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**Final Industry Report
*Agribusiness***

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ABSTRACT: Food insecurity is strategically important and ties directly to US agriculture, which remains “fundamental to our survival.”¹ Its value must be leveraged to address, mitigate, and respond to global shaping forces that are challenging the US agribusiness industry and negatively impacting US sustainable agricultural goals as well as national objectives. Therefore, the US must continue to develop robust ‘whole of government’ policies that provide for food security, address threats of aggressive economic competition and agroterrorism, and inform a comprehensive strategic approach. This will be necessary to “protect the integrity, safety, and resiliency of America’s food system,”² while advancing global food security, which “remains core to our national security.”³

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Industry Study Outreach & Field Studies

Campus Engagements

Center for Strategic and International Studies (CSIS), Washington, DC
American Farm Bureau Federation, Washington, DC
Bunge Limited, St. Louis, MO
Economic Research Service (ERS), International Trade Division, Washington, DC
ERS Agricultural Policy and Models Branch, Washington, DC
USAID, Bureau for Food Security, *Feed the Future*, Washington, DC
Johns Hopkins University, Paul H. Nitze School of Advanced International Studies, Washington, DC
DHS, Customs (CBP) and Border Protection, Washington, DC
American University, Stimson Center and School of International Services, Washington, DC
DLA, Quality Audits & Food Defense, Philadelphia, PA
CIA, Global Food Security and Agriculture Department, Washington, DC

Domestic Field Study Engagements

USDA, Food and Nutrition Services (FNS), Washington, DC
USDA, Foreign Agricultural Services (FAS), Washington, DC
USDA, World Agricultural Outlook Board, Washington, DC
Virginia Poultry Growers Cooperative, Hinton, VA
Claggett Farm and CSA, Upper Marlboro, MD
Smithfield Waverly Farms, Smithfield, VA
USDA Agricultural Research Service (ARS) Facility, Beltsville, VA
NC State University, College of Agriculture and Life Sciences, Raleigh, NC
North Carolina Biotechnology Center, Durham, NC
Syngenta, Research Triangle Park, NC
Premex Innovation Center, Durham, NC
Russell Senate Office Building, Committee on Agriculture, Nutrition and Forestry, Washington, DC
California Institute for Water Resources, Oakland, CA
Roots of Change, Oakland, CA
Climate Corporation, San Francisco, CA
UC Davis Olive Center, Davis, CA
Vander Schaaf Dairy, Escalon, CA
E&J Gallo Winery, Livingston, CA
Harris Ranch, Coalinga, CA
Couture Farms, Kettleman City, CA
Ocean Mist Farms, Castroville, CA
Tanimura & Antle, Spreckels, CA
Monterey Mushrooms, Watsonville, CA

International Field Study Engagements

Agropecuaria Popoyan, Center of Excellence Microbiology, Jocotillo, Guatemala
Agropecuaria Popoyan, Center of Capacity, Innovation and Production (CCIPP), Santa Rosa, Guatemala
US Embassy, Office of Security Cooperation (OSC), Guatemala City, Guatemala
Camara del Agro de Guatemala (CAMAGRO), Guatemala City, Guatemala
Association of Exports of Guatemala (AGEXPORT), Guatemala City, Guatemala
Palin Fedecocagua Coffee Mill and Warehouse, Palin, Escuintla, Guatemala
Servicios de Post Cosecha, Huehuetenango, Guatemala
Cooperative Pena Roja, Huehuetenango, Guatemala
Regional Center of the Institute of Science and Agriculture Technology, Quetzaltenango, Guatemala
USDA Food for Education Program & Catholic Relief Services (CRS), Totonicapan, Guatemala
Guatemala Customs Authority, La Aurora International Airport, Guatemala City, Guatemala

*“The greatness of the United States is founded on agriculture.”*⁴

L. Ogden Armour, 1922

Mr. Armour’s assertion (and depiction – *refer to Chart I*)¹ concerning United States (US) agriculture described an isolationist-minded America that was cultivating the fruits of its labor – unaware that it would eventually become the “most agriculturally productive country in the world.”⁵ Today, his words continue to resonate as American agriculture remains “uniquely tied to both our country’s culture and economy.”⁶ With the capacity to feed those who reside within US borders and simultaneously generate excesses to feed other developed and developing nations, it is clear that “agriculture remains the most valuable of US industries.”⁷ This tremendous capacity comes with even greater responsibilities founded in providing for US and global food security, both of which directly influence and impact US national security.

Over the next several decades, as global shaping forces continue to intensify and changes in the agribusiness industry reshape the food supply chain, the US will need to further develop and capitalize on its national agricultural capabilities. The ability of the US to expand its national competitive advantages, while maintaining its comparative ones, will be essential to adequately lead food security efforts.

This industry study report assesses the current state of agribusiness and food security through both a US and global perspective. This approach provides an effective way to analyze the most pressing challenges and to further understand and pursue the most compelling opportunities. The most significant agribusiness threats, Chinese economic competition and US vulnerabilities to agroterrorism, were taken into consideration when assessing overall national security impacts and the ability to pursue and provide for food security. The analysis made it clear that “understanding the issues are not enough and that smart US engagement is a necessity.”⁸ Consequently, the ability of the US to creatively lead both US and global food security efforts must be informed by whole of government policy recommendations, which this industry report offers for consideration.

Agribusiness

Economic Impact. America’s strong agricultural sector and associated agribusiness facets are key components of a robust US economy and remain integral parts of our success as a nation.⁹ In 2016, \$134.7 billion of US agricultural exports produced an additional \$172.1 billion in economic activity for a total of ~\$300 billion of economic output. This may seem rather insignificant due to its relatively small direct share of US Gross Domestic Product (GDP), at ~1%, however, the “United States Department of Agriculture (USDA) estimates each \$1 billion in agricultural exports supports 7,550 jobs.”¹⁰ And with every state producing exported agricultural commodities, the overall industry supports more than “one million full time jobs, of which 752,000 are non-farm related (*refer to Chart II*).”¹¹

Additionally, the overall contribution of the agriculture sector to GDP has a significantly greater impact due to the “agriculture trade multiplier” effect. This impact is due to the myriad of related sectors (forestry, fishing, textiles, food services, and others) that rely on agricultural inputs. Therefore, the total aggregate value-add from “agriculture, food, and related industries contributed \$992 billion to US GDP in 2015, a 5.5% share (*refer to Chart III*).”¹² More recently, according to the White House, agricultural-related industries contribute to, and make up, “at least 8.6% of US GDP”¹³ today. These empirical statistics underscore the fact that “agribusiness represents a diverse

¹ All charts can be found in the Appendix.

food and agricultural industry that spans the US, supporting millions of jobs along the value chain to ensure that consumers have access to high-quality, safe, and affordable food.”^{14, 15}

Value Chain. The term “agribusiness” typically describes the complete spectrum of activities required to bring food from “farm to fork” with an increase in “food value” at the intersection of each activity.¹⁶ The combination of all these activities into a logical flow creates the *value chain*. Due to the diversity of sectors associated with the overarching agribusiness industry, there is no single, standard value chain that applies universally to agribusiness. For example, the value chain for fruits and vegetables includes inputs, production, packing and storage, processing, and distribution and marketing (*refer to Chart IV*).¹⁷ For the purposes of this industry report, this value chain will be used for further segmentation and future reference.

The first stage of the agribusiness value chain consists of *inputs*. Seeds, fertilizer, water, pollinators, pesticides, herbicides, fungicides, and farming/irrigation equipment represent critical inputs in support of the next stage known as production.¹⁸ Here, activities arranged around small, medium, and large farms that supply cooperatives, exporter companies, and/or producer-exporter companies with fresh or frozen fruit or vegetables.¹⁹ It’s commonly at the input and production stages where research, development, and innovation provide for greater yields.

The next stage in the value chain is packing and cold storage where grading of fresh fruits and vegetables occurs; the associated processes may include product washing, chopping, trimming, mixing, packaging, and labelling in preparation for shipment for export.²⁰ In the processing stage, firms purchase food inventory from the producers and subsequently process dried, frozen, and preserved fruits or vegetables products before exporting.²¹ The final stage is distribution and marketing, where products reach food service firms, wholesalers, and retailers.

There are also other factors that can significantly impact the entire value chain, including infrastructure and transportation, governing regulatory bodies (that provide criteria for export/food standards),²² and global/national trends, such as consolidation.

Consolidation Trends. Consolidation and vertical integration is increasingly prevalent throughout the agribusiness value chain. This revelation is not of great surprise - as industries mature, it is typical that smaller fragmented businesses merge so that larger firms can achieve efficiencies and economies of scale. For example, historically, small family farms represented a large percentage of the agricultural sector in the US. However, over the last three decades, a greater proportion of crop production has trended towards larger family owned farms.²³ Accompanying this trend is a shift toward more crop specialization where farms tend to grow fewer varieties of crops. Advancements in innovation and technology, combined with large capital investments necessary to remain profitable are driving this consolidation. As equipment advances, productivity and yields increase, allowing farmers to manage more acreage with less labor. As the dynamics of competition continue to change, more consolidated suppliers dictate and control prices, where “farmers face less competitive markets in which to sell their goods, leaving them vulnerable to any price offered by a buyer.”²⁴ Consolidation may also lead to greater ‘big agriculture’ influence in shaping policy at the state and federal levels, where there is already a generalized feeling that the small farmer does not have adequate representation.²⁵

US Agribusiness Advantages

Comparative Advantages. The theory of *comparative advantage* argues that “a country boosts its economic growth the most by focusing on the industry in which it has the largest comparative advantage.”²⁶ The US continues to enjoy sizable comparative agribusiness advantages due to “its large land mass bordered by two oceans,”²⁷ access to resources (fresh water, arable lands, oil), and supportive climates. By leveraging these advantages, the US produces

agriculture at lower opportunity costs than most other countries. To that end, these agribusiness “opportunity costs represent a trade-off and the US has made the trade-off worth it”²⁸ because “no nation can be competitive in (and be a net exporter of) everything.”²⁹

