – credit manger
Financial
Financial Accounting
Financial Analyst
Financial Planner
Financial Planning – hedging, protection from commodity price changes
Financial Trading
Finishing Manager
Florist
Food Category Manager
Food Processing Workers
Food Science
Food Scientist
Food Scientist
Foreman
Forest Ranger
Forester
Formal Education- teaching all levels
Fruit Grower
Garden Center Employee
Garden Center Manager
Garden Center Sales
General Farmhand

Genetic Researcher
Geneticist
Geneticist
Geography
Geology
Golf Course Greens Manager
Golf Course Horticulturist
Golf Course Superintendent
Government - animal inspector
Government - federal regulatory agencies
Government - local
Government - plant inspector
Government - state
Government - wildlife advisor
Government Relations
Government Researcher
Graders
Grain Graders
Grain Handlers
Greenhouse Grower
Greenhouse Operator
Grocery Store Workers
Grounds Keeper
Grounds/Turf
Grower
Grower Supply Sales Rep
Growers
Health
Herbicide Sales
Herdsman
Horticulturist
Horticulturist
Human Resource Management
Human Resources
Individuals in Government Agencies
Information Systems/Technology
Insurance
International Business Manager
Irrigation Installer
Irrigation Maintenance

Irrigation Management (Hydrology)
Irrigation System Designer
Irrigator
Journalism
Labor Supervisor - Team Leader
Laborer
Laborer
Land Appraiser
Landscape Contractor
Landscape Contractor Crew Chief
Landscape Contractor Laborer
Landscape Design Sales
Landscape Designer
Landscape Maintenance Crew Chief
Landscape Maintenance Laborer
Landscape Maintenance Manager
Landscaper
Landscaper
Law
Lawyer
Learning and Development Manager
Lending/Finance
Livestock Auction Workers
Lobbyist
Logistics
Machinery Dealers and Handlers
Machinery Operator
Machinist
Majordomo
Management & Business – banking, accounting, sales, insurance
Manager
Manufacturing
Market Research Manager – providing market share data
Marketing
Marketing
Marketing
Marketing
Marketing
Marketing Director
Marketing Manager

Marketing Products
Marketing/Sales - commodity associations
Marketing/Sales - contract marketing firms
Marketing/Sales - grocery retail chains
Marketing/Sales - private food firms
Marketing/Sales - restaurant industry
Marketing - auction house employees
Marketing - p/r
Marketing - promotion
Marketing - sales
Meat Cutter
Meat Graders
Meat Inspector
Meat Packing Plant Crew Leader
Meat Packing Plant Manager
Meat Scientist
Mechanic
Mechanical Engineer
Meteorology
Milk Graders
Milk Handlers
Municipal Arborist
Nanotechnology
Natural Resources Positions
Nursery Propagator
Nurseryman
Nutritionist
Office Manager
Operation Accountant
Operations Director
Packaging
Packers
Packing Shed Manager
Pathology
Pest Scout
Pesticide Applicator
Pharmaceutical Sales
Plant Breeder
Plant Manager
Plant Production

Processing
Processing of Farm Goods - cannery for vegetables
Processing of Farm Goods - gins for cotton
Processing of Farm Goods - mills for grains
Processors - elevators
Processors - feedlots
Processors - packaging facilities
Processors - processing facilities
Production - aquaculture
Production – farming
Production - forestry
Production – nursery
Production – ranching
Production - Wildlife
Production Agriculture - farmers/ranchers
Production Agriculture - managers
Production Agriculture - production employees
Production Manager
Production Managers
Production - farm owners
Production - food processing - management
Production - hired hands
Production - migrant
Production - ranchers
Production - food processing - drivers
Production - food processing - production worker
Production - food processing - sales
Professors
Public Gardens Education Specialist
Public Gardens Horticulturist
Public Policy
Public Relations
Public Relations
Purchasers
Quality Assurance
Ranch Hand
Rancher
Rancher
Rancher
Ranching

Range Management
Range Management Specialist
Ranger Manager
Real Estate Agent
Regulatory (TDA, EPA, TCEQ)
Regulatory/Policy - federal government agency employee
Regulatory/Policy - federal legislators (staff)
Regulatory/Policy - state government agency employees
Regulatory/Policy - state legislator (staff)
Research
Research – biochemist
Research - biologist
Research - chemist
Research and Development
Research Specialist
Research/Development - genetics companies
Research/Development - seed developers
Research/Development - university community
Researcher in Ag
Researchers
Retail Florist
Retailer
Safety
Sales
Sales
Sales
Sales - chemical treatment sales to seed producers/manufacturers
Sales - inside and outside sales
Sales - sales of product to wholesale
Sales – seed sales to farmers
Sales - wholesale sales to retail
Sales and Marketing
Sales Rep
Sales Representative
Sanjero
Science - animal scientist
Science - nutritionist
Science - plant breeding
Science - plant scientist
Science - researcher

