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Food safety : analyzing the connection between government and industrial influence.

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FOOD SAFETY: ANALYZING THE CONNECTION BETWEEN GOVERNMENT AND INDUSTRIAL INFLUENCE

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ABSTRACT

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The purpose of this study was to examine the leaders within the U.S. food safety agencies and the top U.S. food producing companies, including meat, grain, and seed, and determine the presence of connectivity between the separate organizations. This involved looking at detailed biographical information on each leader, including previous and current employment, educational background and board memberships. Following identification of the agencies, companies, and their leaders, social network analysis was utilized to locate visual and quantitative links. Using the theories of C. Wright Mills and William Domhoff, the results showed a powerful argument that the power elite is still active in the current food system and that there is an interlocking structure between the government and private sector. Finding this 'power food chain' that was formed by connectivity and overlap of leaders should be researched further and gives concern to the overall structure of the U.S. food system.

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INTRODUCTION

The purpose of this thesis is to examine the inner relationships among food regulators and food producers. In the past there were large numbers of small food production and processing companies, but following consolidation and buy-outs, large agribusinesses lead the food industry.With this shift, foodborne illnesses have expanded and at the same time funding for government regulations has not kept pace. Drawing on the theoretical models of C. Wright Mills and William Domhoff, the purpose of this thesis is to examine the relationships between leaders of the food safety agencies and those in the top food production companies to determine if there are any formal or informal associations. The research will indicate the most influential personnel and determine the presence of a revolving door between the government and private sectors and provide possible connections that ultimately lead to an influential power elite.

This research is important because the consumption of food products in the United States is relying on government regulation and integrity within the private sector to provide healthy standards. Food safety should be a public health priority, considering foodborne illnesses can be severe, or even fatal. Research to prevent these outbreaks and determine what is causing oversights in regulatory measures would not only create a healthier nation, but also save lives. The identification of apower elite operating to benefit its members could provide long-term solutions to assist in ending dangerous oversights. Little, if any, research has been completed to ascertain this information, which makes this study important for the advancement of knowledge in the area of food safety.

CONSUMER SAFETY CONCERNS

Three areas of recent consumer concern are foodbourne illnesses caused by bacteria and agricultural practices that cause additional health problems, the use of antibiotics on farm animals, and the development of genetically engineered or modified crops. Looking at these three topics will validate the importance of having a strong and reliable food safety system in the U.S. Consumers should not have to be consistently concerned with their health when consuming food products.

Foodbourne Illnesses

Large outbreaks of illness are becoming more common within the U.S. and unfortunately more serious, leaving consumers questioning the safety of their food. It is estimated that each year one in six Americans get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases (CDC, 2013). Due to global distribution, the reports of illness do not necessarily occur in one area or even in one country. If several incidents are reported by medical providers, the location of the problem can be determined more easily, but that is not usually the case and the illness can reach several before it is deterred. Recalls for contaminated foods are not unusual and have been occurring more frequently throughout the agriculture industry, but these recalls often begin after an outbreak has already affected many consumers. Hundreds of recalls have taken place over the last decade, with most representing reactions to a problem, instead of a preventative measure (Hauter, 2012). The lack of solid safety standards and timely

follow-up services provided by the government agencies are part of the problem, causing recalls to occur often and at times too late.

One of the top three deadliest outbreaks of foodborne illness in the U.S. was the listeriosis outbreak in 1998. Consumers were infected by hot dogs and cold cuts produced by the Sara Lee Corporation, killing 21 and causing four miscarriages. Listeria, a rare bacterium, directly affects the human digestive tract and carries a 20 percent mortality rate. Investigations found that after the plant reopened following some remodeling, the line was restarted and the steam caused condensation to form on the ceiling. Harmful material from the remodel dripped down onto the hot dog line, causing contamination (Mokhiber, 2001). The industry was not mandated to test for harmful bacteria, such as listeria prior to shipment; therefore, consumers bought the product and later unknowingly poisoned themselves. The company was fined $200,000 and charged with two misdemeanors for the deaths from the listeria outbreak (Mokhiber, 2001).

In 2006, three deaths along with 205 consumer illnesses occurred after exposure to E. coli from eating U.S. produced spinach (CDC, 2006). The outbreak spanned several states causing an initial spinach ban by the CDC, until the source was found to be a California spinach producer. The vegetable was recalled and the FDA investigated the path of production. Although they could not determine the exact cause, the final report included information detailing the presence of wild pigs, proximity to irrigation wells, and surface waterways exposed to the manure of cattle and wildlife as potential risk factors (FDA, 2007). This serious exposure brought an increased awareness of the dangers of E. coli and the reality of its potential presence in food. No longer was this a bacterium that was only found on residential kitchen counters from raw poultry. In

response, the FDA issued a 'Guide to Minimize Microbial Food Safety Hazards of Fresh-cut Fruits and Vegetables,' which *recommended* prevention measures during processing (FDA, 2007).

Shortly after was another outbreak, with peanuts as the problem, causing consumers to ingest salmonella. In late 2008 and into 2009, the CDC reported that 46 states were affected by the food poisoning, nine people died and at least 691 fell ill. The food recall that followed was the largest in U.S. history, involving 361 companies and 3,913 different products using the contaminated ingredients. The plant had three locations; all were found to have filthy processing conditions, including rodents, birds and mold present in the facilities. The processed peanuts were tested prior to shipment and the results showed the product to contain salmonella. The peanuts were shipped anyway. The FDA pulled any product containing peanuts that was manufactured at the three locations since January 2007. The company filed bankruptcy and in 2013 four former officials were named in a 75-count indictment on charges related to the contaminated peanuts (Johnson, 2013).

The U.S. experienced another listeriosis outbreak in 2011 from cantaloupes produced in Colorado. This was the second deadliest foodborne outbreak in the country, with 30 deaths following (CDC, 2012). The contamination source was determined to be the shed that the cantaloupes were stored in prior to shipment. The melons were not dried appropriately and cultivated the bacteria prior to prepackaging and/or supermarket sales. Just days before the outbreak began the farm had passed a food safety inspection completed by an outside contractor, giving the packing plant 96 points out of 100 (Neuman, 2011: B1). The company employing the auditor stated that he had received two

one-week training courses and had gone on audits with other employees (Neuman, 2011: B1). No charges were brought on the company auditing and the cantaloupe producers are facing numerous lawsuits filed by the victims.

Antibiotic Use

Consumers' concerns stretch farther than contaminated food and extend into antibiotic use, biotechnology, and production conditions. The once accepted methods of agribusiness are now being researched and questioned. The unnatural utilization and overuse of antibiotics to enhance weight and compensate for the terrible living conditions of livestock raised public concern. Michael Pollan, in *Omnivore's Dilemma* (2006), compares industrial feedlots to premodern cities, lacking sewage systems and covered in filth with overcrowding only exacerbating the conditions. This combination is a haven for diseasedand plague-ridden herds, creating loss for the industry and danger for public consumption. Antibiotics act as the preventative measure to subdue pestilence and for this purpose, are given to healthy cattle and poultry. The accepted practices of antibiotic use are now being debated by scientists and consumers, questioning whether the benefits outweigh the concerns.

Use of antibiotics in animals is responsible for 80 percent of the total U.S. antibiotic use annually, but this is not always for therapeutic uses. The Department of Agriculture reported in 1999, 2001 and 2006 that over 80 percent of swine farms, cattle feedlots and sheep farms administered antibiotics for purposes other than treating diseases, to promote faster growth and to compensate for unsanitary living conditions (Kirby, 2006). Evidence of antibiotic resistance has been consistently documented by the Centers for Disease Control (CDC) and World Health Organization (WHO) concerning

scientists that these resistant bacteria will strike the public with large, untreatable outbreaks. These resistant bacteria are also found in food, following testing done on samples of hamburger meat. Twenty percent contained salmonella, with 84 percent of the contaminated portion resistant to at least one antibiotic and 53 percent resistant to three or more (Kirby, 2010). MRSA (Methicillin-resistant Staphylococcus aureaus) is a prime example of this type of resistant strain of bacteria. The CDC reports 80,461 overall cases in 2011 (CDC, 2014). The illness causes life-threatening bloodstream infections, pneumonia, and surgical site infections. The numbers of hospital induced MRSA cases have decreased by a large percentage, but community infections have only decreased slightly. In 2009, MRSA was highly prevalent in 49 percent of swine and 45 percent of swine workers at large company farms in Iowa and Illinois (Dewey, 2008). In an effort to correct this antibiotic over-usage, the FDA implemented a plan that will attempt to phase out the use of medically important antibiotics on livestock and at the same time, phase in veterinary oversight with the remaining antibiotics available (Food, 2013). Currently, the changes that are being made are voluntary for drug companies, and taking effect over the next three years. Some citizens are concerned that the companies will continue issuing these antibiotics for disease prevention, but others are satisfied that the government agency is taking action against over usage, which they have not addressed in decades (Tavernise, 2013).

Biotechnology

Right alongside antibiotics is the concern involving biotechnology and its influence in the agricultural world. The possibility of gene-splicing was discovered in the 1970s, leading to intense scientific work and an aggressive race to bring new products

into the economy. Investors were enthusiastic at the idea of such a profitable new invention being utilized for growing food more efficiently, something that could reshape agriculture completely. Universities gained grants from large corporations to pursue these biotechnology projects providing an outline for future university-corporate relationships. These contracts helped the expansion and growth of genetic engineering (GE) in agriculture and left the door open for commercialization. In 1994, following years of research and development, the first GE food product went on the market and was approved by the FDA. The tomato was named MacGregor and was grown from the GE FlavrSavr seed, which was a seed modified in the laboratory to carry the genes marking a long shelf-life and large size, while taking out the gene that causes it to soften (Hauter, 2012). Although the tomato did have a long shelf life, it was not as flavorful as hoped and became mush when transferred to different climates. The endeavor was a monetary loss for the company and was bought out by a competitor.

Soybeanand corn seeds that are genetically modified are less obvious and at times go unnoticed to the consumer's eye, with scientists adding a herbicide gene directly to the seed. In 1996, the "Roundup Ready" varieties of these seeds were introduced to the agricultural community, appealing to farmers due to the resulting ability ofthe crop to be doused in herbicide, and only killing the encroaching weeds. Corn and soy are versatile crops and unlike fresh tomatoes, these commodities can be hidden in processed foods, leaving some consumers unaware of their existence in the final food products found in the grocery aisles (Hauter, 2012). There are few genetically modified (GM) commodity crops that are in production today, but the current ones have engulfed the market, with corn (85 percent) and soybeans (91 percent) leading the market (Hauter, 2010). The most

popular have been planted in the U.S. and are GM varieties that resist herbicide exposure (Nestle, 2010).The public has minimal ability to determine whether a food product contains any GM components and the companies are not mandated to do so. With a vast majority of processed foods containing unlabeled GM oil, protein, or sweetener ingredients, consumers are not given the ability to choose to partake in or avoid biotechnology in food products (Nestle, 2010).

SHIFT TO AGRIBUSINESS

During the 19th century, the once farming family, growing crops and raising cattle, began to shift away from the agriculture lifestyle. Family food production had been the sustaining method of consumption, with minimal outside purchasing, and even then the product had likely been harvested locally. Even if the residence was still on farmland, the family began relying on work outside the home and was relying more on processed foods for their meals. Canning, pasteurization, freeze dried foods, and other types of food preservation were convenient and needed less time for preparation.

Processed foods continued to gain popularity, beginning in the 1930s when the Great Depression forced huge price cuts on the processed food market, which helped the consumer afford products despite falling incomes, but hit farmers and small food processors hard (Levenstein, 1993). Larger processing companies rose quickly, surviving the price cuts and buying out smaller companies. This pattern continued, driving smaller competitors out of business, resulting in the emergence of large conglomerates. Following the Depression, processed foods continued to thrive and change the culture of cooking. In the 1940's there was not much variance between Midwest, East Coast, or Northern states, with all types of food available at local supermarkets consumers were liberated from seasonality and geographic constraints (Levenstein, 1993:27). This availability allowed farmers to become more specialized in production and the diets of city consumers and farmers began to look similar (Levenstein, 1993).