Competitive Advantages. The US has well-founded and distinct agribusiness *competitive advantages*. These advantages includes exceptional yields and economies of scale that originate from continued adaption of innovative technologies, supportive government policies, advantageous trade agreements, and high-quality standards (and enforcement).³⁰ To illustrate this point, “since 1980, total US corn production has doubled, while land use per bushel has declined by 30%.”³¹ Additionally, “total farm output has increased roughly 40%, while annual fertilizer, herbicide, and insecticide use has actually declined.”³² Going forward, the US must lead the way, from a position of strength, and harness the power of these comparative and competitive advantages. This direction will be required to drive US and global food security while managing, mitigating, and proactively countering global challenges and shaping forces.³³

Global Challenges and Shaping Forces

“The reality is that stressors on the global food supply are not going away.”³⁴ These stressors (shaping forces) will continue to generate increasing pressures on national and global agricultural markets and invariably weaken developed and developing countries’ abilities to provide for domestic and global food security.³⁵ More frequent threats and input reductions to the global food supply system remain powerful reminders that “achieving food security is not a game we can afford to lose.”³⁶ Going forward, these steady and incessant forces will become increasingly more destructive over the next century. Population growth, climatic/environmental changes, demographic shifts, to name a few, represent interrelated shaping forces that will continue to fundamentally jeopardize US efforts in providing for food security.³⁷

Growing Population. The most significant demand-side shaping force remains exponential population growth. Although the late 18th century Malthusian prediction of population growth outpacing the world’s food supply failed to materialize, the threat remains real today. The United Nations (UN) Food and Agriculture Organization (FAO) “estimates that the world will need to produce 60% more food”³⁸ to “satisfy global populations of 8.6 billion by 2030 and 9.7 billion by 2050,”³⁹ with a majority of this increase “concentrated in regions with the highest prevalence of undernourishment and high vulnerability to the impacts of climate change”⁴⁰ (*refer to Chart V*).

Climatic changes/shifts. “Changes in global weather patterns are now projected to have potentially devastating impacts on agriculture in the coming years and decades.”⁴¹ Trends suggest that greater climatic environmental changes and volatility will continue to affect precipitation patterns, shift areas of physical water stress, and modify available land suitable for sustainable production (*refer to Charts VI, VII & VIII*). For example, “there is only, at most, 12% more arable land available worldwide that isn’t presently forested or subject to erosion or desertification, with the most available cropland found in remote areas of South America and Sub-Saharan Africa, where soils are inferior in quality.”⁴² That being said, agriculturally important effects of climate change are numerous, relevant, and significant – all of which play a role in achieving food security and sustainability.

Demographic Shifts. “A bulging population of youth in Africa and rapid urbanization is creating opportunities for an economic growth spurt that will affect food demand.”⁴³ It is predicted that by 2050, the urban/rural mix will reverse and “70% (or 6.3 billion people) of the world’s population will be urban residents.”⁴⁴ Mega-cities will surface in countries around the world (primarily in South Central Asia and Sub-Sahara Africa) that will need to feed more than 100

million inhabitants (*refer to Charts IX & X*). Such a momentous shift promises to stress production capacities and increase competition for available fresh water and land. Ultimately demographic changes will affect the way in which countries provide for food availability, stability, safety and access.

Developing Country Constraints. Global challenges are compounded even more so in developing countries' due, in part, because "growth in food consumption will outstrip production capacity."⁴⁵ Therefore, the overall risk of "food insecurity in many countries of strategic importance to the US will increase over the next ten years due to production, transport, and market disruptions to local food availability, declining purchasing power, and counterproductive government policies."⁴⁶ Furthermore, "food safety issues, economic and social inequities, and food price volatility are seen as persistent disrupters of food systems and food security, which will deprive millions of reliable access to food and challenge their physical security and social cohesion."⁴⁷

Opportunities. US agricultural production capacities will be required to meet growing global demands that can only come from expansive agricultural development and growth. The US has the capacity to take a leadership role in managing these forces in pursuit of achieving US and global food security. However, the realization that most of the new and increased food production must come from outside the US borders necessitates greater emphasis on partnering with industry, academia, and other nations to adequately invest in technology and innovation. As previously mentioned, the ability to leverage technology and innovation to achieve higher yields remains a tremendous US competitive advantage. In fact, despite total farm inputs remaining virtually unchanged since the 1940's, total farm output has increased ~250%, namely due to a 'mirror-image' correlation to *total factor productivity* increases.⁴⁸ It is clear the continued pursuit and application of innovative advancements is well underway in the US, as demonstrated by companies like Virginia Poultry Growers (production line automation), Climate Corporation (satellite data-sharing technology), and Ocean Mist (large-scale automated processing and packaging). This demonstrated resolve is prescient, as to adequately provide for food security, the global food and agriculture systems will need to maximize productivity and production capacities through innovative technologies, despite intensifying shaping forces.

US Food Security

Food security is a complex and highly debated topic with numerous definitions and inclusive dimensions. In fact, there is estimated to be almost two hundred different definitions of *food security*.⁴⁹ One of the most popular definitions comes from the UN FAO, which states that food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."⁵⁰ Conversely, "food insecurity" can be described as a situation where there is a "food shortage, lack of access to food, malnutrition, or some combination of the three."⁵¹ The scope of food security is certainly global, but is often applied to regions, countries, communities and even individual households.⁵² That being said, food security is not just a third world issue, but it also affects developed countries like the US, where ~14% of households suffer from food insecurity.⁵³

Food security can be further segmented into four distinct dimensions which include: *availability, access, utilization* and *stability*. More specifically, availability of food includes simply having enough food on a consistent basis; access implies having enough food for a nutritious diet; utilization includes both the safe and nutritional application of food; and stability refers to a food system that remains resilient to sudden impacts from a natural or manmade crisis.⁵⁴ For further

initial context and for the purposes of this industry study report, food stability/resilience will be addressed in greater depth, from a global food security perspective.

Availability. The foundation of food security begins with availability. According to the UN, availability includes “sufficient quantities of food of appropriate quality, supplied through domestic production or imports.”⁵⁵ Food availability is also closely linked to the use, and scarcity of, natural, human, and economic resources.⁵⁶ Applying these available resources to optimize production efficiencies and output is critical. Associated challenges vary from problem area identification related to the production process as well as uncertainties related to demand volatility. Therefore, the US must utilize its limited resources as prudently as possible to support food security efforts. Policy must seek to find a balance between meeting an increasing demand for food commodities with a focus towards capitalizing on efficiencies in resource utilization. Three such resources are *land use*, *water*, and *labor*, which also remain the most critical (production) inputs to the US domestic food supply. All three also present significant challenges towards achieving long-term sustainability.

Land Use. Arable land is a valuable and finite resource that if not sustained, will adversely impact US food security. It is nearly unthinkable that the US, with its vast economic and natural resources, could face a scenario where food is in short supply, due to insufficient arable land. An understanding of the factors that influence land use becomes increasingly important as one considers options for future regulations and policies. Urban development, farmland ownership, and regulations are all shaping the accessibility of agricultural land within the US.⁵⁷

Urban Development. The America Farmland Trust estimates that over 40 acres of farmland are lost to development every hour across the US and that 24 million acres (an area the size of Indiana and Rhode Island combined) were developed between 1982 and 2010.⁵⁸ Hence, the threat of urbanization remains a concern for the future availability of land designated for agricultural use. Specifically, when comparing historical land use trends from 2007 to 2012 (*refer to Chart XI*), cropland has only increased by ~1% following a steady decrease over the previous twenty-five years.⁵⁹ This increase is most likely attributable to the release of land from the Conservation Reserve Program, with minor offsets from conversion to other types of land and urban development. Therefore, although development is still depleting the nation’s prime farmland, it is at a greatly reduced rate, which also suggests that recent efforts to preserve agricultural lands are having a positive effect.⁶⁰

Farmland Ownership. Relationships between farmland owners and those farming the land are influencing land transfers and will continue to have profound long-term implications for US agriculture.⁶¹ A 2016 USDA report reveals that of the 911 million acres of US farmland (crop and pasture), 96% are owned by family farms (45% small farms, 51% mid-size and large farms) and approximately 39% of the acreage is rented. Also, almost 40% of non-operator landlords are retired farmers who no longer work their lands. Furthermore, estimates suggest that only 10% of America’s farmland will be transferred from 2015 thru 2019⁶² and incentives will play a large role in future land use as renters tend to be more concerned about short term profits and less about good farming practices and sustainment. Lastly, the average age of the US farmer has increased from 50.5 to 58.3 over the past thirty years and farming is now one of the oldest occupations.⁶³ As farmers increase in age, questions arise about future accessibility of land to new entrants and whether they will rent or own farmland.⁶⁴

Regulations. Land use policy in the US is complex and resides at multiple levels - federal, state, and local.⁶⁵ Over the past century, states have increasingly delegated authority to local governments to adopt land use plans, establish zoning districts, manage development, and mitigate

the adverse impacts of land use on natural resources and the environment.⁶⁶ Federal programs created in the 1970's to incentivize increased production had the unintended consequence of creating widespread soil erosion and poor land management.⁶⁷ Therefore, in 1985, Congress initiated a precedent of linking federal subsidies to farmers that adhere to USDA standards in an effort to reduce production and conserve natural resources.⁶⁸ Programs such as the Agricultural Conservation Easement Program (ACEP) provide federal and state funds to purchase development rights of privately held land to protect the long-term viability of the nation's food supply. Said initiatives are designed to prevent conversion of productive working lands to non-agricultural uses; as of 2016, the ACEP had purchased over 300,000 acres.⁶⁹ These issues represent just a few examples of how US policy can influence trends in land use.