Scientific
Seamstress
Secondary agricultural education programs
Seed production
Seed sales
Seed sales
Service Industries - ag extension
Service Industries - chemical sales
Service Industries - equipment sales
Service Industries - financial advisors
Service Industries - lawyers
Service Industries - management consultants
Service Industries - technology
Slaughter Work
Sociology
Sociology
Soil Conservation Specialist
Soil Science
Soil Scientist
Soil Scientist
Soils
Statistician
Stock Supplier
Stockbroker
Suppliers – equipment
Suppliers - seed
Support Industries - feed/seed sales companies
Support Industries - fertilizer production and sales
Support Industries - packing sheds
Support Industries - trucking companies
Support Industries - veterinary medicine
Tailor
Teachers
Teaching
Technical Support – either field or phone bases support network for goods and service
Telemetry Data Systems
Tissue Culturist
Tourism
Toxicologist
Tractor Dealer/Salesman

Tractor Driver
Tractor Driver
Tractor Mechanic
Train Operator
Trainer
Transportation
Transportation
Transportation
Transportation - ports
Transportation - railroad
Transportation - railroad
Transportation - railroad engineer
Transportation - sea freight firms
Transportation - Truck Driver
Transportation - Truck Driver
Transportation - trucking companies
Transportation - warehouse man
Truck Driver
Truck Driver
University Researcher
USDA – (i.e. forest service, NRCS, FDA, etc.)
USDA Inspectors
Utilization of Agricultural Product – dairies, etc.
Various types of scientists
Vet
Veterinarian
Veterinarian
Veterinarian
Veterinarian
Veterinarian
Veterinary Assistant
Veterinary Medicine
Veterinary Science
Virology
Warehousing
Wholesale Florist
Wholesaler
Wildlife Management
Wildlife Specialist
Wool Processing

2. What are the industries that play an important role in the input segment of agriculture?

Advertising
Advertising – it influences input decisions
Ag Chemical Supply
Ag Credit/Financial Operations
Ag Equipment Supply
Ag Production
Ag Systems Coordinator – shipping and distribution
Agencies – Farm Bureau, NCBA, etc
Agricultural Products
Agri-marketing
Agronomist
Agronomy
Analyst
Animal Industries
Animal Production/Husbandry
Animal Science
Automotive
Banking
Banking
Beverages
Biological and Chemical Industries
Brokers
Capital investment
Chemical Sales
Clothing
Computer Systems Analyst
Construction
Consultants - wide variety of consultative careers that focus specifically on the input process
Container Design/Supply
Cotton for Fabric
Credit and Banking
Crop Chemical - Dow
Crop Insurance
Crop Protection
Distributors
Economics
Education - as an influence to input segments i.e. extension, vocational ag, etc.
Energy

Engineering/Equipment
Entomologists
Entomologists
Equipment
Equipment Dealers
Equipment Dealers - tractors et al.
Farming
Federal Agency Staff
Federal Agency Staff
Feed
Feed Companies - Cargill
Feed/Seed Companies
Feedstuffs
Fertilizer
Fertilizer
Fertilizer
Fertilizer
Fertilizer Dealers
Fertilizer Industry - potash
Fertilizer Supply
Finance
Financial
Financial – financing for operations
Financial industries
Financial Service
Financial Services
Food Industries
Food Processors
Forestry
Forestry
Fruit
Fuel Industry
Fuel Suppliers
Fuel Suppliers
Government
Government Policy – (perhaps not an industry but certainly impacts the input segment), Farm Bill, USDA (BLM, Forrest Service, etc)
Hard Goods Supplier
Hothouses for Sprouts
Labor
Labor – not sure how to categorize this but it influences the choices you make in what

you can produce
Labor Contractor
Land/Real Estate
Legal Services
Legislation, Policy, and Regulation
Lending Institutions – Banks
Lumber and Sawmill Operators
Machinery
Machinery Dealers
Manufacturers of Hard Goods – handling equipment, tractors, etc
Manufacturing
Manufacturing
Manufacturing
Manufacturing
Marketing
Marketing
Marketing
Marketing Specialists
Meat
Mechanical Engineer
Natural Resource Management Assistance
Nuts
Packers
Pharmaceutical - Pfizer
Plant Breeder
Plant Pathologists
Plant Pathologists
Plant Production/Husbandry
Poultry
Processing
Production
Production Analyst
Production and Manufacturing
Public Policy
Ranching
Real Estate
Research & Development
Research and Development
Research and Development – not an industry but influence what might improve products
Research and Technology - animal genetics