Today, the bulk of U.S. food is grown on less than one million farms, with farmers making up less than one percent of the nation's population (Hauter, 2012). The total number of farms has decreased, but the size of specialized farms has grown, impacting the environment along with multi-crop farmers producing on a much smaller scale (Nestle, 2010). A farm based on a single-commodity crop abandons the original versatile and congruent land utilization and uses industrialized methods to achieve the same or higher yield of a single crop with fewer workers. These industrial farms are considered agri-businesses, and as with any business there is an economic focus to remain in operation and to dominate a specific market. Competition can decrease prices, limit expansion, and cause a financial struggle for a business; therefore, control over the product is essential. These general business tactics have been conducive to the development of powerful industrial farms that rule production and have shut out the ability of small farms to vie for a seat in the agri-business world. Today, the food system relies heavily on industrialized agriculture to meet production needs and enables the ability to purchase foods from all different regions. Agribusiness has also formed a surplus in production allowing the food system to expand on a global level, providing food not only to other regions, but countries as well (Manning, 2004).

Today, there are many companies in the corporate farming world and the meat processing industry that have risen to dominant positions. These are mainly large processing plants that have slowly bought out smaller businesses and have been continuously successful in their sales, such as Tyson, Hormel, and DOW. These leaders have climbed to a towering position over the smaller agriculture processors and are currently controlling the market. Their success relied on introduction of new products,

buy-outs of other companies, and clout over the rest of the industry and in the political sphere. For example, the poultry industry recruits local growers to become financial "partners" in company, by providing chickens from the industry with a contract to the farmer to raise them, then return them to the slaughterhouse for weigh-ins and then promised payment. The growers are at the mercy of the company, who can require expensive improvements to the lot, give sick or smaller chickens in the flock provided, and/or provide inaccurate weigh-ins that decreases the grower's payment (Stull, 2013). This is just one way that control is gained over the smaller farming businesses, leaving powerful agribusinesses to dictate the operations of the food production system.

Tyson Foods is one of the leading companies for meat production in the U.S., reaching $33.3 billion in annual transactions (Watrous, 2013). The sales of beef, chicken, and pork by the company originated with the raising and sellingof poultry inareas surrounding its small Arkansas town, but continued to grow into the largest poultry production company in the meat industry. In 2000, Tyson had operations in 18 states and 15 countries and exported to 73 countries worldwide (Wolfe, 2011). When an opportunity arose for the company to expand into the beef market, Tyson did not avoid the prospective acquisition. After months of debate and offers from several other large companies, Tyson bought Iowa Beef Processors (IBP), the largest beef packer and second-largest pork packer and distributor in the U.S., for $4.6 billion (Wolfe, 2011). Following the new addition to the Tyson family, 50 percent of their revenue was derived from beef sales and Tyson became one of the largest protein producersin the world (Wolfe, 2011).

JBS is an extremely large corporation that is also a leader in the meat industry, originating in Colorado; it is now headquartered in Brazil. In 2008, JBS made its final acquisitions in the company's long-term investment plan to become a global contender in the protein market, purchasing U.S. based industries Swift Foods, Smithfield Beef and Pilgrim's Pride (JBS, 2014). The history of these two companies' acquisitions, prior to their buy-out, makes JBS's strategy more clear. Swift Foods was a meat packing company that was founded in 1855 in Massachusetts and grew into the third-largest U.S. processor of beef and pork, still holding that rank when it was purchased by JBS (Jelmayer, 2007). Smithfield still ranks in the top five meat producers in the U.S., but sold its beef business to JBS, which was then renamed to JBS Packerland. Pilgrim's Pride was the largest U.S. chicken producer when it filed for bankruptcy, and until its acquisition, JBS was focused on beef, pork and lamb in the U.S. This $800 million bid made JBS an instant powerhouse in the chicken industry, with the company still owning 75.3 percent of Pilgrim's Pride (Salvage, 2013).

Monsanto leads the world in seed production, with the sales of their GM products, such as the Roundup Ready soybeans, corn, and cotton, to agribusinesses nationwide. From their introduction in 1901 to 1980, the company was profitable through their chemical products that were used for agriculture, household cleaning, and governmental operations. Insecticides and herbicides, such as DDT and 2,4-D, were widely purchased by farmers to assist in crop growth and sustainability. The government was also a customer during the Vietnam War, buying millions of gallons of "Agent Orange" and spraying it on Vietnam, Laos, and Cambodia as a combat strategy. DDT, 2,4-D and Agent Orange were all eventually banned by the U.S. for use due to their environmental,

biological, and health effects that were documented years after application. In the 1980s, the direction of Monsanto changed, shifting to biotechnology and establishing a molecular biology group in 1981. The company was the first to genetically modify a plant cell the following year and began field testing in 1987. The biotechnology advances continued and in 1994, Monsanto was the first to win regulatory approval for the sale and use of a dairy cow hormone, Posilac, which increases milk production by 30 percent over the life of a cow (Kirby, 2010). The Bovine Growth Hormone (BGH) is a protein that is naturally present in a cow's milk at low levels. The product, Posilac, is a genetically engineered version of the BGH with a technical name of recombinant bovine growth hormone (rBGH); therefore, when it is used it will increase the concentration of BGH that is already present in milk (Nestle, 2010). The hormone BGH produces another hormone in these animals, insulin-like growth factor-1 (IGF-1). Increased levels have been linked to breast, colon, and prostate cancer in adults, and precocious puberty in girls (Kirby, 2010). Due to higher milk production from the use of rBGH, larger dosages and more frequent use of antibiotics are needed to treat or preventudder infections, mastitis (Nestle, 2010). Several countries, Canada, Australia, New Zealand, Japan, Israel and the EU, denied Monsanto access and banned the use of rBGH. Two years following Monsanto's controversial introduction of Posilac, their Roundup Ready soybeans hit the market, providing herbicide within the seeds for farmers. The company also began acquiring other businesses that were involved in seed production and biotechnology, even including pharmaceutical companies, continuing their expansion, up to present day (Monsanto, 2014). These acquisitions and their continued approval by regulatory

agencies in the U.S. have led them to their dominant position in many areas of agriculture, chemical and biotechnology production globally.

Another top ranking global seed producer is DuPont Pioneer, a division of DuPont Chemical Company. DuPont began its journey through agriculture patents and then moved into high-quality gunpowder and dynamite, supplying for the Union during the Civil War. The founder's great-grandsons changed the company'sdirection and DuPont bought several smaller chemical companies, developing new products, such as nylon and Teflon (Hauter, 2012).The company thrived in biotechnology and in 1997 took interest in Pioneer Hi-Bred, the world's largest seed company at the time, doing joint research on corn hybrids. In 1999, DuPont bought the remaining portion of Pioneer, giving the biotechnology section of the company the new business name of DuPont Pioneer, leading the industry in herbicide resistant products that grow higher-yielding crops (DuPont, 2014).

DuPont and Monsanto have been compared to Coca-Cola and Pepsi in the biotechnology and GM industry, leading the world in production, sales, and profit. The concentration of power in the agriculture industry falls under these two companies following their huge acquisitions and mergers. This has left little to no opportunity for any other agribusiness to compete and prevent these mega-industries from gaining complete control. The same could also be said for the meat processors and distributors, Tyson and JBS, who minimize the ability of other companies to advance in the market. The grocery chains and restaurants prefer to work with only a few wholesale suppliers, with the larger industry securing the contracts because lower costs and the capability of huge production amounts.

FOOD SAFETY

With health concerns increasing for the food consumers in the U.S., attention should begin to be directed to food safety standards. Initiatives were developed in the early-1900's, following a shift in the area of food production. Cultural changes and economic problems caused the structure of the U.S. food system to change, expanding the need for standards and regulations. That need continues into 2014.

Within the current food system in the U.S., citizens rely on the government to ensure that food is available in surplus, reasonably priced, but most importantly safe for consumption.The formation of the current agricultural setting keeps food costs lower and provides greater food variety, but these prices and items are also impacted by the global economic structure. The price of fossil fuel, fertilizers, tax rates and labor can play a large role in the cost for the consumer. Therefore, the location of agricultural industry is often determined by its costs of production, increasing distance between food producer and the food consumer. The food purchased is not only produced in a different region of the U.S. or a different country, but it is usually an unknown source to the consumer.

Since local food production is so minimal, it would be unreasonable to expect the average citizen to apply their own safety measures when purchasing and eating food products from all over the world. Thus, U.S. food safety measures were established by the government to begin operating in conjunction with the structure of the already established food system. Food safety policy has undergone several changes and

restructuring since the initial introduction in the early-1900's. Prior to government involvement, food inspection was largely considered as the duty and responsibility of the consumer, not the government (Young, 2003). Most of the original food regulations were instituted by the states and mainly served trade interests by setting standards on weight of exports.

The USDA was formed in 1862, marking it as the first agency that was specifically connected with food production. Although it was founded early in U.S. history, the promotion of food safety and regulation came much later. Initially the USDA began to set standards and regulatory inspections to open the U.S. up for trade with foreign countries. U.S. producers and packers urged this, because it would enable them to compete in foreign markets (USDA, 2014). The agency'soriginal purpose was to assist America in the availability of global trade, but also to expand and provide education involving agricultural production throughout the country. Research was funded, grants were given, and inventions were created, such as barbed wire, all to benefit the farmer. The agriculture world grew consistently. In the early 1900's the USDA initiated action to address safety concerns about food production and consumption. In Upton Sinclair's novel, *The Jungle*, the meat industry was described with disturbing detail, exposing truths about the horribly dirty conditions of the Chicago slaughterhouses (Sinclair, 1906).

> "All day long the blazing midsummer sun beat down upon that square mile of abominations: upon tens of thousands of cattle crowded into pens whose wooden floors stank and steamed contagion; upon bare, blistering, cinder-strewn railroad-tracks, and huge blocks of dingy meat-factories and fertilizer tanks, that smelt like the craters of hell—there were also tons of garbage festering in the sun, and the greasy laundry of the workers hung out to dry, and dining-rooms littered with food and black with flies , and toilet-rooms that were open sewers (Sinclair, 1906: 260)."

The book gained popularity and the public uproar prompted President Theodore Roosevelt to open an investigation on these terrible manufacturing conditions (Goodwin, 1999). In 1906, the claims were confirmed, impelling the government to provide regulatory measures through the Pure Food and Drug Act and The Meat Inspections Act. This was followed with the label 'adulterated food', which defined products containing chemical or additives that were substituted to give the same appearance and taste as the original recipe. These foods began to worry high-quality producers who feared that their products might be undermined by deceitful goods (Swann, 2003). The Pure Food and Drug Act required standard ratios between original ingredients and the 'adulterated' additions, and if the producers failed to meet this they were forced to label the food as sub-standard and low-quality (Young, 2003). The Meat Inspection Act was signed the same day, which set the regulatory standards that are currently used in the U.S.It requiredinspectors at slaughterhouses to verify that the animals going to slaughter were actually aliveupon arrival and disease-free. It also required that the slaughter-houses where meat was processed would uphold sanitary conditions throughout the course of production.

In 1938, Congress passed the Federal Food, Drug, and Cosmetic Act (FFDCA), giving the FDA the right to oversee the safety of food, drugs, and cosmetics. The goal was to prohibit the movement in interstate commerce of adulterated and misbranded food, drugs, devices, and cosmetics for other purposes. Regulators had the discretionary authority to set standards "wheneverin the judgment of the Secretary such action will promote honesty and fair dealing in the interests of the consumers" (FDA, 2009:93).

The national concern with food production spawned regulatory action from the FDA also, that at the time was located within the USDA's Division of Chemistry. The employees were primarily involved in the chemical analysis of agricultural products. The Pure Food and Drug Act and the FFDCA shaped the modern function of the FDA, examining food and drugs, specifically for products that were adulterated or mislabeled, where either the ingredients were not labeled clearly or not stated at all.

These original food safety policies from 1906 are the same that are to be upheld today. There have been revisions and additions, but the original still acts as an influence on current standards. Thus, the food system has changed several times over, but the rules and regulations have remained the same.