The Environmental Protection Agency (EPA) is another federal regulatory body that has significant implications for the agricultural sector/industry.⁷⁰ "Traditionally, farm and ranch operations have been exempted or excluded from many federal environmental statutes and regulations, and some point out that the relative number of environmental regulations affecting agriculture is small compared to other industries."⁷¹ "Currently, the EPA has provisions governing air, water, energy, and pesticide use that all have reporting or compliance mandates applicable within the agriculture sector."⁷² To counter this oversight, agricultural professional affiliations and lobbying groups have been vocal about the negative impacts related to over-regulation. Much to their satisfaction, in May 2017, the USDA announced that the current administration was considering changes that would lessen regulatory constraints deemed excessive.⁷³ That said, a balance must be reached that allows farmers (especially small farmers) to remain profitable and preserve natural resources over the long-term.⁷⁴

Water. Water is another finite natural resource essential for food production. Agriculture is, by far, the largest consumer of water, accounting for 70% of the water used in US, while rivers, lakes, and reservoirs contain less than 1% of the freshwater available for use.⁷⁵ As previously mentioned, the FAO projects that by 2050, there will be a doubling of demand for food globally, but the amount of water withdrawn by agriculture will be limited to an increase of only 10%.⁷⁶ This, in addition to numerous water scarcity stressors, will challenge conservation and sustainability efforts and goals.

Climate Change. Climate change directly impacts the future distribution of the water supply. Snow and ice packs are diminishing, sea levels are rising, and the concentration of greenhouse gases are increasing.⁷⁷ Global trends suggest that warmer temperatures are projected to occur over land, causing changes in evaporation and precipitation patterns, which will lead to more frequent and pronounced droughts and flooding. The impacts of climate change are also effectively raising the 'farming belt' to higher latitudes. Traditionally, this defined latitude is known for specific weather conditions that result in ideal crop production, with farmers seasoned in farming crops. This northerly belt migration also impacts the supply of water and rising temperatures in the US are already posing a real threat to southwest water supplies.

Increased Consumption. The water footprint, or the amount of water required to produce a commodity over the entire value chain, varies with market demands and the different types of regional commodities. For example, California (as one of the top agriculture states) has been under scrutiny as a large consumer of irrigated water. This demand is necessary to produce specialty crops such as fruit and nuts, as well as grain and pasture crops to support its meat and dairy industry.⁷⁸ Interestingly enough, animal care typically draws a larger water footprint than most crops. In fact, the US pork water footprint was estimated to be 8.2 gal/4oz serving, with a total

pork industry water use of 525 million gal/yr.⁷⁹ Therefore, the projected increases in the production/consumption of animal products will further challenge freshwater resources.⁸⁰

Energy Production Demand. Biofuels compete directly with food production for water. Corn is the most common US biofuel feedstock crop, which consumes a large percentage of freshwater resources, including an estimated 5.6 cubic miles per year of irrigation water withdrawn from America's rivers and aquifers.⁸¹ This biofuel reality accounts for ~40% of the crop yield in non-food use and will continue to exacerbate US water scarcity issues.

Sustainability. Sustainable agriculture and efficient water management will be of utmost importance for increasing future yields without stressing the water supply further. It will require a balance of solutions from stakeholders working collectively to improve water scarcity and food security. California provides an excellent case study for addressing water scarcity issues, at a more scalable, national level. More specifically, the state has recently enacted the Sustainable Groundwater Management Act, as well as more stringent regulations and policies imposed by the California Department of Food and Agriculture (CDFA) on agricultural water usage. The need to strategically change the way in which we use water requires immediate attention. To that end, the opportunities to improve water conservation will require three things: commitment, clear objectives, and funding.

Labor. Labor represents one of the most important finite 'human' resources essential to the production component of availability. The USDA indicates there are roughly three million people employed in farm work across the US, and two thirds are family farmworkers.⁸² For decades, both have been in relative decline due to automation or mechanization of farm activities (*refer to Chart XII*).⁸³ Of the one million hired farmworkers, roughly half are unauthorized (i.e., illegal).⁸⁴ This is to say, both authorized and unauthorized farmworkers only represent 4.5% of the 11 million unauthorized immigrants living in the US.⁸⁵ These numbers suggest immigration plays a critical role in providing for adequate and needed agribusiness labor.

Immigration. According to Texas A&M, "immigrant labor accounts for 51% of all dairy labor and dairies that employ immigrant labor produce 79% of the US milk supply. If eliminated, US dairy herds would decrease by 2.1 million cows, milk production would decrease by 48.4 billion pounds, and the number of farms would shrink by ~7,000. Additionally, retail milk prices would increase by an estimated 90.4%."⁸⁶ The inseparability of US farm labor and immigration becomes more apparent when one considers some of these forecasted impacts. And according to the USDA, commodities like fruits, vegetables, tobacco, and poultry have even more labor requirements than dairy (*refer to Chart XIII*).⁸⁷ Immigrant labor in the US, thus, remains in high demand across many important agricultural sectors.

Farm owners typically desire to hire immigrants over US citizens as a source of farm labor for several reasons⁸⁸ including: they are more likely to accept employment at lower wages,⁸⁹ they are a more reliable source of labor,⁹⁰ and they offer more flexibility for seasonable labor.⁹¹ These reasons, particularly when combined, make the immigrant workforce inextricable from agribusiness. This is especially true for farm activities that cannot, or are too costly to, supplant labor with technology.⁹² Ironically, and almost counterintuitively, the underlying driver behind the "illegal immigration problem" remains a strong US economy, which has been a driving force behind intensified calls for immigration reform.⁹³

Immigration Reform Debate & Analysis of Labor. The US government has sought policy to control immigration while satisfying farm labor needs for decades.⁹⁴ Powerful lobby groups, such as the American Farm Bureau, advocate for less government interference or *employer-friendly* immigration laws.⁹⁵ Others pull on the heartstrings of Americans, as the descendants of

immigrants who support *immigrant-friendly* laws. And then there are those who desire the current *hybrid* or a *merit-based* immigration system that prioritizes individuals who offer value to the nation.⁹⁶ The common themes among immigration reform proposals are the protection of American jobs and national security assurances. Farm owners desire access to a flexible and reliable labor pool and immigrants/foreign workers satisfy this need. As such, any restrictive immigration policy will most likely be met with strong resistance.

To grow agribusiness, expenses must remain low to maximize profits. This desired end-state makes the decision to seek the least expensive labor options easy, which leads to the hiring immigrants. As previously mentioned, the alternative is technology, which is often not affordably obtained (particularly for small farmers). Although not an elixir, merit-based immigration, to its credit, is capable of supporting farm labor, while placing ample pressure on employers to hire US citizens that can lead to wage growth as well as innovation.

Other, Unique Form of Labor – Bees. The US food supply is extremely reliant upon crop pollination by insects, which should be considered an additional form of “free” labor. The value of the crops that honey bees pollinate equates to \$24 billion⁹⁷ and this labor consists of the transfer of pollen (cross-pollination) that ultimately produces seed and fruit, representing an integral and very important input for agriculture.⁹⁸ Specifically, honey and bumble bees play a critical role in agriculture considering that 75% of the vegetables, fruits, and seeds produced from the major global cultivated plant crops depend upon bee pollination.⁹⁹ Additionally, bee pollination accounts for over 74% of all globally produced plant-derived lipids, fat-soluble vitamins, such as vitamins A, E, D, and K, and water-soluble vitamins, such as vitamin C.¹⁰⁰ Consequently, honey bee pollination provides nutritional security.

To support this critical input variable, agriculture industries hire managed, transportable honey bee colonies for the scheduled pollination of field crops. Hired honey bee colonies provide a degree of efficiency and reliability that unmanaged pollinators are unable to provide. The California almond industry, for example, hires honey bee colonies for pollination services because almond trees bloom during a season (i.e., January – April) when wild pollinators are mostly inactive.¹⁰¹ An example of other industries that hire honey bee colonies for pollination services include apple, onion, citrus, cotton, and sunflower.¹⁰² Apiarists earned \$337.8 million in 2016 and \$435.0 million in 2017 for these pollination services.¹⁰³ However, these fees are significantly lower than the estimated \$10 billion that it would cost if human labor was used for pollination instead.¹⁰⁴

For managed honey bees, multiple research studies suggest a variety of factors causing declines in honey bee populations. Over-reliance on a single subspecies of honey bee and an absence of genetic diversity may expedite colony disorder (CCD) and reduce overall resiliency against other stressors.¹⁰⁵ Additionally, the exposure of honey bees to the application of insecticides and fungicides negatively impact the overall health of honey bee colonies.¹⁰⁶ Healthy, well-nourished honey bee colonies feeding on a variety of pollens and nectars from diverse flora are the most reliable and efficient crop pollinators. They can provide nutritional security and contribute to food security through crop production. Unfortunately, despite an overall growing trend in global apiculture over the last few decades (e.g., 45% growth since 1961), the growth in apiculture lags the increasing global demand in pollinator-dependent agriculture for the same period (e.g., > 300%).¹⁰⁷ Any policy recommendations that stabilize and safeguard the health of managed and wild pollinators will ensure that this valuable source of labor at the input level agribusiness is available for feeding future generations.

Access. According to the UN, access includes “access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet.”¹⁰⁸ The US, through its ability to leverage

many of its competitive advantages, “creates the conditions for trade.”¹⁰⁹ And according to Michael Porter, “a nation whose firms gain from these industry advantages are able to export.”¹¹⁰ This industry study report will therefore focus on trade as the main contributing factor affecting access and affordability. Arguably, the intrinsic, often forgotten, ability to ensure food remains accessible and affordable is as important as the economic impacts of agricultural trade.

Agricultural Trade. Through the power of agricultural trade, the US fundamentally addresses “the three elements of food access - physical, economic/financial and socio-cultural.”¹¹¹ This accessibility leads to real food affordability for the American consumer. Hence, “average real prices for cereals, meats, dairy, and sugar declined by 40% between 1961 and 2010.”¹¹² This has been achieved vis-à-vis greater globalization, which drives competition due to [mostly] free markets and lower investment entry barriers. Furthermore, increases in accessibility to new export markets are greatly facilitated by USDA programs, such as the Market Access Program (MAP) and Foreign Market Development (FMD) program, which partner with trade associations and producers to share marketing/promotional costs (\$174 million and \$26.4 million, respectfully), provide export training, and build export markets for US agriculture. This accessibility also accounts for a greater variety of (counter-seasonal) foods at competitive, consistent, and affordable prices which would diminish greatly without the benefit of a thriving global food trade market. Global trade competitiveness, supported by trade agreements, ensures there is not only enough demand for US agribusiness exports, but an inexpensive way to access and import the food the US is unable or unwilling to produce domestically.