Research and Technology - plant genetics
Research and Technology - bio-engineering
Researcher
Sales
Sales
Sales
Science
Seed
Seed
Seed
Seed
Seed Companies
Seed - plants & vegetables
Seed/Genetics Firms
Shippers
Shipping
Silviculturists
Silviculturists
Soil
State Agency Staff
State Agency Staff
Synthetics for Fabrics
Teacher
Technology
Transportation
Transportation
Transportation
Transportation
Transportation
Transportation
Transportation
Vegetables
Veterinary
Veterinary Industry
Veterinary Medicine
Veterinary Services
Water
Water
Water Delivery Systems/Operation - especially flood irrigation
Water Management Entities

3. What are the system components needed to depict the industry of agriculture?

Advertising
Ag Commodity Coordinator
Ag Literacy Promotion
Ag Lobbyist
Agriculture Leadership
Agri-marketing
Agronomy
Animal Science
Animal Systems - breeders etc
Aquaculture
Biosciences
Capital
Certification
Climate
College Recruiters
Community and Social Infrastructure
Computer Systems Analyst
Conservation Components
Consumer
Crop Management - genetics, ag chemicals, fertilizers, scouting, equipment, precision ag
Dairy Production
Delivery/Distribution Systems
Development
Development
Diplomacy/Trade Systems
Distribution
Distribution
Economic Analysis - profit/loss, taxation, optimization of scale, debt management
Economics
Education
Education
Educational Components
Engineering Systems
Environment
Environmental Inputs - land, water, wildlife, environmental regulations
Equine
Extension/Outreach
Farmers
Finance

Financial Systems
Fruit Farms/Orchard
Government - all levels
Grain Industry
Greenhouse
Health Research
Hydrologic Systems
Inputs
Inspectors
Labor - workers, management, immigration issues, protection and safety issues, regulatory
Land Acquisition Preparation
Landscaping
Livestock Production
Logistic Systems – warehouse, trucking, delivery
Manufacturing
Manufacturing System – takes production inputs and processes to consumable goods
Market Intelligence
Marketing
Marketing
Marketing
Marketing
Marketing
Marketing
Marketing
Marketing
Marketing Components
Marketing System – creating demand for products
Marketing Systems
Marketing/Sales
Media
Natural Resources
Operational Systems – internal stakeholders that keep the system operating i.e. finance, HR, payables, customer service, IT, BT, etc
Organizational & Communication Skills
Packing and Value-added
Plant Systems - breeders of seed etc.
Planting/Growing/Harvesting
Policy
Policy Systems
Positive Resources - such as advertisement

Preparation
Processing
Processing
Processing Components
Processing Plants - meat, milk, food
Processors/Packers
Product Distribution
Production
Production
Production
Production
Production & Production Systems
Production Agriculture
Production Component
Production System – basic component input that provide raw materials
Public Opinion
Refining/Processing
Regulatory
Regulatory/Policy
Research
Research
Research and Development
Research and Development System – improvement to manufacturing or production
Research and Development
Row Crop
Sales
Sales
Sales
Sales and Marketing - harvesting, packing/shipping, distribution, coops, direct marketing
Sales Systems – getting goods/services to consumers
Science
Science – lab
Science Systems
Service
Service Components
Service Industries
Service Systems
Service Systems - services that keep the system operating
Short and Long-term Planning
Sociology

Soils
Storage
Support
Teaching
Transportation
Transportation
Transportation
Turf – golf courses
Turf – stadiums
Value-added Processes
Veg Farms
Wholesale and Retail Brokers and Purchasers

VITA

Name: Edward Wayne Romero

Address: College of Agriculture and Life Sciences
Texas A&M University
322 Horticulture/Forestry Building
College Station, TX 77843-2138

Email: ewromero@tamu.edu

Education: Ph.D., Agricultural Education, Texas A&M University, May 2008
M.A., Agricultural and Extension Education, New Mexico State University, July 1991
B.S., Agricultural Economics and Agricultural Business, Minor: Finance, New Mexico State University, May 1990

Professional: Assistant Dean, College of Agriculture and Life Sciences, Texas A&M University, College Station, TX
September 2003 – Present

Founding Director, Office of Student Diversity, College of Agriculture and Life Sciences, Texas A&M University, College Station, TX
September 2006 – December 2007

Assistant to the Dean for Multicultural Affairs, College of Agriculture and Life Sciences, Texas A&M University, College Station, TX
October 2000 – August 2003

Associate Manager, Western Farm Bureau Mutual Insurance Company, Buena Vista Agency, Las Vegas, NM
2000

Multi-Line Agent, Registered Representative, Edward W. Romero Agency, Western Farm Bureau Mutual Insurance Company, Las Vegas, NM
January 1995 – October 2000

Program Coordinator, College of Agriculture and Home Economics, New Mexico State University, Las Cruces, NM
January 1992 – January 1995