CURRENT FOOD SAFETY POLICY

As of 2013, there are 12 agencies that are actively involved in regulating food safety within the U.S. The two main agencies within the federal government are the Food Safety and Inspection Service (FSIS), directed by the United States Department of Agriculture (USDA) and the Food and Drug Administration (FDA). With a combined one billion dollar annual budget, these agencies regulate food production, packaging, storage, transport, labeling and distribution. The USDA is responsible for developing and executing federal government policy on farming, agriculture, forestry, and food. Within the USDA, the FSIS, carries the responsibility of ensuring that the commercial supply of meat, poultry, and egg products are safe, wholesome and correctly labeled and packaged. The FDA is responsible for protecting and promoting public health through regulation and supervision of food safety (and several other areas of public consumption and use unrelated to agriculture and food).

Demands on these agencies are intense and at times considered unattainable by researchers. For example the FDA employs 700 inspectors to oversee 30,000 food manufacturers and processors, 20,000 warehouses, 785,000 commercial and institutional food establishments, 128,000 grocery and convenience stores, and 1.5 million vending operations (Nestle, 2010:59). With a budget of $283 million for the entire inspection process during 2000, less than two percent of the facilities were inspected (Nestle, 2010).

Other agencies do not make up for the difference since the USDA regulates different areas of the U.S. food system.

The distribution of responsibility amongst the food safety agencies is difficult to review, due to several structural oversights that should be considered. For example, hot dogs in pastry dough, open-face meat sandwiches, pizza with meat toppings and soups with more than two percent meat and poultry are regulated by the USDA. On the other hand the FDA regulates hot dogs in a roll, closed-face meat sandwiches, cheese pizza and soups with less than two percent meat and poultry (Nestle, 2010). An even more puzzling example is the inconsistent regulation of broth. The USDA regulates beef broth and the FDA regulates chicken broth. When they are sold in a dehydrated form the agencies switch (Nestle, 2010). Thus, many food industries are monitored by more than one U.S. governmental agency even though production occurs at the same location. This leaves some foods and facilities with double the attention and enforcement, while others are rarely inspected.

Chronic underfunding plagues the agencies as the food industry continues to grow. The FDA suffers tremendously with an extremely low budget in comparison to their responsibilities. It is estimated that 85 percent of the known foodborne illness outbreaks are associated with FDA-regulated food products, employing only 1,700 inspectors in comparison to 7,600 with the USDA who is only associated with 15 percent of the outbreaks (Trust, 2008). Each agency struggles to maintain enough employees to complete the task of inspections in a timely and organized way. The frequencies of inspections are determined by the agency's standards; therefore, some agribusinesses receive double or triple the attention, leaving others receiving no visits (Dyckman, 1999).

This leads to a waste of manpower, spending time, money and effort on safety issues that are no longer considered a threat to consumption, but are still mandated (Robinson, 2001). This method leaves obvious room for error and the problems continue. For example, consider all the resources given to the FSIS to focus directly on slaughterhouses and their practices, in contrast to its minimal authority regarding product transport, storage, and commercial retail and lack of authority in the pre-processed product on the farm (Trust, 2008). Structurally the food safety system continues to be flawed.

Food and food ingredients that are developed through genetically engineered (GE) plants must follow the guidelines under the FFDCA, which are the same standards conventional foods must observe. The biotechnology company disseminates their safety assessment of the product to the FDA, which includes the identification of distinguishing attributes of new genetic traits, whether any new material in food made from the GE plant could be toxic or allergenic when eaten, and a comparison of the levels of nutrients in the GE plant to traditionally bred plants (FDA, 2014). The FDA then assesses the company-submitted data and does not do testing of its own (Hauter, 2012). The agency has recognized that there are diverse and controversial views on GE foods and the process that is administered to approve these products. Following these concerns is the consumer's desire to know whether the food they are eating and serving to their families is produced using genetic engineering. Currently, food labeling for these products is voluntary unless the food contains an additive that contains an allergen. The FDA reports that they have received two citizen petitions regarding GE food regulations, requesting a change in the requirements of labeling GE foods and they are currently reviewing these requests (FDA, 2014).

CURRENT RESEARCH

The U.S. agencies that monitor consumer safety during food production, processing, distribution, sales and introduction of new biotechnologies have an important role in society and a heavy burden. They advise on regulatory standards and monitor the industries that are to uphold these set standards. They also research new technologies that are constantly being introduced. With GE products swarming the markets of agribusiness, adequate testing and follow-upson these innovations is a difficult undertaking. Occurrences, such as food-borne illnesses, antibiotic abuse and unlabeled GE foods, lead the public to question the agencies' abilities and motivations. These uncertainties and breakdowns have led to an examination of the examiners.

The General Accounting Office (GAO), an independent, nonpartisan agency that works for Congress, performed an evaluation of the current food safety system and suggested a new approach to the current structure. In 1999, the GAO reported that the 'U.S. needs a single agency to administer a unified risk-based inspection system' (Hunter, 2001:25). It was concluded that a single agency would enhance food safety and create a more consumer friendly network. This is not a new concept. It was discussed in 1972 and the GAO testified again in 1994 that the single agency approach was preferred. Other countries use a single agency approach and have had successful results. Great Britain and Ireland were left with little choice after mishandling of an outbreak of 'mad cow' disease. The other two countries, Canada and Denmark, changed their structure to

achieve higher program effectiveness and cost saving strategy, due to budgetary crises. After this implementation, Canada was expected to save about 13 percent of its food inspection budget, totaling $29 billion per year (Dyckman, 1999). Coordination between agencies would also stretch out the manpower to reach more establishments, leading to safer foods. It would also save money, because only one visit would be made to each location, instead of two or more. Policies could be reorganized to match the more modern agricultural world and strategies could be made more efficient when shared.

The GAO continues to place federal oversight of food safety on their list of high-risk areas in need of transformation to achieve greater economy, efficiency, effectiveness, accountability, and sustainability (GAO-11-278). They diagnose that the root of the problem is within the fragmented layout of 15 agencies administering several laws. The FDA Food Safety Modernization Act (FSMA) amended the FFDCA in January 2011, providing the FDA with the ability and authority to order food recalls on products when the originating company refuses to do so voluntarily. Prior to this the FDA only had power to force a recall on infant formula. Now the agency can issue an advisory about adulterated food and may encourage voluntary recalls by the producers of the food product, but if they refuse the FDA can mandate the recall. The GAO investigated the process following the initiative of recalls in foods that may be or are contaminated and the method of information dissemination. Obviously, a prompt response to foodborne illnesses is important for public safety and is a critical part of prevention and with the ability of the FDA to initiate recalls a structured reaction is desired. The GAO examined how the FDA implements its authority and researches the challenges the FDA faces, if any, in advising the public about food recalls or outbreaks of foodborne illness and how

the agency addresses those challenges. It was found that the FDA carries communication challenges when alerting the public about recalls or outbreaks, leading the GAO to recommend "issuing regulations or industry guidance to clarify its ordered food recall process and implement recommendations from others to address FDA communication challenges in advising the public about food recalls and outbreaks" (http://gao.gov/assets/600/593032.pdf). Again, GAO determines that an agency involved in food safety is struggling with communication issues and is not able to reach its full capability of public safety continuing down the current path.

The current food safety system in the U.S. is based on practices shaped over 100 years ago and has undergone minimal changes. If anything, there has been an increase in agencies responsible for food safety, causing even more challenges relating to communication and coordination. Even so, all of the agencies are accountable to the President, Congress, the court system and the public (FDA, 2000). The food production machine never stops and the supermarkets never empty, so an overhaul or even repairs could disrupt public consumption. Despite the research on the operational aspect of food safety, little if any research has looked at a potential inner relationship with the leaders of these government agencies and the agribusinesses that they monitor.If relationships are present, determining their origin provides insight into how helpful the connection is. It will also reveal whether these leaders are revolving back and forth between the government and private sectors. An examination of this revolving door of personnel and the strategic movement of key players should be explored.

To further understand the potential for conflicts of interest among regulators and producers, Marion Nestle in *Food Politics* (2002) described that the revolving door is not

a new concept when looking at the food safety agencies and the private sector of food production. Nestle used several individual's as examples in her writing, specifically those moving from the USDA and FDA to private lobbying firms representing large food production companies. For example, Michael Taylor was a lawyer working as counsel at the FDA. He went to King & Spalding law firm, who directly represented Monsanto, but then returned to the FDA as Deputy Commissioner for Policy. In that position he was part of the team that issued the policies on food biotechnology and genetically engineered hormones that at that time were being created by Monsanto. He later moved to the USDA, then back to King & Spalding, followed by Monsanto as the Vice President for Public Policy. He resigned from that position and went into the nonprofit sector, until President Barack Obama appointed Taylor as the Deputy Commissioner of Foods with the FDA in 2010, where he still presides.

Dietary recommendations from the USDA have also evolved due to lobbying pressure from the agribusinesses. In 1977, the U.S. Senate made a dietary recommendation to "decrease consumption of meat" and in 1980 this advice was revised to say "choose lean meats", with even the serving size increasing from 5-7 ounces a day to 4-9 ounces a day by 1995 (Nestle, 2002). Behind these changes were lobbying pressures that extended over long periods of time, because these labels could become problematic for the meat industry. The lobbyist efforts were successful and the American Heart Association's recommendations of dietary change to prevent heart disease and cancer were stagnant (Nestle, 2002). The lobbyist are hired specifically to represent private interests and are consistently forming and maintaining relationships within the

government sector through campaign contributions, personal meetings, etc. This also offers the opportunity for employment movement between sectors.

This movement begins to form a network not only to benefit the individual, but also expands the interconnectivity between the private and government sectors. Nestle explained that "when officials of regulatory agencies go to work for industry, they are almost certain to be paid better than they were in the government jobs, and they contribute to industry the valuable expertise that they acquired at the expense of taxpayers" (Nestle, 2002: 101). She continued, describing the industry executives that are recruited to government positions and how those movements "raise questions of conflict of interest, because it is difficult to imagine that they can make decisions without keeping their former employer's interests in mind" (Nestle, 2002: 101).These movements, relationships, and connections made by individual's in positions of leadership help form a powerful group, or a 'power food chain', that carry the responsibility of food safety in the U.S. Studying this network of powerful leaders is important research to assist in determining what elements of the food safety system are problematic or leading negative implications.

THEORY

C. Wright Mills was a social scientist who centered his work on the theoretical perspective of rationalization, which focused on practicality, measurement and control over traditions, values, and emotions. It is one of the main sociological principles behind bureaucratization and the rise of capitalism. He looked attentively at sociocultural systems through an interdependent lens, using this focus to explain social structure and processes. Although many theorists influenced his work, including Max Weber, Karl Marx, and Thorstein Veblen, Mills had a theoretical approach all his own and was very critical of conventional social sciences. He began constructing what he thought would be a more adequate model of the industrialized society and its profound effects on social organization and human values and behavior (Elwell, 2002).

The Power Elite (Mills, 1956) is an example of Mills' exploration of rational-legal bureaucratic authority and the effects it has on the governing and the governed in the democratic process (Elwell, 2002). He studied the United States and concluded the power structure shaping the nation was formed by elites that were generated from different areas, but come together to oversee the rest of the nation's occupants. As bureaucracies became more centralized, the control and authority over the population narrowed, placing a huge level of responsibility on the powers that be. The consequences of their actions, or lack of, had a massive impact on every person that operates under the elite and continues to do so. These power alliances, he concluded, leave the masses

powerless, which raises questions at the macro-scale about whether the U.S. is truly a democracy. Mills explained that the dominant institutions that operate within this elite category could be narrowed to three: military, corporate, and political. Although separate entities, these three formed what he termed as an interlocking triumvirate, consisting of the powerful, the wealthy, and the prestigious people of America. Mills theorized that authority figures moved within and between the three institutions, holding positions of power, and centralizing the associations between these individuals. This movement leaves the direction and outline of society in the hands of these elite few that carry powerful positions continuously throughout their lifetime. Mills argues that this is a continuous cycle; therefore, one would expect to find the same pattern of power in the agencies and companies making decisions about our food systems.