Trade Surplus. The US national debt, “which now exceeds \$21 trillion, will soar to more than \$33 trillion in 2028, well passed the level that economists say could court a crisis.”¹¹³ Therefore, many believe it remains the biggest threat to national security. In the same vein, “an ongoing trade deficit is detrimental to the nation’s economy because it, too, is financed with debt.”¹¹⁴ And “as of 2017, the trade deficit was \$566 billion.”¹¹⁵ Until recently there had been a widening agricultural trade surplus, but “the value of US agricultural exports declined in 2015, reversing five consecutive years of export growth, producing a shrinking trade surplus worth about half its 2014 value at \$19.5 billion.”¹¹⁶ Although a portion of this shift can “be explained by lower commodity prices and a stronger US dollar,”¹¹⁷ this negative agricultural export trend signifies market risk and represents an agricultural trade weakness.

As the agribusiness industry continues to grow faster than domestic demand in several sectors, so does its “reliance on export markets to sustain prices and revenues,”¹¹⁸ including markets in China, the largest US agricultural export market as of 2016 (*refer to Chart XIV*), “which has grown 13% annually on average, over the past ten years.”¹¹⁹ Any slowdowns, disruptions or potential tariffs will “have a trickle-down effect throughout the global economy and ultimately will affect the US.”¹²⁰ Therefore, an over-reliance on the Chinese agricultural import market represents a potential weakness for the agribusiness industry. Although strengthening agricultural demand may generate steady export levels of major commodities over the next decade “the US share of global exports tends to fall as competition from other countries erodes the US share.”¹²¹

Tariff Outlook. The current threatening environment related to agriculture trade tariffs is dangerous and short-sighted. Although not in jeopardy of reinstating a trade policy analogous to the infamous Smoot-Hawley Act of 1930 (which “plunged US trade by nearly 75%”¹²²), the tit-for-tat escalatory rhetoric between China and the US is risky if for no other reason because “a tariff to protect one industry amounts to a tax on all of its customers.”¹²³ The overall impact to US exports including pork, soybeans, cotton, corn, wheat and beef only represents a modest \$25 billion tax on a “reciprocal trade relationship that last year amounted to nearly \$700 billion.”¹²⁴ However, a 25%

tariff on these agriculture commodities/products would be significant for “a wide swath of the farm economy, from small to large farmers,”¹²⁵ many of whom are already challenged by multiple years of low crop prices. In a zero-sum game, even if USDA Secretary Perdue does execute *Commodity Credit Corporation* reliefs for farmers, shifts in trade will make global suppliers more attractive to Chinese buyers and open an opportunity for Asian, Europe (EU) and South American actors to syphon market share away from the US commodities sold to China. Such trade-restricting measures reduce accessibility and not surprisingly, contribute to a decreasing US agricultural trade surplus.¹²⁶

Demand & Access Creation. “As the world’s economies become more integrated, global trade and the links between countries grow ever deeper.”¹²⁷ Therefore, free trade agreements (FTAs) become even more critical as they “lower barriers to agricultural trade and create demand for US agricultural commodities in foreign markets.”¹²⁸ Embracing this reality, the US has 20 free trade agreements (*refer to Chart XV*) in effect, and in 2015, “47% of all US exports went to FTA partners, representing 10% of world’s GDP (or \$710 billion).”¹²⁹ These FTAs “have expanded agricultural trade with developed and developing countries and, in turn, have created growth opportunities for US agriculture.”¹³⁰ Additionally, “for 16 of the 20 countries that the US has FTAs with, US exporters will face zero tariffs on 98% or more of agricultural goods;”¹³¹ the two most recent and impactful FTAs for agriculture being North American Free Trade Agreement (NAFTA) and the Central American Free Trade – Dominican Republic Agreement (CAFTA-DR). The latter FTA truly underscores the integral role long-term investment, access, and collaboration play in trade.

Long Term Investment, Access, Collaboration. “Investing in agriculture is one of the most effective ways to increase rural incomes and drive national economic growth.”¹³² This growth is only achievable through synchronized frameworks like ones found in the Farm Bill, the Global Food Security Act, and the Foreign Agricultural Service Strategic Plan. Furthermore, export growth requires expanding markets that can only come from international investment, “by boosting agricultural productivity, strengthening supply chains, and promoting sound market-based principles for agriculture sector development and trade.”¹³³ Through a ‘whole-of-government’ US approach, targeted investments and partnerships with developing countries are possible. Cooperation with non-governmental organizations (NGOs), private and public sectors and actors, programs and initiatives such as the Global Harvest Initiative, Millennium Challenge Corporation (MCC), *Feed the Future* (FTF), Corporate Council on Africa (CCA), and the African Growth and Opportunity Act (AGOA), generate trust and demonstrate US resolve committed towards open and free agricultural trade markets that lead to symbiotic economic prosperity. These motivations leverage vast resources to support long-term relationships that often lead to invaluable trade understandings, accommodations, and agreements.¹³⁴ Although this strategy does not guarantee immediate net positive agricultural trade balances, the patient, long-view approach will eventually lead to US economic gains (e.g. in sub-Saharan Africa, “1 % increase in agricultural productivity eventually led to US export growth of \$77 million.”¹³⁵)¹³⁶

Utilization. Food security utilization encompasses access to affordable and nutritious food that is safe from contamination and disease. According to the UN, use or utilization includes “food through adequate diet...to reach a state of nutritional well-being where all physiological needs are met.”¹³⁷ Given the abundance of inexpensive, nutritious, and safe food in the US, Americans typically take nutrition and food safety for granted, with a greater interest and focus on convenience, variety, and perceived value. This is a mindset that must be changed if the US is to adopt new cultural food behaviors and approaches in the coming years to support

changes in food consumption related to growing nutritional demands in the US by 2050.

Nutrition. Economic Impact. The statistics are sobering and indicate an increasing trend in obesity over the last seventeen years that will continue to rise.¹³⁸ This upward trajectory is a snapshot of adults who will require medical care due to health-related conditions from unhealthy diets and weights. Obesity-related healthcare costs are a part of the fastest growing portion of the federal budget, representing over \$150 billion, with even more associated costs in lost productivity, on an annual basis.¹³⁹ And rising healthcare costs will continue to divert financial resources to pay for domestic programs in lieu of investing in the readiness of the armed forces.

All Volunteer Force Impact. Sustaining the nation's all-volunteer force reinforces national security and allows the armed forces to fight and win wars. However, future manpower demands are in jeopardy because of the obesity threat attacking the next generation of armed forces applicants. The end result is that only 28.6% of Americans, seventeen to twenty-four years of age, qualify to serve,¹⁴⁰ with the primary disqualifying reason being an inability to meet physical requirements due to overweight or obese.¹⁴¹

America's Youth. The reality is that overweight or obese children "are at a greater risk for high blood pressure, type 2 diabetes and heart disease."¹⁴² These medical conditions become lifelong health issues since "the longer children are overweight or obese, the more likely they are to remain so into adulthood."^{143,144} Therefore, the quality of breakfast and lunch offered at schools becomes more important as US society has shifted to eating more meals outside of the home. "Children eat half their daily intake at school and therefore the potential benefits from improved school meals and healthier competitive foods on school campuses could be considerable."¹⁴⁵ On a positive note, the quality of school meals is improving with the updated nutrition standards that align with the federal dietary guidelines.¹⁴⁶ These updates "provide all children access as well as exposure to healthy meal options."¹⁴⁷ Healthier meal choices promote healthier eating habits for children to adopt earlier in their lives for lifelong benefits.

However, adhering to federal dietary guidelines does not universally apply to meals provided by childcare facilities. With only a few states having laws governing the nutritional standards for childcare facility meals, a more holistic approach is necessary to fight obesity. It will take local, state and federal efforts, along with families, schools and childcare facilities to change how and what Americans eat. At the state and local levels, policies addressing school meal programs and childcare facility meal programs that include nutritional education have had the most impact on reducing obesity. Therefore, federal oversight must occur to expand these successful national programs to reach America's youth regardless of socioeconomic status and geographical location.

Food Safety. A generally accepted belief is that food purchased and consumed in the US is safe. "Consumers take for granted the food they have purchased has met and passed the necessary safety guidelines established for each phase of the agribusiness value chain."¹⁴⁸ The reality is that food safety monitoring and assessments occur throughout US food production system and sanitation procedures exist for controlling foodborne pathogens.¹⁴⁹ The Food Safety and Inspection Service (FSIS) of the USDA issues recalls on meat, poultry, and egg products, while the US Food and Drug Administration (FDA) issues recalls on other food as well as pet food and animal feed.¹⁵⁰ These recall programs are critical because activity detections within the agribusiness value chain can pose a serious risk to consumers, who typically do not appreciate the "workings of the food supply chain unless a recall is issued."¹⁵¹

Any domestic or international food security discussion must address, or at least include, the concept of safe food, specifically the management and oversight of a comprehensive food

safety system. Embedded in this discussion is the myriad of challenges associated with maintaining food safety inside and outside US borders, due to globalization and international trade. "International trade in food products cannot grow unless consumers have confidence in the institutions that ensure food safety."¹⁵² Therefore, ensuring that food entering the US is safe by enforcing consistent sanitary and phytosanitary (SPS) standards remains a perpetual USDA mission that must be met to maintain and build consumer confidence. Not surprisingly, the advent of globalization has complicated efforts to enforce standards. In fact, the majority of the food safety risks originate from rapidly growing imports of fish, vegetables, and fruits "sourced in low-income countries that have a weak capacity to ensure food safety."¹⁵³ Inversely, challenging these same SPS standards, in support of US exports ensures "sovereign rights are not misused for protectionist purposes and do not result in unnecessary barriers to international trade."¹⁵⁴ On this front, USDA efforts have been impressive and "since 2009, over 2,000 SPS, technical, and other barriers to the export of American agricultural products, have helped to spur record exports of US agricultural products."¹⁵⁵

Safety and health-related risks, such as foodborne illnesses from pathogens and the possibility of bio-terrorist attacks on the food industry, drive the need for increased focus on food safety. Therefore, "US consumers must rely on the triad -- the USDA, the FDA, and the Centers for Disease Control and Prevention (CDC)."¹⁵⁶ While the food industry is responsible for producing safe food, these agencies (and their sub-divisions) enforce laws, policies, and regulatory practices that ensure the safety of US food and the reduction of health-related risks.¹⁵⁷ Specifically, these agencies are responsible for setting food safety standards, conducting inspections, ensuring compliance with standards, and maintaining a strong enforcement program to deal with those who do not comply with standards.¹⁵⁸

"The geopolitical landscape demands that the US further examine the vulnerabilities associated with food safety in the context of food security, both domestically and abroad."¹⁵⁹ "As the world faces significant food security problems, food safety is likely to gain even more prominence as a global issue through 2025 and require increased collaboration among nations."¹⁶⁰ Food security and food safety are interrelated, but "access to food is irrelevant if the food is unsafe and contaminated with foodborne diseases."¹⁶¹ Implemented in 2017, the FDA Food Safety Modernization Act (FSMA) has strengthened the food safety focus by addressing systematic weaknesses in US food safety system and improving the US regulatory systems' capacity to detect and respond to food safety problems from a preventive posture instead of a reactive one.