The influential role of corporate leaders can be traced back to the Supreme Court decision of 1886, declaring that the 14th Amendment protected the corporation. This ruling gave the corporate world a large hand in the economy and shielded them within the growing capitalist society (Mills, 1956). Accordingly, the political leaders are the top policy makers in America and uphold elected and appointed positions that, although they change frequently remain clustered around the upper class citizens. These power elite are an intricate set of overlapping cliques that share in decisions that have national consequences (Mills, 1956:18). This leaves the lower circles in society in an impotent position, surrendering control to the top power brokers operating within the triumvirate. The individuals falling under the power elite are termed by Mills as ‘mass society’ and are representative of those who have little to no power over the higher circles of influence.The description is not meant to be a homogenous depiction that loses the

distinctions of age, sex, occupation, religion, race or class, but offers a picture of a group that cannot counter the power of the elite no matter what their societal descriptors (Domhoff, 1968). This particular mass of people lost what little organization and unity it had, minimizing its influence and ability to limit the power of the elitists. The divisions within the masses have multiplied, incapacitating any chance of control. According to Mills, this society still exists; therefore, it is important for the researcher to determine who represents the 'mass society' and who is the power elite in the U.S. food system. William Domhoff, a sociologist who also studied the power structures within the United States, agreed with many of Mills' elite theories and the presence of a small ruling class dominating over the large masses. Expanding upon dominance in political and economic arenas, Domhoff details the encompassing influence of the elite in almost all facets of the educational, social, economic, and political life. He describes what has happened to the mass society and their ability to operate in conjunction, instead of below the higher circles.

If the power elite dominate the mass society and direct the ebb and flow of the public norms and regulations, there must be some explanation behind the overlapping course that this group follows. Although these elite members are separated into different entities of the triumvirate there is some degree of unification, through similarity of outlooks and values. They uphold similar interests, of course to maintain themselves in an elitist position, but also in significant matters of policy (Domhoff, 1968).

Although American society was not founded on the principles of an aristocracy, inherited nobility, or high church dignitaries, it has indeed formed an upper echelon. Emerging from the origins of equality, a superior class became visible through enormous

increases in wealth making their own ascendancy possible (Mills, 1956). The tempo of the capitalist development made it possible for these elite to continue growing over the majority. Once established, the power elite continue their control through several methods. Their integrated upbringings and backgrounds, due partially to economic class, begins the social and psychological aspects that shape them into adults. This is quickly followed by their service to their country through military assignment or a continuance of their education at the college level. Then, once in the work force, whether in a political, military or corporate role, the unwritten understanding of coordination to assist and develop objectives dictated by their respected positions is sought. At this level the triumvirate becomes interlocking through both unforeseen and purposeful actions by its members (Mills, 1956).

Mills and Domhoff argue that members of the power elite grow up in the higher economic sphere, likely determining their social endeavors and influencing the direction of their future. They attend comparable schools, social functions and share similar upbringings, with values, beliefs and desires running parallel. They discuss private schools, summer resorts, gentlemen's clubs and other social functions that immediately begin formatting the minds of the future citizens of the higher circles (Mills, 1956/Domhoff, 1967).

The next endeavor on the path to being in the elite category includes attending college, but not just any college. Ivy League schools were the trend for the American upper class, with Harvard, Yale, and Princeton leading the attendance rate. Edward Digby Baltzell describes that in the 1920s, the proper college degree became an important criterion to determine advancement into elite status (Baltzell, 1964). Presidents, Vice

Presidents, and other high ranking politicians were educated at these choice schools and this pattern continued into the business world, with top executives also attending (Domhoff, 1967). Large corporations scout and recruit at these top-notch universities, not always because of the quality education that is received, but because the courses, research, and lecturers are often funded by the enlisting company. It can be found that the large university grants typically go to a small handful of elite universities and fund training and research in specific areas (Beckman, 1964). "Members of the power elite...have created university chairs and research institutes to pursue topics of interest to them, at the same time playing an active role as university trustees in getting rid of professors with undesirable views" (Domhoff, 1970:255). Not only is the elite class determining where the funds go, but also what will be taught and distributed. It is a strategic move by the government and corporate leaders that increases the hiring of individuals that have already been shaped by a social class and have received an education from an elite school. Mills and Domhoff theorize that an individual's choice of college is of great importance and plays a large role in later employment, but also in continuing their position of power. This research will look at the prospect of this theory and education backgrounds of individuals in the current food system continuing into the world of education.

Aside from all these social and educational backgrounds, the unity of the power elite is at times an unambiguous relationship based simply on coordination. Members of these higher circles pursue several diverse interests based on their specific connections and to succeed in these pursuits it is recognized that cooperation may be necessary. "Many of them have come to see that these several interests could be realized more easily

if they worked together, in informal as well as in more formal ways, and accordingly they have done so" (Mills, 1956:20). The power elite are not always coordinated in their goals and the methods to achieve them, but they carry an understanding that keeping open avenues will assist in the pursuit of their respective interests and plans. It has also been found that it is easy and profitable for the elite to interchange positions, based on mostly informal associations (Domhoff, 1968). When Mills looked at the political directorate three-quarters were political outsiders and closely linked to the corporate world, either financially or professionally. In 1953, only three members were considered political professionals, spending most of their lives running for or occupying an elected position (Mills, 1956:231). Due to the large role the government plays in business regulation, obtaining a position in one of the agencies makes a person a more marketable member within the corporate world. Recruitment from these regulatory agencies became popular, which began the consistent movement between the three entities of the power elite. Mills specifically refers to government positions as 'stepping stones' into a corporate career (Mills, 1956). So, not only do these powerful leaders have similar backgrounds and education, and a need for cooperation, but they also use the ability to cross over into different positions to their advantage to monopolize the triumvirate.

Domhoff differs in the definition of the power elite that Mills describes, in that there is a distinction between the elite and the upper class. What he uses interchangeably as the upper, or governing, class, is represented by the people who own, receive, and contribute a disproportionately large amount of money in comparison to the majority of the United States. However, Domhoff shows that some members of this group will never control any more than the items and property that they personally own, merely staying in

the upper level of society and not contributing to an institution. Members of the power elite may or may not be within the upper class of society. The important determination is whether the upper class controls the institution that the elite member serves. If it can be shown that members of the upper class control the corporations through stock ownership and corporate directorships, the military through the Department of Defense, and the corporate law profession through large law firms and major law schools, we will have gone a long way toward demonstrating that the aims of the American power elite, as defined by Mills and the work of Domhoff, are unavoidably those of members of the upper class (Domhoff, 1967:10).

Two things can be determined as inevitable consequences of an advanced industrial society based on a capitalistic model. One, there will be a rise of a powerful group that will control the means of production, political power, and shape the formation of society. Two, below them will be an unorganized accumulation of individuals that will lack any type of power and will be controlled by the elite without hindrance (Domhoff, 1968). Mills is not shy in expressing his concern over the increasing amount of control that the power elite seize from the mass society. Concentration of the economy, the needs of big corporation, and the unwritten alliances in regards to monetary arrangements and development schemes isolate the elite group from the rest of society (Marcuse, 1964). "The institutions of society have lost or abdicated whatever position they once had as centers of rational thought, freedom, and initiative. The schools long ago abandoned any opposition to the Establishment. Religion has traded its concern with the freedom and development of the human soul for a mess of comfort and respectability. The universities have been lulled or forced into quietude by liberal grants for research in behalf of the

interests of the power elite, by the rise of the academic bureaucrat, by a relentless war against their independent teachers. “Science has become a machine in the service of the power elite” (Domhoff, 1968:20-21).

In conclusion, public opinion carries much less weight than what the original definition of democracy described, leaving a wide gap that is not easily traversed. The mass society no longer stands united, making the group easily swayed and manipulated by the power elite. The decisions roll down from the higher circle and are received and expected by the large, but divided, group.

The work of Domhoff and Mills was completed decades ago and looked at the way power is concentrated and wielded in the U.S. society. Using their theories the researcher specifically wants to see what type of connectivity is held between individuals, the positions they hold, the colleges they attended, and their employment records. Since their work, it has been suggested that there is a “revolving door” between the corporate food industry and government regulators, but little, if any, research has been conducted to determine whether there is a ruling class or power elite that controls the food industry and its oversight in the United States (Nestle, 2010). The purpose of this research is to determine the presence of a current power elite that is controlling the leadership positions within the food system in the U.S. and establishing what the powerful group looks like now, through answering the following questions:

1. Following the work of Mills and Domhoff, leaders in the government and private sectors attended the same schools. Do similar trends exist among those who hold elite positions in the food industry and those responsible for regulating it?

2. What do the organizational networks looks like between the elite position holders in the U.S. food safety agencies and the major food producers?

3. After analyzing the career trajectories of current leaders, what do these look like? Is the movement occurring in a uniform fashion from government to the private sector or from the private sector to the government?

METHODS

This study uses an analytic inductive process to examine historical, media, and organizational records to identify the career paths of policy and decision makers in the food industry (Charmaz, 2000). A qualitative content analysis will look at current employment information of the U.S. food safety agencies and the top food production companies. Then, Social Network Analysis (SNA) will be used to determine what type of connections, if any, identified individuals in positions of power have through social, educational or institutional networks. This will be established through documentation about personnel holding official positions within the selected companies or organizations and also through patterns of networking, recruitment, and/or institutional attachment. This material will be collected through a systematic analysis of textual data from internet resources, including government websites, news and media resources, biographies and resumes, social media sites, public records, and other reputable educational databases.

Social Network Analysis

SNA will be beneficial in this research for determining visual connectivity, but also provide numerical data determining the presence, or absence, of the same. It uses network theory to analyze social connections through nodes, which represent individual actors within the network and/or links (D'Andrea, 2009). These links represent relationships between the individuals through education, employment, organizations, etc. SNA requires defining a boundary for the data collected for a network population;

therefore, as mentioned above the research was limited to the current top tier individuals of the government agencies and the current leading officials in the private sector. SNA provides two types of output, visual and quantitative. Visually the researcher is offered a quick output that will show the connectivity through graphic representation. Figure 1 shows an example of the output that SNA provides visually and how central nodes can be identified through their positions in the network. Nodes B, D, E, F have central locations in the network shown, connecting to three other nodes each. Node A is connected to E only because of F and/or D. Node B is directly connected to D and E, but node D provides another connection for B to reach E. Therefore, if the direct link was removed, an indirect link would still be provided.

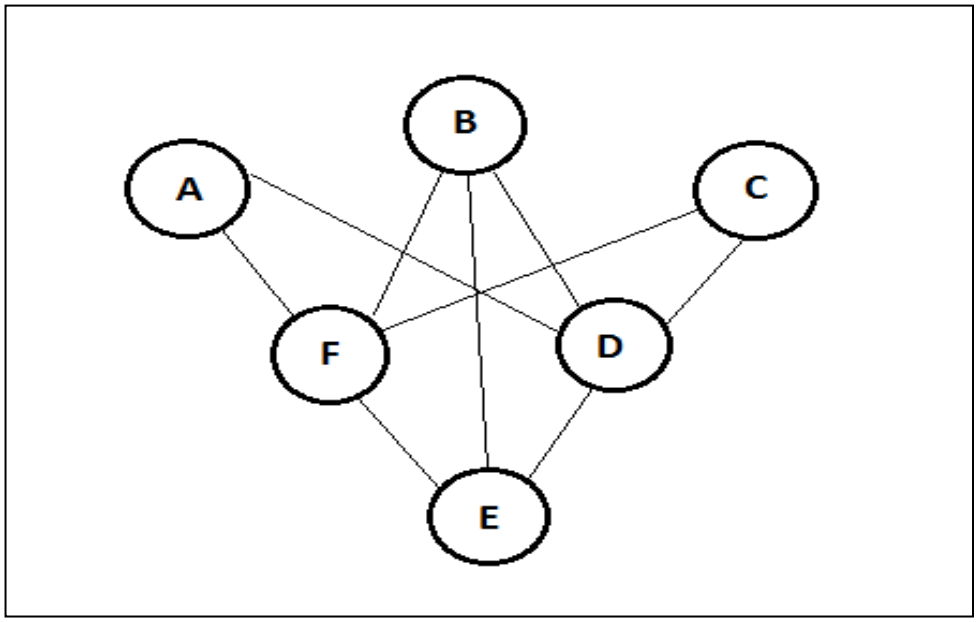

FIGURE 1. Example of Node Connectivity

SNA also calculates different quantitative metrics to give the researcher additional characteristics of the network beyond the visual data display. The calculations can assist in directing the researcher to specific companies, colleges, organizations, and/or individuals from the data collection that show patterns, repetition, or high connectivity

(Johnson, 2011). With such a large collection of data a visual representation is difficult, but the ability to narrow it through these calculations gives the researcher a chance to view the highest levels of connectivity more easily. For example, Figure 2 cannot be easily translated and is overwhelming to utilize in research. Visually it looks like a jumbled mess of nodes, but through calculations certain areas can be recognized as vital roles in the network. Then the researcher can focus on the portion of the analysis that provides the most information.