However, the reality is that foodborne illnesses continue to threaten the viability of the US food safety system. Despite comprehensive FSMA investigations at each stage of the US agribusiness value chain, the CDC "estimates that each year, 48 million people get sick from foodborne illnesses, 128,000 are hospitalized, and 3,000 die."¹⁶² Likewise, the USDA estimates that foodborne illnesses cost the US more than \$15.6 billion each year.¹⁶³ Therefore, there remains additional buy-in opportunities from agribusiness value chain stakeholders and cross-agency coordination to achieve more sophisticated safety measures and more timely/transparent consumer notifications of foodborne outbreaks and subsequent product recalls.

Farm Lobby & Farm Bill. *Farm Lobby.* The power of the farm lobby is more than alive and well, it is a seemingly impervious influence in Washington, DC. Case in point, farm lobby pressure led President Trump to shockingly consider re-entering the Trans-Pacific Partnership (TPP) just four days after he stated, when addressing farmers' concerns related to Chinese tariffs, "Our farmers are great patriots. They understand that they are doing this for the country."¹⁶⁴ At one time, this seemed unthinkable, as Trump's intention to block the TPP was a signature

campaign promise, calling it a “rape of our country” and subsequently withdrawing the US from the deal on his first day in office.¹⁶⁵ This dramatic reversal demonstrates the power that the agribusiness sector and its farm lobby have with respect to national security direction influence.

The farm lobby includes numerous industry-specific and sector-wide trade organizations as well as large companies. Together, they “contribute to the reelection campaigns of their favorite Agriculture Committee members, then send their skilled, and always affable, operatives to work the committee rooms and halls of Congress during the legislative drafting process.”¹⁶⁶ Ultimately, they create an incredibly powerful farm coalition,¹⁶⁷ which has averaged \$136 million dollars annually in lobbying capital over the last ten years, making it the sixth highest spending sector in the US; even ahead of the defense sector.¹⁶⁸ Most notably, half a billion dollars was spent in lobbying during the legislative process for the 2014 Farm Bill.¹⁶⁹ Adding to the power of the farm lobby, is the widespread agribusiness interests in almost every congressional district of both political parties. For instance, the thirteen corn belt states alone currently hold 26 of 67 Congressional Agricultural Committee positions, with a balanced mix of 15 Republicans and 11 Democrats (*refer to Chart XV*).¹⁷⁰ Overwhelmingly, the power of the farm lobby and their Congressional supporters is best seen in the policies they influence.

Farm Bill. The Farm Bill has been incredibly stable since farm subsidies started in 1933 under President Roosevelt’s depression era New Deal.¹⁷¹ For eighty-five years, through all types of administrations, congressional majorities, national circumstances, and even changing cultural ideologies, the farm bill has adapted and more importantly, survived. In 1977, Congress logrolled the bill by adding in the food stamp program to ensure urban support came along with traditional rural support.¹⁷² In 2008, the bill “easily overrode a Presidential veto, by margins of 316-108 votes in the House and 82-13 votes in the Senate.”¹⁷³ In 2014, despite a budget crisis, a historically ineffective Congress, and a multi-year boom cycle for farmers,¹⁷⁴ (shown in *Chart XVI*), a farm bill still passed through Congress.¹⁷⁵ The farm coalition is so strong that it has the power to maintain enduring policies that no longer even make sense.

Enduring Policies. Ethanol production quotas, outside the Farm Bill, originally created to reduce US reliance on foreign oil, remain in place even though hydraulic fracturing has ended US dependence on foreign oil. They remain because they provide a \$4 billion dollar benefit to the grain industry.¹⁷⁶ Additionally, sugar subsidies continue in the Farm Bill despite the fact that sugar accounts for less than 1% of overall farm revenues, while costing US consumers “\$3.5 billion dollars each year and reducing employment by more than 127,000 jobs.”¹⁷⁷ In an astounding demonstration of the farm lobby’s power, tobacco subsidies continued until 2005, twenty-one years after Congress mandated the US Surgeon General’s Warning on tobacco products.¹⁷⁸ Then when Congress finally eliminated the tobacco subsidies, they provided the tobacco buyout giving tobacco farmers \$9.6 billion dollars in payments over a 10-year period to ease the transition off government support.¹⁷⁹ The farm lobby’s influence traditionally resulted in some wasteful subsidies along with some well targeted subsidies and resistance to environmental or other regulations.¹⁸⁰ Now, as recent events in Washington, DC prove, the powerful farm lobby is using their leverage to influence farm-related policies that impact national security.

Global Food Security

In 2015, the US National Intelligence Council concluded, “that global food security is a US national security concern” and those “countries that cannot feed their populations pose threats to national and regional security and stability, as well as US interests.”¹⁸¹ Conflict, migration, and disease are too complex to prove that food insecurity causes them, however, there is a strong correlation. In fact, according to Emmy Simmons, a food security expert and US Agency for

International Development (USAID) veteran of thirty years, food can “trigger, exacerbate, prolong and catalyze conflict.”¹⁸² Furthermore, in 2016, Congress approved the Global Food Security Act and declared that “it is in the US national security interest to promote global food security, resilience, and nutrition.”¹⁸³ This act required “the President to develop and implement a Global Food Security Strategy”¹⁸⁴ and suggests US political leaders understood, and potentially still understand, the importance of proactive global food security leadership.

Whole-of-Government Approach. The US Global Food Security Strategy was designed to be an “integrated whole-of-government strategy and an agency-specific implementation plan.”¹⁸⁵ This whole-of-government effort, entitled *Feed the Future*, is led by USAID and includes the US Departments of Agriculture, Commerce, Interior, Treasury and State, the MCC, the Overseas Private Investment Corporation, the Peace Corps, the US African Development Foundation and the Office of the US Trade Representative.¹⁸⁶ *Feed the Future*’s three “interrelated and interdependent objectives” include “inclusive and sustainable agricultural-led economic growth,” “strengthened resilience among people and systems,” and a “well-nourished population,” with an emphasis on women and children.¹⁸⁷ To meet these objectives, *Feed the Future* focuses on stability and resilience.

Stability and Resilience Focus. *Stability* is “the availability of, and access to, food regardless of sudden shocks to the system (e.g., political unrest/conflict, economic, or climatic crisis) or cyclical events such as seasonal food scarcity.”¹⁸⁸ *Resilience* is defined as “the ability to withstand and recover from these shocks and/or additional short-term setbacks (from weather, pests or diseases) affecting crops and livestock, household illness, falling incomes.”¹⁸⁹ The overarching goal of the Global Food Security Strategy is to “sustainably reduce global hunger, malnutrition, and poverty,” with one of its three objectives being to “strengthen resilience among people and systems.”¹⁹⁰ This focus is becoming more important, as increasingly frequent and intense shocks and stresses threaten the ability of people to emerge from poverty. Food spikes associated with conflict and strife, for example, are becoming more frequent, volatile, and disruptive (*refer to Chart XVII*). And it is clear that “spikes in international food prices create serious economic hardship for urban consumers in countries that are dependent on food imports, which immediately generate social and political unrest.”¹⁹¹ This political instability and fear of unstable prices only perpetuate high and volatile food prices and supports the belief that “wars of the early 21st century are ‘food wars’ and that food will continue to be used as a weapon.”¹⁹² In this context, *Feed the Future* is mitigating current risks, while working to prevent more expansive future risks from developing. More specifically, the program is focused on twelve nations and for the purposes of this industry study report, efforts in Guatemala and the African Union (with a Mali vignette) are highlighted.

Guatemala. Challenges. The food security focus in Guatemala is an integrated strategy that addresses food security challenges. The primary availability challenge is an increasing demand of a young, fast-growing population that doubles every twenty-four years, while combatting natural disasters, such as droughts and floods, which “significantly affects crop production and the fragile distribution infrastructure.”¹⁹³ The second challenge is an access-related one – poverty. In Guatemala, “51% of the population lives below the poverty line” which is worse in rural areas where “71% are poor and 24% are extremely poor.”¹⁹⁴ The primary challenge to utilization is nutrition, where Guatemala suffers from “the highest national level of chronic malnutrition in the Western Hemisphere, at 49.8%.”¹⁹⁵ This, in turn, leads to the “third highest prevalence of moderate to severe stunting among children under five years old.”¹⁹⁶ To combat these challenges, the US works, in conjunction with the government of Guatemala and other

donors, to focus on both “market-led agricultural development and the prevention and treatment of undernutrition.”¹⁹⁷

Continued Opportunities. *Feed the Future* has been indispensable in addressing these challenges, while driving Guatemala’s economy towards achieving higher levels of stability and prosperity. By targeting Guatemala’s primary agribusiness industries in poverty-dense areas, *Feed the Future* initiatives seek maximum impact. Through its efforts, as of 2016, the initiative has touched the lives of “more than 75,000 small producers and farmers with improved technologies and practices, resulting in \$24 million in new income and 230,000 fewer cases of child stunting.”¹⁹⁸ USAID Foreign Assistance Service teams continue to work with local and federal governments, along with the private sectors and nonprofit NGOs, to stimulate positive change and, ultimately, build stronger alliances between the two nations. Unfortunately, pronounced levels of corruption and ineffective governance have prevented the Guatemalan federal government from significantly contributing to these efforts.¹⁹⁹

To address this shortfall, USAID is working with leaders from private firms such as Asociación de Exportadores de Guatemala (AGEXPORT), Agropecuaria Popoyán, and the Institute of Science and Agriculture. Through such efforts, impressive results have followed, some of which center around technology, research and development, as well as innovation sharing, all of which are increasing yields, increasing margins, and improving capacities. To that end, such investments have helped Guatemala to become one of the most successful Central American countries with respect to overall economic growth. Most notably, its exports have increased over 300% since joining the Central America Free Trade Agreement-Dominican Republic (CAFTA-DR) free trade agreement.

A strong Guatemala also supports several US national interests tied to economic prosperity. As a trade partner, approximately 40% of Guatemala’s trade (imports and exports) is now associated with the US. And a more stable Guatemala only increases trade volume and enhances regional alliances.²⁰⁰ Just as important, a more prosperous Guatemala increases US homeland security, where Guatemala’s instability has led to a significant amount of “unauthorized immigrants and other illegal activities, such as drug smuggling and human trafficking across US borders.”²⁰¹ Mexicans no longer make up the majority of the US unauthorized immigrants. Instead, unauthorized immigrants from countries in Central America, such as Guatemala and El Salvador, have steadily increased as more families attempt to flee political instability and/or economic hardship.²⁰² Strengthening Guatemala’s agriculture and economy is a proactive way to address domestic US security concerns at the source. These food security issues do not just impact US national security interests in Central and Latin America, they also play a role in other parts of the world, including in Africa, where instability is already driving significant US military engagement and where the food security picture is projected to get much worse, before it gets better.

Africa. Challenges. The challenges in Africa related to the food security pillars are namely production issues concerning availability, poverty challenges associated with accessibility and malnutrition concerns related to utilization. Food production on the continent is plagued with land, water and weak governance issues, all of which frequently lead to internal conflicts further depriving access and availability of land for farming. Additionally, international conglomerates competing for land and biofuel production, challenge and weaken the ability to effectively produce enough food.²⁰³ To make matters worse, urbanization is consuming arable land that could be used for food production and the land that remains available “tends to lack the adequate amount of water, with only about 6% of it is suitable for irrigation.”²⁰⁴ Compounding

these food security challenges is the projected African population growth previously mentioned, which is projected to grow more rapidly than any other region in the world.²⁰⁵

Most African countries rely on rainfall for agriculture and most people in Africa are engaged in subsistence farming. These facts notwithstanding, the impacted governments struggle to produce sound agricultural policies and necessary infrastructure to support food storage and transportation, making food availability a persistent problem. Like Guatemala, Africa has food access challenges due to poverty and weak markets that lead to high malnutrition rates. In Mali, for example, more than 29% of the population suffers from malnutrition. Also, water challenges across the African nation cause food prices to increase drastically during dry periods, thereby significantly impacting food accessibility for low-income families. Lastly, ongoing conflicts in nations like South Sudan exacerbate poverty, which further breaks down the agribusiness value chain and creates even more food insecurity.

Opportunities. Two primary African led food security efforts associated with the *Feed Africa* Strategy come from the African Development Bank (AfDB) and the AGAO. The goal of *Feed Africa* is to improve agricultural development and production for the continent. The strategy seeks to transform agriculture in specified zones to achieve self-reliance in key foods such as rice, wheat, and horticulture products.²⁰⁶ All five regional African blocks and key international partners participated in the creation of *Feed Africa*, which was finalized with a declaration aimed at improving regional food security²⁰⁷ through prioritized research and development funding, targeting agricultural production and critical input improvements.

Another impressive effort underway is the AGOA, which is a US-led investment opportunity that provides and helps fund access to international markets. This effort requires that participating African countries comply with annual budget allocations to support AGAO initiatives. To augment the efforts by AGOA, the African Union (AU) has crafted a strategy called Comprehensive Africa Agricultural Development Program (CAADP),²⁰⁸ which is aimed at enhancing agricultural production on the continent. The AU's goals are to support member states by aligning their agricultural policies with agricultural (sector) sustainment strategies. If executed judiciously, the combined efforts of AGOA and CAADP will continue to play an integral role in improving African food security.

Feed the Future is also active in Africa as demonstrated in Mali. Its Mali strategy is based on a two-pronged approach aimed at supporting entrepreneurs through targeted investment opportunities. The program is helping Mali conduct research and development in drought resistant seed production in the pursuit of higher yielding crops. USAID also assists Mali in implementing modern agricultural methods as “agriculture is a pillar of Malian economic growth and provides 80% of the jobs in the country.”²⁰⁹ With improved agricultural production, the country can increase its exports beyond African borders. Also, with technology and soil revitalization, agricultural yields can be increased, especially for key crop commodities. Higher yields will lead to commercialization and increased nutritional value in the Malian diet. Irrigation improvements will also play a vital role in increasing food production, given that “of the 2.2 million hectares of irrigable land in Mali, only 14% is currently irrigated.”²¹⁰

Given the criticality of agriculture to Mali's economy and the potential larger food security impacts, US-led efforts should be expanded to further capitalize on Mali's agricultural potential. Furthermore, efforts in Guatemala and Mali illustrate how the US, via the *Feed the Future* program, is not only supporting, but leading global food security efforts, despite growing threats.

Food Security Threats. The ability of the US to adequately provide for both US and global food security becomes increasingly more complicated when actors threaten our economic

prosperity through aggressive economic practices and acts of agroterrorism. Chinese economic competition and US vulnerabilities exposed to agroterrorism are the most significant agribusiness threats that affect national security and impact our ability to effectively provide for food security.

Chinese Competition. As the National Security Strategy (NSS) outlines, China has changed the paradigm from the traditional US view of “at peace” or “at war” to a continual economic and geopolitical competition.²¹¹ China is now the world’s second-largest economy, accounts for 20% of Fortune 500 companies, and “holds \$347 billion of the US trade deficit.”²¹² However, it “still considers itself a ‘developing nation’ that should not be subject to the same trade rules as the US and other ‘developed’ countries.”²¹³ According to the *2018 People’s Republic of China’s Agricultural Policy Goals* document, an aggressive approach is outlined that “ensures national food security through intensive and value-added productivity growth and developing Chinese state-owned global commodity market actors.”²¹⁴ China’s economic rebalancing and oligopolistic ambitions are manifested in economic inducements, exponential expansion of trade, foreign agricultural production, and aggressive foreign direct investments (FDI) to achieve food security and support their geopolitical aspirations.²¹⁵ As an example, China recently purchased significant portions of agribusiness industries and the associated trade secrets when Shuanghui International Holdings purchased Smithfield Ham and ChemChina purchased Syngenta.

Economic Prosperity Implications. China’s growth engine requires diversification of sources, as well as different markets, and China is using the *Belt and Road Initiative* sphere of economic influence, pursuit of export opportunities, and significant vertical integration to compete with other nations and multinational firms. The US agricultural trade implications and concerns are profound and include: the further use of different sets of rules, the “China effect,” the consolidation of market force and supply chain power, and more dubious trade practices and WTO disregard. The most disturbing and disruptive common theme being a lack of transparency and compliance - “key issues that impact [agricultural] trade globally.”^{216, 217}

As the US agribusiness industries continue to grow faster than domestic demand in several sectors, so does its “reliance on export markets to sustain prices and revenues,”²¹⁸ including markets in China, “which over the past ten years, have averaged an annual 13% increase in US agricultural imports.”²¹⁹ Any slowdowns, disruptions or potential tariffs will “have a trickle-down effect throughout the global economy and ultimately will affect the US.”²²⁰ Therefore, an over-reliance on the Chinese agricultural market represents a potential weakness for the agribusiness industry, if not carefully managed. Although strengthening agricultural demand is projected to generate steady export levels of major commodities over the next decade “the US share of global exports tends to fall as competition from other countries erodes the US share.”²²¹ That said, given current US fiscal policies and the administration’s focus on trade balances, a protectionist bias may survive, which will only weaken overall economic prosperity.

China and the US “are caught in a Thucydides Trap, which warns of the hostilities that may come when an established power is confronted by a rising one.”²²² In agriculture, China’s aggressive practices and drive towards food security will inevitably create more (economic and trade) friction. The US is currently ill-prepared to address this challenge without a strategic, whole-of-government approach, which includes assistance from allies who are similarly frustrated with China’s aggression.²²³ US investment in soft power resources and capabilities remains critical in the promotion and leadership of global food security. China’s expanding geo-strategic and economic influences must not alter the course of these national security-related efforts and the US must continue to compete for political alliances and partnerships “to move China in the right

direction and towards a set of rules aligned with US interests.”²²⁴ As the US leverages agriculture to engage in economic competition with China, it must also address its vulnerabilities to agroterrorism.

Agroterrorism. Food defense includes “measures that reduce the chance of the food supply becoming intentionally contaminated using a variety of chemical or biological agents or other harmful substances - these intentional acts are rare, difficult to detect, and impossible to predict.”²²⁵ Such intentional acts are considered acts of agroterrorism.

“Before September 11, 2001, a direct, large-scale attack on US soil seemed far-fetched; unconventional warfare changed the way the US analyzed these threats.”²²⁶ The purpose of agroterrorism is to cause fear, chaos, and economic decline, all while saturating the public with doubt in its governments’ ability to protect the nation.²²⁷ “Without focus on industry partnership, a dedicated research and technology budget, and a long-term 21st century strategic plan which combats agroterrorism, the US is vulnerable for exploitation.”²²⁸ As an example, if the US grain supply experienced a pathogen²²⁹ or if a zoonotic outbreak occurred,²³⁰ the impact would most likely be devastating.