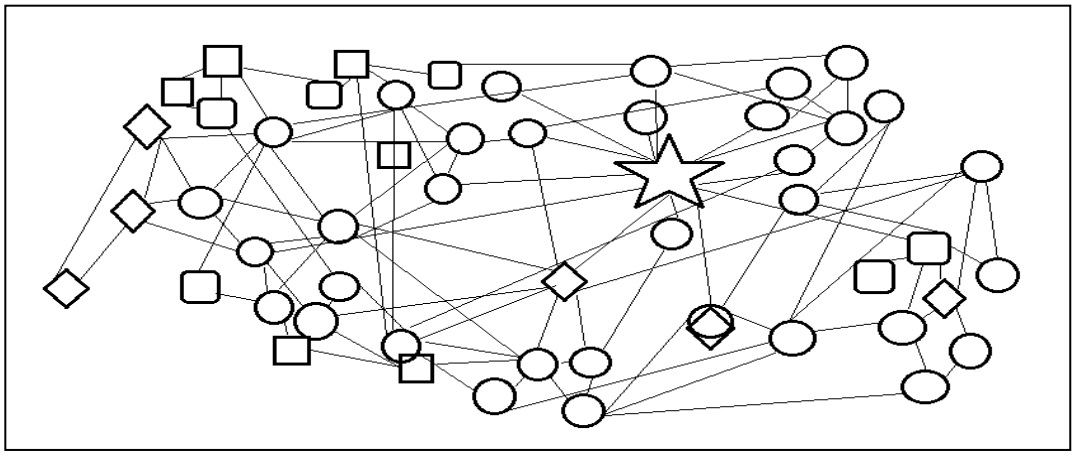

FIGURE 2. Example of unlabeled and problematic output.

SNA uses different types of measures to look at the level of connectivity and the amount of reliance on certain individuals and/or organizations. Node distributions include bridges, which shows an individual whose weak ties can fill a relational hole, providing the only link between two nodes, or even two separate clusters (Granovetter, 1973). The centrality of nodes will also be identified, quantifying the "importance" or "influence" of a particular node (Hanneman, 2011). SNA measures centrality through different types of calculations, based on what type of link analysis the researcher wants to determine. This research will use the following types of centrality, degree, closeness, betweenness and eigenvector to determine different measurements in the network. The simplest form of

measuring centrality is using the degree calculation, which counts the number of connections of each node (Opsahl, 2010). In Figure 3 it is easy to view the connections within the network, providing a number for how many connections it has. As the data amount grows, this method is less valuable visually, but also quantitatively.

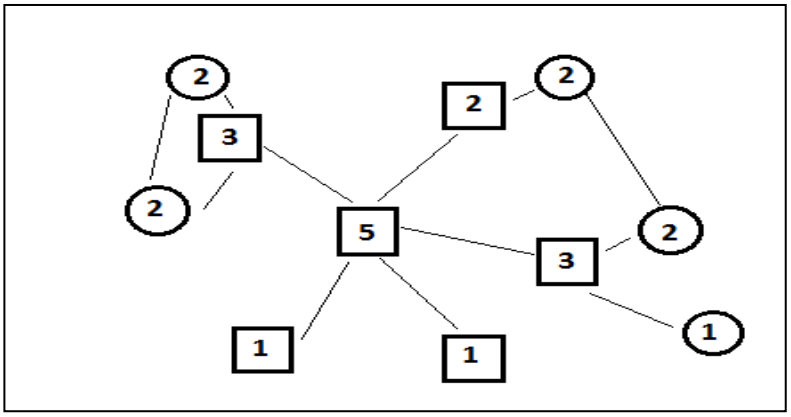

FIGURE 3. Degree Centrality

Closeness centrality looks at the natural distance that is present between nodes or node clusters and the closer the node in question is to them determines the closeness value. The more centrally located a node is, the lower its total distance is to all other nodes, increasing the closeness value. Betweenness centrality calculates how essential a node is in bridging different parts of the network and predicts how the node will affect the structure of the network if removed (Wasserman, 1994). It measures each node and calculates the number of individuals/organizations that it directly links, providing an indirect connection between those previously unconnected. Betweenness is defined by the link analysis program utilized to analyze the data as the gatekeeper who may control information flow between different parts of the network. Eigenvector centrality takes the betweenness calculation a step further. It provides a relative score for each node in the network based on its connectivity and then scores the node in question by the score of the

nodes it connects. This provides not only the number of nodes it connects directly, but also measures the importance of the nodes or clusters that it is providing a bridge, with the eigenvalue showing a different ranking for the node in question than its betweenness value. In the link analysis program it defines the eigenvector value as a strong influence in the network due to the nodes' direct links to other highly active or well-connected entities. For example, in Figure 4 consider node A, which connects clusters H, B, F and G and node D connects clusters C and E. Although node A connects more clusters, the overall score given to each cluster makes node B carry a higher eigenvalue with the node in question.

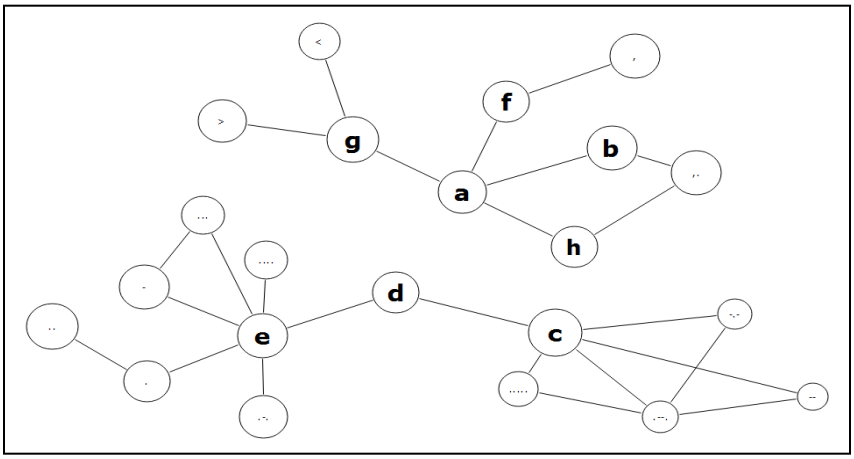

FIGURE 4. Identifying levels of centrality.

Generally, these levels of centrality should be positively correlated, when they are not, certain aspects of the opposition can provide important information. For example, if a node carries a high betweenness value, but a low degree, this can mean that the node's few links are crucial for the network structure. Or, if there is a high degree value and a low betweenness value, this shows that there are redundant connections (other nodes provide the same connection) and that communication between the nodes can potentially bypass the node in question and still reach its targeted destination.

Link Analysis Program

The program that will be utilized in this research to calculate the data will be IBM i2 Analyst's Notebook 8, version 8.9.3, which is designed to evaluate relationships between set nodes. These nodes will be the individuals' names, along with their biographical information collected from the research. With this program there can be various types of nodes analyzed, including people, organizations, education, etc. The program will allow the researcher to identify, analyze and create visual patterns, if any, with the data. Statistical information can be obtained through clustering, time-series analysis, and matching algorithms to detect anomalies. IBM i2 can also provide predictions through pattern recognition. This program will be immensely helpful and relevant to this research, analyzing data collected through visual patterns. Limitations to this program can include data collection errors by the researcher causing the analysis to give inaccurate output. This research also includes the collection of current 2013 data; therefore, if this information changes, the link analysis will no longer be correct. To remain accurate, the data would need to be updated regularly, but for this study, it will show the correct link analysis for the year 2013.

Phase One

Phase one consisted of data collection by the researcher between the dates of September 2014 and December 2014. Each agency and private company was identified through research, followed by the names of the leaders within these entities. There was not a predetermined number of individuals for each government agency or private company required for collection, but instead followed the guidelines mentioned above due to varying employment statuses. The researcher primarily used Google, Google

Scholar, and BASE search engines and while collecting biographical information for individuals, social media outlets will also be utilized, including but not limited to LinkedIn, Facebook, and Google Plus. Social media sources provided an ample amount of available biographical information that an individual provides openly to the public. All of these sources limited the data collected to only what was currently available to the researcher via the internet.

The top ten companies were determined within three sections of the food production industry, meat, seed and grain. These industries were selected due to their significance to food production in the United States, including the size of the industry, consumer sales and history of production growth. Agricultural crops grown and harvested in the United States draw a majority of sales from grain, more specifically corn, therefore validating grains inclusion in the research (USDA, 2013). Even more sales were received from livestock each year, with the United States being one of the top producers and consumers of meat (USDAFAS, 2014). Based on the process of production, neither of these industries would exist without seeds, adding the seed industry into the research. Through Google Finance, the researcher determined the top ten companies in each category through their reported annual revenue for 2013. Then, each company website was reviewed to find the names of the leading officials, which was done through the examination of an employee's title, rank, salary, and/or partnership within the company. This led the researcher to the most influential personnel within each company. After forming this list of individuals, employee data was collected, if available, for each employee on the company's website. Once this was collected, a search for deeper biographical information on each individual was completed in order to identify

educational, social and employment background, including but not limited to names of colleges attended, memberships within organizations, social activities, previous research completed, past employment history, political associations, and family connections.

The U.S. food safety agencies were predetermined by the U.S. government and were used for this research. They included the United States Department of Agriculture, Food and Drug Administration, and the Food Safety Inspection Service. The current officials of 2013 that were appointed or elected to leadership positions were identified and listed. These names were gathered through reliable government websites and public record. The study assessed the organizational structure of the agency and pulled names in leadership from the top four tiers of leadership personnel. A biographical search of each individual was completed in order to identify information regarding educational, social and employment background, including but not limited to names of colleges attended, memberships within organizations, social activities, previous research completed, past employment history, political associations, and family connections. It should be noted that the preliminary time frame for the officials remained current, looking specifically at 2013, unless it was deemed necessary to look at previous position holders. For example, if a private sector leader identified in the meat, seed, or grain industry was previously positioned in the government sector of food safety, that information was analyzed and included in the research.

Once the top food companies were determined, the names of lobbyists associated with them during the 2013-2014 business years wereidentified.In 1995, legislation was passed that set defined standards for labeling someone as a lobbyist and if these criteria were met, the individual must register and disclose their sources of funds (Nestle, 2002).

This allowed the researcher to obtain current names of registrants representing the top food companies. Then a full biographical search for each individual was conducted, including identifying educational, social and employment background, including but not limited to names of colleges attended, memberships within organizations, social activities, previous research completed, past employment history, political associations, and family connections.

Only reliable sources were used during the collection of each individual's biographical information, with the researcher looking at the author's credibility and knowledge of the subject, the dates of publication, biases in the writing or the source, and whether information could be verified through other sources.[1] The source had to contain an author, unless the site was associated with a reputable institution, such as a respected university, a credible media outlet, a social media site with information provided by the individual, or a government site or department.

Once collected the biographical information on each individual selected through the methods described were entered into Microsoft Excel, forming a spreadsheet. This method of organization allowed easy access to the abundant amount of information that was obtained during collection. The researcher was able to easily upload the entered information into a link analysis program.

Phase Two

Phase two of the research involved utilizing the IBM i2 program to analyze the collected names and biographical information, which resulted in two types of output, visual representation and quantitative metrics. This provided the researcher with an abundant amount of data on the collected individuals and their biographical information.

The excel spreadsheet was imported into the IBM i2 program, where the nodes and links were chosen manually by the researcher. The information was then processed into a visual network, followed by the centrality calculations, including degree, closeness, betweenness, and eigenvector. At this point the data could be processed in several different visual outputs, depending on what the researcher was attempting to show or highlight.

The described research and analysis established what, if any, relationships reside between officials in the private and government sector when researching U.S. food safety. A qualitative content analysis provided an unbiased collection of current data from the included personnel, reflecting on the theory of Mills and Domhoff. This work gave conclusive results to questions asked in the research.

RESULTS

Following the collection of data, social network analysis, and the focused assessment of the results, this research study showed the presence of an interlocking structure involving the government food safety agencies and the private sector of food production. There was also a trend involving educational backgrounds in relation to the connectivity between the separate entities, leading to an implication of a possible recruitment or funding pattern. It was also found that certain food companies have higher levels of centrality, making their presence critical to the network structure. The researcher was unable to determine whether the movement occurring between sectors was uniform or favoring one direction more frequently. The following results are powerful to the argument that a power elite, similar to the one described by Mill's and Domhoff, is still active in the current food system and the research moves toward a theory of a 'power food chain.

Data Collection and Modifications

During the researchers' initial determination of the top ten companies within the meat, seed, and grain industries; it was found that several of the top ranking companies were located outside the U.S. It was also quickly established that there are several more million dollar operations within the meat industry than with seed and grain production. At this point the researcher made the decision to change the method of criteria for determining the top production companies in these three areas. The analysis would now

contain U.S. companies with earnings over five million in revenue, containing a maximum of ten companies within each category. It was also found that many of these companies produce multiple products, which leads to different websites, annual revenue reports, and executives for each area. Therefore, the earnings were totaled from the company's production of the specific area in question, meat, seed, or grain. If the specific amount was unable to be separated from the overall report the total annual revenue was used.

The top ten meat companies were initially located through the Meat and Poultry's annual top 100 ranking for the leading companies in North America (Clyma, 2014). The numbers were then confirmed by the researcher through Google Finance, Forbes.com, and/or the official company website for each one. The results show that the following met the researcher's criteria: Tyson, JBS USA, Cargill Meat Solutions, Smithfield Foods, Inc., Sysco Corporation, ConAgra Foods, Inc., Hormel Foods Corporation, National Beef Packing Company, Keystone Foods, LLC, and OSI Group, LLC. The top ten seed companies were identified, but five of them were found to be based somewhere other than the U.S. After looking at more information on U.S. seed companies it was found that they would not make the revenue cut-off. The revenue for each one was retrieved from each company's website and confirmed through Google Finance and Forbes.com if possible.[2]The seed companies included: Monsanto, DuPont USA, Syngenta, Land O' Lakes, Inc., and DOW. There were three U.S. grain companies that were found to meet the financial criteria and the U.S. locale, leading the researcher to Cargill, Archer Daniels Midland, and ConAgra Foods, Inc. The company list and financial records can be found in Appendix A.

All the names of leaders and board directors were found on their respective company websites. Each company had a different number of found individuals working in these positions of authority, therefore, the amount of data will vary for each one. The data collection resulted in 559 individuals (rows) and included 19 columns of biographical information collected from the above resources. The rows list the individual'sname that was selected from the top tiers of the companies and agencies that were selected to be a part of this study. The columns included the current company that the individual worked for and their title in that position, colleges attended (3), previous employment (3), organizations that the person is associated with previously or currently (4), boards that they serve on previously or currently (4), and the lobby column shows any registry on the 2013-2014 list (3). The numbers chosen for each category were based on the average amount needed for each individual. If more biographical information was retrieved than the number of columns allotted for that particular category, the researcher sorted from most current to least current. If this excluded any information that the researcher determined significant, it was entered into a notes column, making the information accessible, but not used in the data analysis (i.e. presidential campaign director, college guest lecturer). If little to no biographical information could be found for the individual, the name was still entered and the column(s) were left blank when necessary. This did not hinder any analysis through the IBM program; it simply did not show a node for that particular category for that individual.

Overall Output

A scan for any obvious connections while entering the biographical data was highlighted by the researcher and later showed that there were 90 individuals who had

been employed or connected to a government agency prior to their employment in the private sector and vice versa. This was approximately 6 percent throughout the entire collection of data that had a direct and obvious link through previous employment. The observable connections are not always of highest importance and the researcher was looking to Mills and Domhoff's theory of an interlocking structure, which was not easily viewed and/or calculated through the initial spreadsheet.

The first analysis was completed for the entire spreadsheet, importing the data and using a force directed graph to display the material. The primary nodes were represented by the individual's names, which offered the necessary distinguishing feature separating the nodes from one another. A direct link to the primary node from all of the column categories were inserted manually by the researcher. This would allow the program to show links between all of the data, without limiting the analysis to only showing connectivity to secondary nodes. Figure 5 shows the output provided by the program, which shows how overwhelming a chart of this size can be, making it somewhat invaluable for the researcher. The information was calculated and gave a quantitative output, providing the levels of centrality.

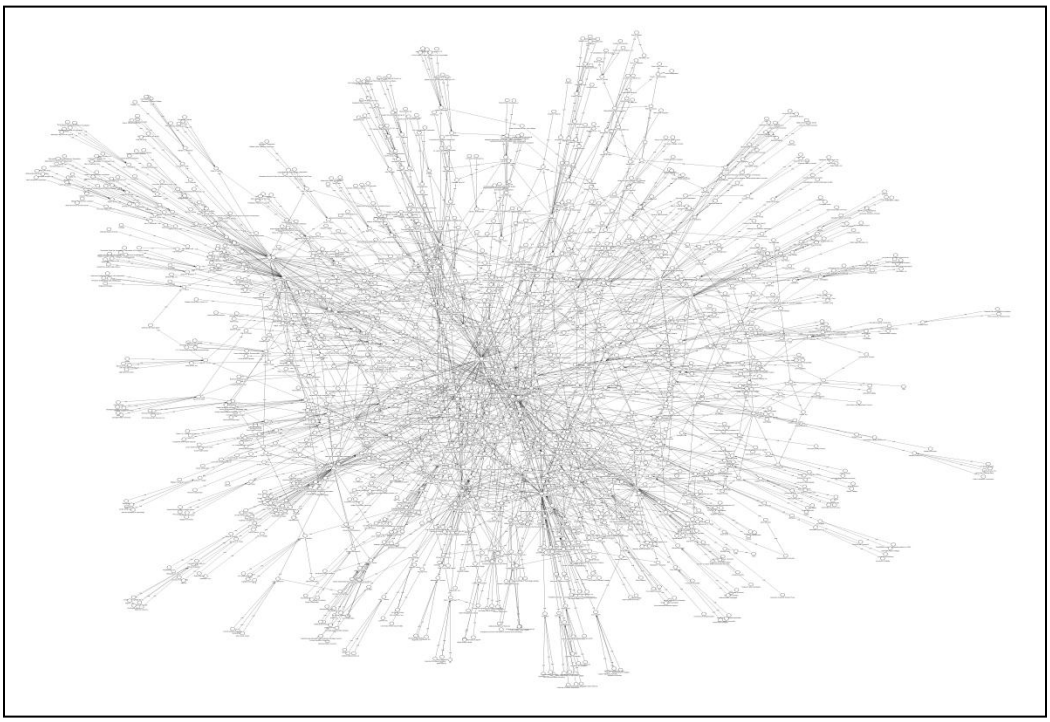

FIGURE 5. Complete data set using a force directed graph.

When viewing Figure 5, it is easy to recognize the outliers along the edges of the graph, which show single connections to a primary or secondary node closer to the center of the network. In social network analysis, those nodes are not as critical to the research due to their minimal connectivity. Without them in the chart there would be nominal changes, and quantitatively only decreasing the centrality levels of the node that the outliers are connected to. Even then, the levels of connectivity are so low that the impact on their value would not experience a large decrease in centrality. The researcher then has the ability to filter out the nodes, based on their centrality values. Those figures will follow in later portions of the study, focusing on specific links shown in Figure 5.

Looking at the quantitative output from the overall data analysis, the top contenders within the centrality calculations were identified. It is hard to utilize the company and/or the government sector to calculate any centrality due to the varying amounts of entries within the spreadsheet. This causes the calculations to be skewed for

that area, so although the analysis may be determinate of actual connectivity, the researcher cannot make that determination from the output. This will not minimize the validity of the education or individual centrality output, because those entries are not established via company relation, but by individual biographical connection. Providing insight into the nodes location in the network can reveal information about the overall network structure. This data reveals the individuals and the other entities linking one another and shows whether there is a presence of an interlocking triumvirate between them.

Individual Connectivity

By taking the calculations provided from the overall data the individuals with the highest betweenness centrality values were identified. It also creates the ability to take a focused approach, determining who were possible "gatekeepers" within the structure. The top individual in the degree centrality calculation is Chris Policinski, who is directly connected to 12 different nodes. Although this shows that this individual, who is currently a board member with Land O' Lakes and Hormel, is connected to several nodes, it does not give the researcher information regarding importance within the network structure. Policinski's direct connections do not include a government agency and no influential clusters; therefore his emphasis resides only in his large number of direct links. When looking at his closeness and betweenness values, he drops significantly and is not even in the top ten names. The top two individuals in the closeness, betweenness and eigenvector calculations are Fitzhugh Elder IV and Jeffrey Ettinger. Elder is a lobbyist, currently working with the Russell Group and registered with Monsanto, Cargill, Hormel and Land O' Lakes. He also previously worked in several areas within

the government sector, including the U.S. House and the U.S. Senate as an assistant. When calculating his degree centrality, he falls well below several other individuals, quantitatively showing that Elder is a key player tied to important nodes and although the direct connections may be low they are critical. Ettinger is currently the chairman of the board of directors at Hormel and previously was employed in the U.S. Court of Appeals. He also attended Harvard Business School, which is a large cluster in the network giving Ettinger fewer direct connections, but linking him to three very large clusters, Hormel, Harvard and the U.S. Government.

Government and Private Sector Connectivity

To provide a closer look at government connectivity within the large amount of data collected, the spreadsheet was filtered to only individuals who had current or previous direct connections with the U.S. Government. This narrowed the analysis to 196 primary nodes. The results of the centrality calculations are shown in Table 1, with the information separated into individual, education and the private sector.

Degree Centrality		Betweenness Centrality		Eigenvector Centrality	
		Individual			
Kathleen Bader	9	George Poste	2979	Malcolm Bertoni	0.059
Francisco Sanchez	8	Donald Felsinger	2899	Linda Fisher	0.058
Donald Felsinger	8	Andrew Schindler	2730	Kathleen Bader	0.058
Jeffrey Ettinger	7	Kathleen Bader	2705	Michael Taylor	0.058
Albert Zapanta	7	William Anderson	2700	Francisco Sanchez	0.057
		College			
George Washington University	15	University of Illinois	1986	George Washington University	0.056
Harvard University	14	Georgetown University	1979	Harvard University	0.056
Georgetown University	10	George Washington Univ	825	University of Maryland	0.031
University of Maryland	9	Harvard University	621	Georgetown University	0.031
University of California	6	Stanford University	608	University of California	0.023
		Company			
Monsanto	8	Monsanto	3706	Monsanto	0.023
Cargill	6	Keystone	996	Cargill	0.023
Dupont	6	Dupont	591	Dupont	0.02
Archer Daniels Midland	5	Glover Park Group	201	Akin Gump Strauss Hauer& Feld	0.02
Tyson	5	Tyson	116	Archer Daniels Midland	0.019

TABLE 1. Top five centrality values relating to the U.S. Government.