A National Center for Food Protection and Defense survey showed that Americans ranked *food protection* as the highest US priority, signifying a preference to dedicate more funds towards protecting food than all other areas susceptible to terror, including public transportation hubs, power grids, and airborne biological/chemical agents.²³¹ These concerns and results support the need for stronger food defense measures and are further justified by recent epidemics that had devastating results, including the *E.coli* outbreak that resulted in over 4,000 illnesses and 53 deaths²³² and the Foot and Mouth disease (FMD) outbreaks that cost the United Kingdom (UK) over \$17 billion.²³³

Economic Prosperity Implications. The nation’s economy is a key target of agroterrorism. The farming and ranching industry is intertwined with many sub-economic components (i.e., pickers, processors, machinery, transportation),²³⁴ that includes 2.1 million farms operating on 939 million acres of land worth \$1.43 trillion,²³⁵ all of which is susceptible and exposed to agroterrorism. As a case in point, during the UK FMD epidemic, “more than 9,000 farms were affected, which resulted in the slaughter of 6.2 million animals.”²³⁶ Not only did it take years to re-establish export markets, but, as already mentioned, billions were lost. However, “the losses experienced by the UK pale in comparison to a projected similar US outbreak, which could exceed \$60 billion.”²³⁷ Given these devastating results and grim projections, a more robust, US-led food defense network is needed.

Agrodefense Refocus. Unfortunately, “the President’s 2018 budget removed all agriculture and animal-specific research for the Department of Homeland Security’s science and technology directorate, signaling an obvious and substantive reduction of support from the Executive Branch for agriculture and agrodefense research.”²³⁸ This direction counters the results of a 2017, *Defense on Animal Agriculture* report that stated:

The increasing rate of emerging and reemerging zoonotic disease, along with threats and attempts by those with nefarious intent to attack food and agriculture, point to the need to exert more effort to eliminate vulnerabilities and reduce consequences associated with America’s agricultural sector. This critical infrastructure sector produces, processes, and delivers the systems and commodities that feed billions of people and animals throughout the US and globally...given its critical importance to food safety and availability globally, protecting this sector is a matter of national security.²³⁹

This statement exemplifies the magnitude and importance of the agribusiness sector as it relates to agroterrorism and a requirement to refocus agrodefense initiatives. The reality is that 21st century terrorism has successfully utilized unconventional means by the weaponization of commercial commodities, which could disrupt thousands of ‘inputs’ into hundreds of hub-processing and packaging locations...thereby affecting millions of products.²⁴⁰ Therefore, the US can no longer overlook this complex, open agriculture enterprise and must focus on this real threat to further mitigate vulnerabilities.²⁴¹ From a global food security perspective, forward planning and readiness will be required from senior leaders to lay the foundation for an effective food defense system.

US Food Security Policy Recommendations²

Availability Recommendations. The issues surrounding US food availability are complex and multi-faceted. Environmental concerns and sustainment of limited resources are often misaligned with the profit-seeking side of agriculture. What is indisputable is that land, water, and to a lesser extent labor, are finite resources being depleted by global force shaping trends. Without increases in production output and capacities, even the most developed countries will face devastating food security challenges. With that in mind, the US needs to:

- Seek to reduce barriers of entry for the next generation of farmers and increase funding for USDA’s Beginning Farmers and Ranchers Loan Program. This will provide affordable working capital for the purchase of land and equipment for those undertaking a career in farming. These efforts will help to alleviate the pressures of an aging US farming population.
- Curtail foreign investment in critical US agricultural inputs. Skyrocketing prices for prime agricultural land has created a lucrative market for savvy foreign investors. The Committee on Foreign Investment in the US (CFIUS) process must be carefully analyzed and necessary changes should be made to preserve US control of land and water rights necessary for food production.
- Invest in desalination technology. Ocean water accounts for 97% of the world’s water. The Claude "Bud" Lewis Carlsbad Desalination Plant in San Diego is one of the latest desalination plants built with the most advanced technologies²⁴² and it consumes just over 4,000 kWh/acre-foot. The government should subsidize companies for investing in this technology.
- Assess graywater collection and reuse programs. For a typical household in the US, graywater³ can make up as much as 80% of its total wastewater and be reused if supporting infrastructure exists.²⁴³ Because there is no federal law directly governing graywater management and its use, state regulations are widely varied.²⁴⁴ The biggest challenges facing graywater today are regulatory concerns. The government should fund research to determine the definitive nationwide criteria for graywater collection and reuse for agriculture, enact consistent regulation to

² The US and global food security policy recommendations presented in this industry study are made assuming an unconstrained resource environment. It is recognized these recommendations represent the an initial ‘ways-based’ level analysis, which will require additional feasibility assessments that take into consideration political realities, resource trade-offs, and ‘means-based’ perspectives.

³ Graywater is water generated from clothes washers, showers, bathtubs, and lavatory faucets, etc.

facilitate its use, and invest in the infrastructure for using graywater to help alleviate water scarcity.

- Implement fair and reasonable merit-based immigration policies that support agribusiness, defend agricultural inputs, and protect farmers. Because neither unfettered immigration nor closed borders offer viable options, tradeoffs are necessary. Immigration reform should address three fundamental aspects to ensure: (1) agribusiness has an adequate supply of labor, (2) farm workers receive adequate wages, (3) increases in opportunities for career progression are possible.
- Increase federal funding for research and development in the agriculture sector. Investments must underpin future solutions to pressing issues such as resource scarcity and the health and resilience of managed/wild pollinators. Furthermore, US food security is dependent on research conducted by universities and colleges (like the NC State model/framework). Therefore, the US must continue to enhance collaboration between the public, private, and academic sectors and leverage the land grant extension programs to provide current growing practices and water conservation to local producers.

Access Recommendations. The US must safeguard its ability to add value, increase food access, manage affordability, and create demand by proactively managing mutually beneficial trade practices on a global scale. More specifically, the US should drive towards steadfast resolution of reasonable/targeted agribusiness ‘modernizations’ to NAFTA.²⁴⁵ Acceptance of risk in certain areas to achieve broader favorable terms that help offset growing Chinese market dependence, is advisable, while focusing on achieving exceptional scientific standard enforcements. Also, the US should grow and diversify into more ‘CAFTA-DR-like’ markets, using Guatemala as a business case from which to learn (*refer to Chart XVIII*).

Although the next “green revolution” isn’t expected for at least another ten years, the need for “precision agriculture systems continue to spread as the technology improves and is more widely adopted by farmers of all scales around the world.”²⁴⁶ Therefore, in anticipation of this, the USDA must collaborate with the Department of Education to expand efforts to assess the employment realities and trends that will affect the entire agribusiness supply chain, especially in industries with forecasted labor force decreases due to globalization, new technology and innovations. A comprehensive federal assistance program that “develops technical and administrative skills of local populations, businesses and institutions will set the stage for successful long-term development that generates inclusive benefits”²⁴⁷ for the farmers and those affected by a more globalized agriculture industry.

The current administration and congressional leadership must move towards treating agricultural trade differently than trade associated with all other industrial sectors. Policymakers should “dust off” the *Agricultural Trade Act of 1978* and consider expanding agricultural trade offices in key targeted regions. They should also include language that supports additional protection of agricultural products from standard trade-related restrictions. Perhaps, and just as importantly, these actions would signify that excessive and unfair export restrictions and food tariffs run contrary to US national/global food security objectives.

The US needs to reengage with its European allies in its pursuit of revitalizing the Transatlantic Trade and Investment Partnership (T-TIP). “The EU is currently the US’s fourth largest agricultural export market with 2015 exports valued at \$12.3 billion.”²⁴⁸ A trade agreement would drive higher commodity prices and diversify the US trade portfolio to offset/balance pacific-rim competition. Additionally, the US needs to diplomatically rekindle its interest in joining the

TPP. The participating eleven countries account for up to “42% of all US agricultural exports”²⁴⁹ and “leaving TPP cost the US farm economy over \$4.4 billion and over \$350 million in lost pork production alone.”²⁵⁰ This continues to represent a significant missed opportunity for agricultural trade and agri-business writ large.

Relentless diplomacy and engagement through multiple organizations (G8/G20 summits, UN, World Trade Organization (WTO), etc.) and other trade avenues (modernized FTAs) must be pursued to continue to pressure nations to comply with the highest common scientific standards. Additionally, the US should collaborate with other WTO nations concerning a pledge to prevent, or cap, trade restricting actions/tariffs in anticipation of the next significant climatic/cataclysmic world event. This would have a stabilizing effect by alleviating some volatility risk, while providing a foundation from which to increase resiliency to “shocks.”²⁵¹

A strategic trade plan is needed that uses a ‘systems-based’ approach to leverage a “holistic way of addressing a complex and interactive set of [agricultural trade] problems within a set of boundary conditions.”²⁵² More specifically, using tenants from California’s agri-councils framework and Africa’s business centers/agricultural value chains (AVC) approach, the US needs an agricultural trade strategic plan that effectively:

- Defines and defends strategic trade lines of effort (LOE). The strategic plan must harness and leverage US agricultural diversity to foster understanding and roles/responsibilities of players and where they fit into future trade/export relationships. A segmentation analysis using key variables (farm size, crop type, etc.), must support strategic agricultural value chains that present the greatest opportunities for investment and long-term growth. This approach will support “likely future demand, competitive advantage and the potential to drive massive increases in productivity.”²⁵³ Society and industry continue to move the agriculture community towards consolidation and these LOEs will “figure out how the small farm plays a role in it.”²⁵⁴
- Drives scalable private and public partnerships. The strategic plan must prepare and facilitate farmers and agribusiness sectors to more effectively compete and cooperate with rising peer-competitor nations (namely China) in a way that creates more opportunity and fosters/deepens relationships between private and public sectors. Incremental in design, this plan must be based on a national competitiveness foundation of cooperation and coordination, vice strictly competition. Tax and/or long-term incentives should be considered to support scalable ‘clusters’ of interconnected firms, supplies, and institutions (based on variables such as regions, functions, commodity) that drive trade/export solutions.
- “Catalyzes change through distinct and strategic investment.”²⁵⁵ The strategic plan must focus and articulate trade objectives that center around changes being driven by macro-conditions/shaping factors. It must revolve around an aggressive vision that truly challenges influencers to support the “diffusion and adaption of ideas.”²⁵⁶ Focused and strategic investments must support agricultural survival, which these days translates to global ROI generation and exports.²⁵⁷

Utilization Recommendations. Addressing nutrition in school and childcare facility meal programs must be affordable to implement. Purchasing locally sourced foods through ‘farm to school’ programs which can be expanded to childcare facilities is the viable option. These programs will support local economies and help children obtain healthier foods and eating habits

while at school. Sharing best practices and lessons learned across state lines is another way to standardize all meal programs. Access to healthy, nutritious food is key in reducing childhood obesity and motivating entire communities in this healthy movement will have a lasting impact.