The results show several repetitions within the different centrality calculations and provide names of who or what entity carries the most connectivity with the U.S. Government. These numbers substantiate the presence of direct and indirect links between the government and certain individuals', colleges and companies. The network structure, without these entities, would not only look different, but possibly fail to provide network opportunities for the nodes to ever connect. Kathleen Bader has a high degree centrality, but is also in the top five for betweenness and the eigenvalue. Not only does this show that she is directly connected to more nodes than other individuals, but that she also provides a vital connection between some aspect of the network. Her biographical data shows that she is currently on the Tyson board of directors, but she also previously worked for DOW, Cargill and Homeland Security. Bader attended two

colleges that are linked to several others in this particular network, University of California and Harvard University. It is important to explain that although Bader did not attend certain colleges or hold employment at other companies, this network analysis shows that the potential to be connected through other means is present. For example, she attended University of California and Harvard University, as did Jeffrey Ettinger, who is directly linked to seven other nodes. Ettinger is currently serving on the Hormel board of directors. Robert Fraley also attended University of California and is employed with Monsanto as an executive vice president. Bader is now indirectly linked to Hormel and Monsanto, which gives Tyson connectivity to two other major companies in food production. When looking at previous employment Bader provides these three food production companies a link to DOW and Cargill. If taken even further, Monsanto's degree centrality is eight, with one of those direct links being Linda Fisher, who was previously employed with them. She is now a vice president with DuPont, a company that is in the top five of each centrality calculation involving the U.S. Government.

Monsanto ranks as number one in all the centrality calculations, showing its high level of direct connections, but also that the company offers essential links to other aspects of the government. Of the eight direct connections, six are employed with Monsanto, three specifically as lobbyists. Fraley, who was mentioned previously, was a technical advisor directly for the USDA and now a chief technology officer with a huge private sector company.

Cargill has a high degree centrality, but a low betweenness value (51.44), meaning that there are redundant connections and that network links can bypass this particular node and still reach the same destination. The higher eigenvalue shows that the

direct connections from Cargill are large clusters, such as Kathleen Bader, who is high ranking in all categories of centrality. Also, Dominique Harris is a Cargill lobbyist, who attended George Washington University, which is also in the top five colleges of all three calculations.

DuPont rates as third for all the centrality measurements highlighting another powerful link in the network. It is tied with Cargill for degree centrality and surpassing the same company in the betweenness calculations, quantitatively showing its value as a gate-keeper for other nodes. DuPont provides a link between Monsanto through an employed lobbyist, Linda Strachan, who previously worked for Monsanto, the USDA as Assistant Secretary, and the U.S. Environmental Protection Agency. Although her closeness centrality may be lower, she provides a connection between DuPont and Monsanto, increasing DuPont's eigenvalue because of Monsanto's large network cluster.

Education Connectivity

The theory of Mills and Domhoff brought attention to the education factor that played a large part in the interlocking triumvirate. Previously, the government sector was the specific focus, but it is also important to the research to show how colleges are interlocking with the private sector. If the theory is still accurate there should be specific colleges that directly linked to food production companies. To show these connections the companies were filtered from the overall data and processed. The centrality factors were calculated, excluding degree because a count of the nodes was not what the researcher was attempting to obtain. Table 2 shows the quantitative information from the processing. The top three colleges for each category of centrality did not change, which indicates the presence of influential importance to the private sector network structure.

College Centrality Values in the Private Sector

Closeness Centrality		*Betweenness Centrality*		*Eigenvector Centrality*	
Harvard University	9.59	Harvard University	14.19	Harvard University	23.82
Cornell University	9.53	Cornell University	6.16	Cornell University	23.53
Northwestern University	9.4	Northwestern University	4.96	Northwestern University	21.9
Iowa State	9.31	Iowa State	4.25	University of Pennsylvania	18.87
University of Pennsylvania	9.3	University of Virginia	4.19	Iowa State	17.8

TABLE 2. College Centrality Values

Harvard University is obviously a large player in connecting other nodes, but is also an important player in the government agencies as well (refer back to Table 1). It leads to an implication that these high levels of centrality suggest a recruitment pattern by the food safety agencies and private companies. This link could also provide forms of communication between the two that otherwise would not be present. The visual data output can be seen in Figure 6, showing the importance of Harvard University within the analysis. Harvard directly connects to 10 out of the 16 food production companies listed and also the USDA and FDA.

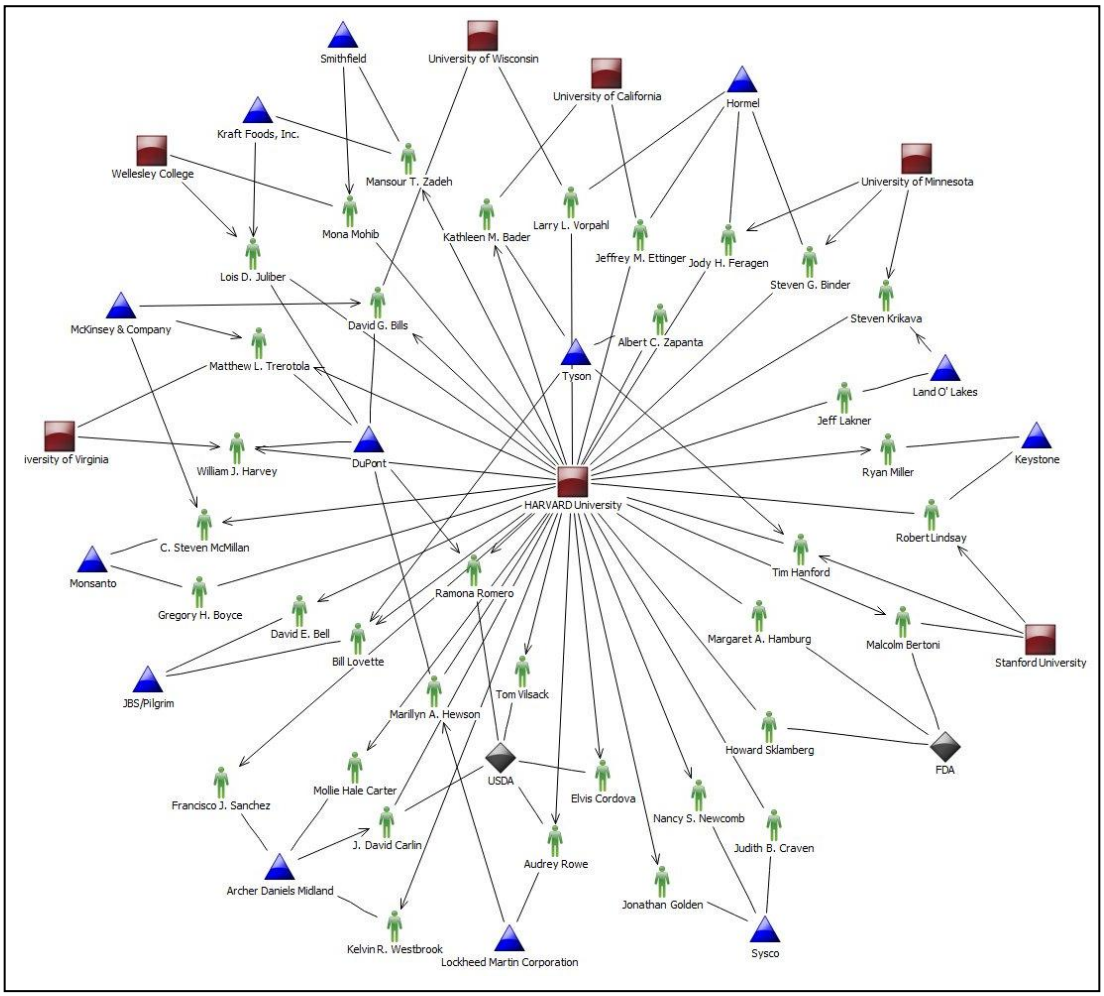

FIGURE 6. Harvard Link Analysis

Cornell University also has high levels of centrality, directly connecting to nine out of the 16 companies and also the USDA and FDA. These specific links can be seen in Figure 7, which show that the chart is smaller, but this does not diminish Cornell's importance in the network. Northwestern University is directly connected to half of the companies listed, including the USDA and FDA, and can be seen in Figure 8. Neither Cornell nor Northwestern is included in the top five levels of centrality when looking specifically at the government agencies, but they show a significant increase when it involves the private sector.

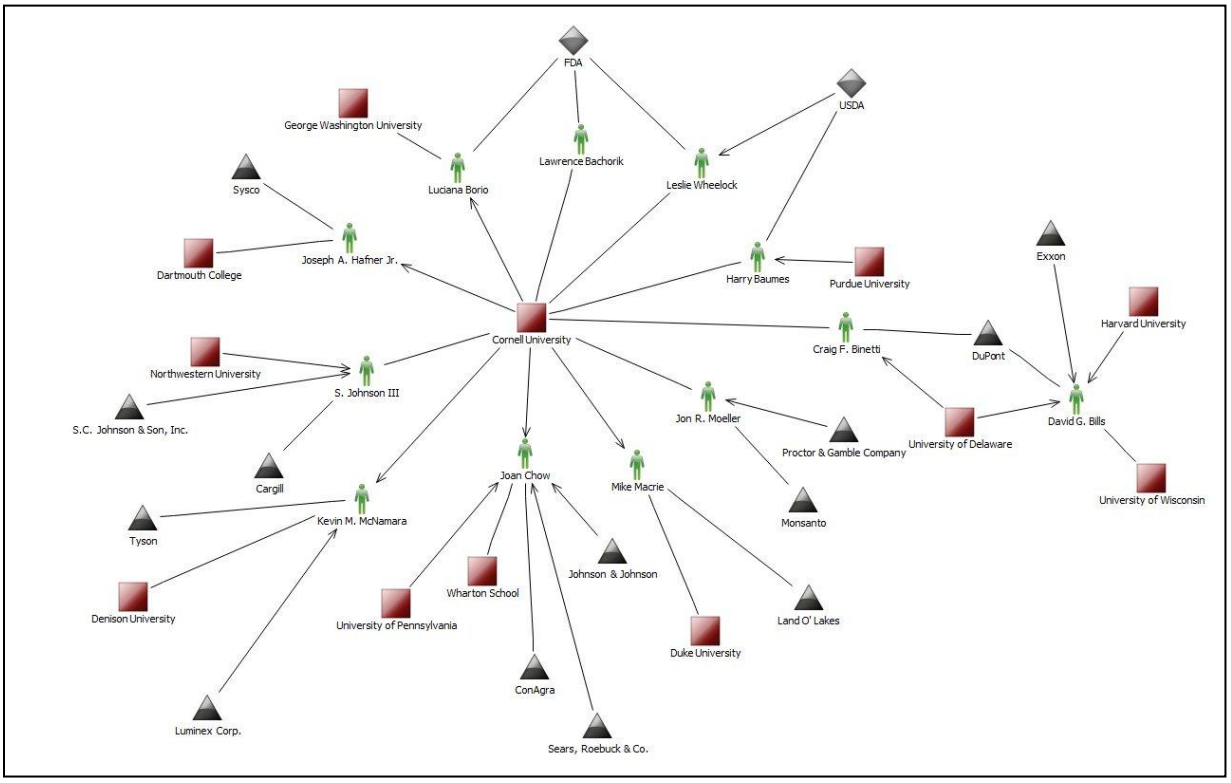

FIGURE 7. Cornell University Link Analysis

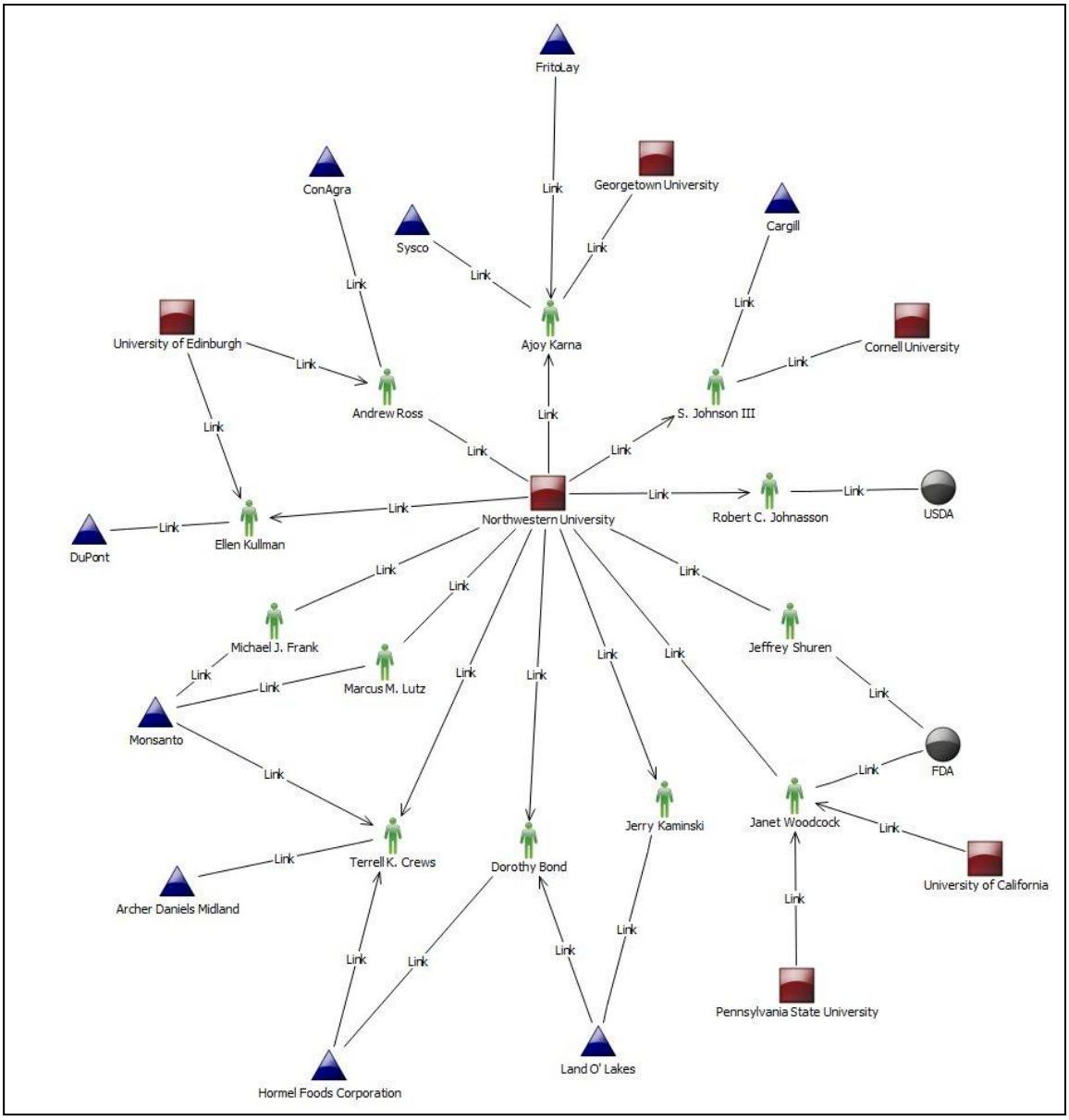

FIGURE 8. Northwestern University Link Analysis

Entire Data Analysis

For the last analysis the researcher used the entire data collection. When looking at the centrality calculations with the entire data versus only the government related agencies, a different network structure is presented. This provides centrality calculations based on the connectivity within the entire data set. Table 3 shows calculated results of centrality degree, betweenness, and eigenvector.

Degree Centrality		Betweenness Centrality		Eigenvector Centrality	
		Individual			
Christopher Policinski	12	George Poste	59681	Fitzhugh Elder IV	0.114
Gwendolyn King	11	Jeffrey Ettinger	37702	Jeffrey Ettinger	0.097
C. Steven McMillan	11	Kathleen Bader	34452	Linda Fisher	0.094
Ellen Kullman	11	Thomas Shipman	32072	Steven Krikava	0.092
Terrell Crews	11	Terrell Crews	30793	Francisco Sanchez	0.092
		College			
Harvard University	38	Harvard University	218217	Harvard University	0.164
University of Minnesota	22	University of Minnesota	37121	Georgetown University	0.069
George Washington University	15	Northwestern University	31471	George Washington University	0.063
University of Pennsylvania	14	University of Virginia	28687	University of Minnesota	0.056
Cornell University	13	Cornell University	28219	Stanford University	0.034
		Company			
Hormel	52	Hormel	165844	Monsanto	0.157
Land O' Lakes	46	DuPont	119621	Hormel	0.125
Cargill	45	Monsanto	115037	Cargill	0.123
Monsanto	38	Cargill	109161	Land O' Lakes	0.095
DuPont	37	ConAgra	105526	ConAgra	0.085

TABLE 3. Entire Data Centrality Calculations

For a visual look at the connectivity within the overall data between the government agencies and private sector, a chart was filtered from the overwhelming appearance of Figure 5, shown previously. Figure 9 shows a highlighted and magnified view of the government's overall relationship to the private sector specifically. Although not all of the individual names are found from Table 3, it is important to clarify the interlocking areas specifically related to these entities. A filter was applied to the chart, leaving only 22 nodes, providing an intricate look at one section of the network structure.

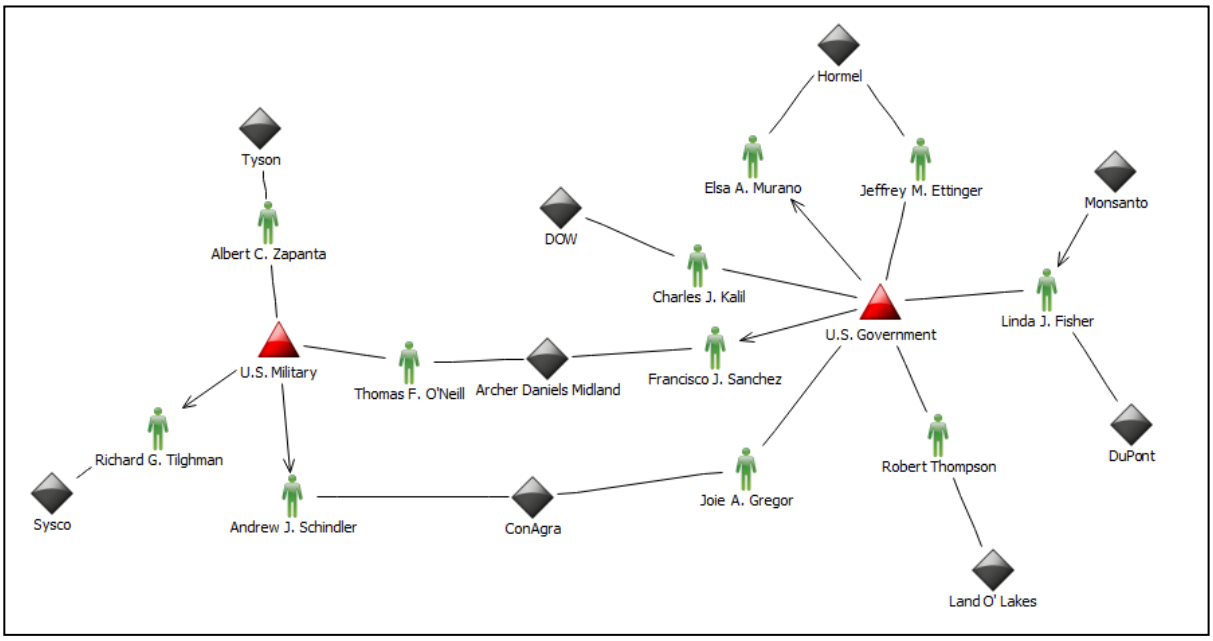

FIGURE 9. Focused look at U.S. Government to food corporations.

CONCLUSION AND FUTURE RESEARCH

The findings of this study represent the appearance of an interlocking structure in the current area of food production, safety, and research. It provides a visual and mathematical depiction of who holds the highest level of connectivity within the food safety agencies, food production companies, lobbying firms, and educational institutions. Instead of only determining that an individual previously had a direct connection with another entity, this research shows the indirect connections and how that affects the network structure involving food safety. The U.S. food system is consistently failing the public, whether through lacking health standards, industry oversight, or recalls that cause major illness or death. The revolving door that is consistently being utilized between the government and private sector is possibly carrying a large impact on the safety of the food consumer.These powerful leaders linking the food network and making policy and regulatory decisions in both sectors are consistently interconnected. The results of this study are moving the researcher toward the theory of a 'power food chain' and the presence of apower elite, similar to that of Mill's and Domhoff. The content of the relationships found could not be determined and the movement over a longer time frame is unable to be traced from the data collected for this study.

The results of this research could imply that the powerful, interconnected individuals in leadership roles are failing the consumer due to their conflict of interest from previous employments, alma maters, and/or memberships. It could also be implied

that the educational facilities that these leaders attended are feeders to the large food companies, providing an employee that is already trained for a particular position and adherent to the particular company. The implications are concerning and should be researched further.

Future research should be completed to expand and develop upon the possible theory of the 'power food chain' involved in food safety. Using the information already provided in this study, researchcould extend analysis to include each entity exposed as a large contributor to the network structure between the private sector and the government agencies. Acquiring records from colleges, private companies and related organizations could expand on the calculations that have already been performed. Also, looking at institutions that fund research grants, campaigns and scholarships could provide some background to the proven connections. Since, the individuals involved in the set agencies, companies, and lobbyist groups have been established for 2013, there could be a comparative analysis done annually or even over an extended time frame. These additions could offer an even larger collection of evidence to assist in the theory of a 'power food chain' and to show a consistent presence of an interlocking network within the U.S. food system.

LIMITATIONS

In research there are always limitations that the researcher cannot control and/or change, which can cause shortcomings or restrictions on the conclusions of the study. These are important to note and are a good source of information

This study was limited by what biographical information was available to the researcher for each individual. The analysis, output, and calculations can only be done on retrievable data that is entered into the initial spreadsheet. This could mean that if biographical information was obtained, it could hold relevance, but it could also result in no changes in the overall calculations. If this access to this information is unobtainable the cell is simply left blank. This is a limitation out of the researchers control and the impact on the conclusion is immeasurable.

While running the data through the link analysis program it was quickly found that the more individuals listed as employees with certain companies, the higher their degree centrality. This was an oversight when the methods for this research were established and was not realized until the link analysis program was used. More limits should be set for the number of the individuals entered into the initial data spreadsheet under each company or government agency, which would address the problem relating to skewed data in the quantitative output. Visually the structure still provides good representation, but calculating any centrality metrices has the possibility of being inaccurate. The data could be calculated with the exclusion of the individual's current

employment, but that would hinder any ability of the researcher to show links between current and past employment, with this being an essential area of comparison for this study. Future research should address this issue as to avoid inaccurate data output when processing the entire data collection.

1. Data collected for lobbyists between 2013 and 2014 due to the dates of registry.

2. DuPont's sales were calculated through subtracting what percent the company reported as seed sales.

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APPENDIX A

Company	Revenue (in millions)	Source	website	Meat&Poultry Top 100
Tyson	34,374.00	Google Finance		33.3
JBS USA	30,550.90	JBS website	http://ww	31.3
Cargill Meat Solutions	35.4	Cargill website	http://ww	18.00
Smithfield Foods, Inc.	13,221.10			13.09
Sysco Corp.				11.8
ConAgra Foods, Inc	15	Google Finance		8.2
Hormel Foods Corp.	8,751.65	Google Finance		8.2
National Beef Packing Co	10,429.49	Google Finance		6.8
Keystone Foods, LLC				6.3
OSI Group, LLC	5.9	Forbes	http://ww	5.9
				statista.com
Monsanto	14,861.00	Google Finance		10,340
DuPont	8,209	DuPont website		8,217
Syngenta	6,298.00	Google Finance		3,204
Land O' Lakes	4,761.68	Land O' Lakes website		
DOW	7.29	DOW website		1,642
Cargill	35.40	Cargill Website		
Archer Daniels Midland	41.48	Google Finance		
ConAgra Foods, Inc.	15	Google Finance		

TABLE 4. Top Companies and Revenue

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