While many factors intrinsically link US food safety and security to national security, the most salient connection stems from the numerous health risks and vulnerabilities associated with the US food system. The FSMA initiated necessary regulatory reform in preventive food safety measures, however additional coordinated laws and regulations are critical in providing for a more secure food system. “The goal of industry and regulators is to have a food safety system that is built upon a sound foundation of Good Manufacturing Practices (GMPs) prerequisite programs and incorporates risk-based preventive controls directed at controlling hazards.”²⁵⁸ Therefore, the US needs a consolidated agency with proper authorities and resources to manage the US food system holistically so that it is also equipped to engage internationally.²⁵⁹

Global Food Security Policy Recommendations

Farm Bill & Lobby Recommendations. Given the new focus on economic competition with China, the US must determine the most effective way to productively leverage the Farm Lobby and the agribusiness sectors’ interests. The key will be to work with the Farm Lobby and the broader farm coalition to leverage inputs that affect NSS implementation. Rather than targeting sweeping reforms of lobbying or campaign finance laws, the administration should work within the current system to more effectively execute the NSS and economically compete with China.

Economic Recommendations. To prevail in this economic competition, the US needs to create policy focused on China’s strategy. The Trump administration should engage directly with Congress and the agribusiness sector leaders and influencers to craft the policy. As already mentioned, integral to this policy should be joining the TPP and strengthening NAFTA and CAFTA to create strong trading blocks that can counter-balance the weight of the Chinese market and Chinese manufacturing. To prevail in economic competition with China, the US needs an industrial policy that engages and accounts for the Farm Lobby. Also, a “comprehensive economic dialogue”²⁶⁰ must be established to collectively and relentlessly challenge non-compliance issues (via WTO) and demand more trade transparency and compliance. Additionally, the administration needs to “expand the scope of CFIUS’s reviews by interpreting “national security” to include food security.”²⁶¹ Therefore, USDA needs to be welcomed to the table so that agriculture systems are scrutinized when reviewing FDI proposals. This would provide another tool to minimize investments that threaten domestic food security “by disrupted trade markets and giving foreign competitors an unfair advantage.”^{262, 263}

Additionally, the US must double-efforts over the next five years in a stronger pivot towards assisting African countries with their continued trade development and export opportunities. Africa’s food security influences, impacts and opportunities are too great, with its “agriculture sector generating on average 29% of GDP, employing 65% of the labor force in agriculture-based countries, and playing a crucial role in generating overall growth and global prosperity.”²⁶⁴ This will require the creation of a task force, similar in design to the *Agriculture and Rural Prosperity Task Force*, which needs to bring together dozens of agencies, public and private actors, and institutes (like CCA) to make recommendations to the President on the most effective way in which to further shape our policies and focus resources that align with the Africa’s “*Feed Africa*” strategy and CAADP. The US must also continue to encourage improved rules of law, while expanding its aid to regionally integrate and strengthen private sector development.

These actions will guarantee the US grows an even stronger, more impactful and influential regional presence.

Furthermore, the US must do more to assist the African Union in its ability to bargain and negotiate trade negotiations with China, to ensure its resources, land, and its ability to prosper remain resilient. This approach must embrace our strong resolve centered on national shared values of prosperity to counter the Chinese “sharp power” increasingly being used for exploitive and self-serving national needs.

Food Defense Recommendations. Scholarly research, reports, and the resources dedicated to the defense of the US food supply chain demonstrate the importance of fighting agroterrorism as a national security concern. “A deliberate and successful attack on the US food supply would cause widespread physical, psychological, and economical pandemonium.”²⁶⁵ Given these realities, agroterrorism should be identified as a national security and primary socioeconomic concern (clearly outlined in the NSS). Additionally, necessary and increased funding to support Department of Homeland Security's science and technology purposes remains critical.

Research takes years and speed is the chief component in fighting pathogenic and biological warfare. Said another way, agroterrorism is not the platform to test impromptu rapid response.”²⁶⁶ Therefore, Congress should create incentives to spur competition among industry leaders to entice more research for simulated responses to real-time scenarios while partnering with the private sector. By leveraging a stated US advantage that “our society is more competitive than collaborative,”²⁶⁷ private sector farmers must be engaged in seeking solutions, as they undoubtedly will be summoned if a threat arose.”²⁶⁸ “Senior leaders must continue to study agribusiness, so the food supply chain can be explored for food defense awareness and flaws”²⁶⁹ and so that the US may execute a long-term, technologically-advanced strategy to prevent agroterrorism.²⁷⁰

Conclusion

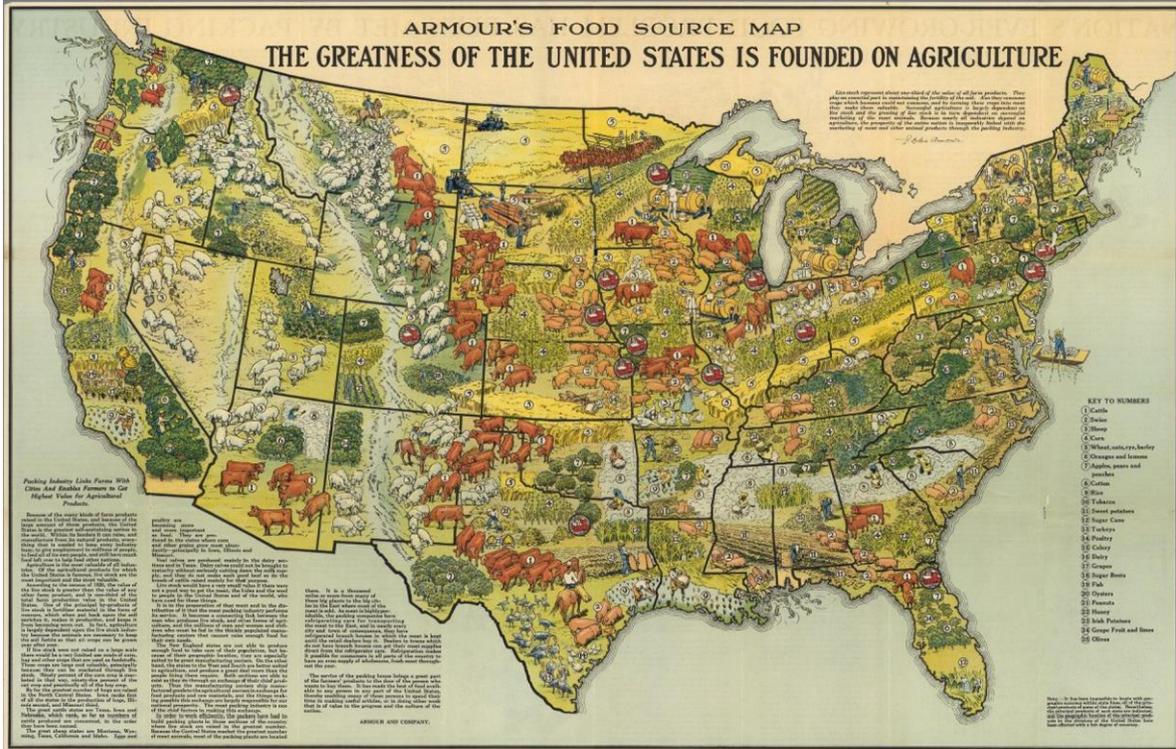
Although it has been almost one-hundred years since Mr. Armour’s insightful assertion, US agriculture continues to be a foundation of greatness into the 21st century. The US was founded as, and remains, an agricultural nation. Now, more than ever, the future is fraught with global challenges and shaping forces that will propel agriculture and agribusiness onto the global world stage. Fortunately, the US has enormous comparative and competitive agricultural advantages that provide for incredible opportunities to achieve numerous national security objectives. However, this is only possible if we, as a nation, focus on providing for critical areas of US and global food security. Domestically, this amounts to a continued focus on key issues that make up the availability, access, and utilization pillars. Globally, the US will need to continue to pursue and expand *Feed the Future* programmatic efforts, while strengthening these food security pillars in key countries and pivotal regions. Notably, sustainable results cannot be achieved unilaterally or without simultaneously improving the US food defense posture and engaging in strategically pragmatic and smart economic competition with China.

This industry study report, through thoughtful analyses, identifies food security opportunities, which support, and serve as the basis for, a myriad of policy recommendations. Common sustainment themes surfaced that center around key areas including targeted funding increases, incentive development, innovation and technology sharing, protections from trade disruptions and foreign investments, and cooperative, scalable solutions in support of strategic agricultural interests, resource preservation and economic returns. Most fundamentally, the US should transform agribusiness into a food security priority issue. This would require a comprehensive, ‘whole of nation’ approach that allows for an integrated strategy affected by

policies that harness and further develop unique US agricultural advantages towards achieving targeted economic and national security gains. The industry study policy recommendations presented lay a foundation for an agriculturally strong future; one that envisions US and global food security leadership marshalled by creative resiliency and international resolve in support of 21st century national security objectives.

Appendix – Charts

Chart I



Source: <https://www.davidrumsey.com/luna/servlet/detail/RUMSEY~8~1~278701~90051810:Armour-s-food-source-map>

Chart II

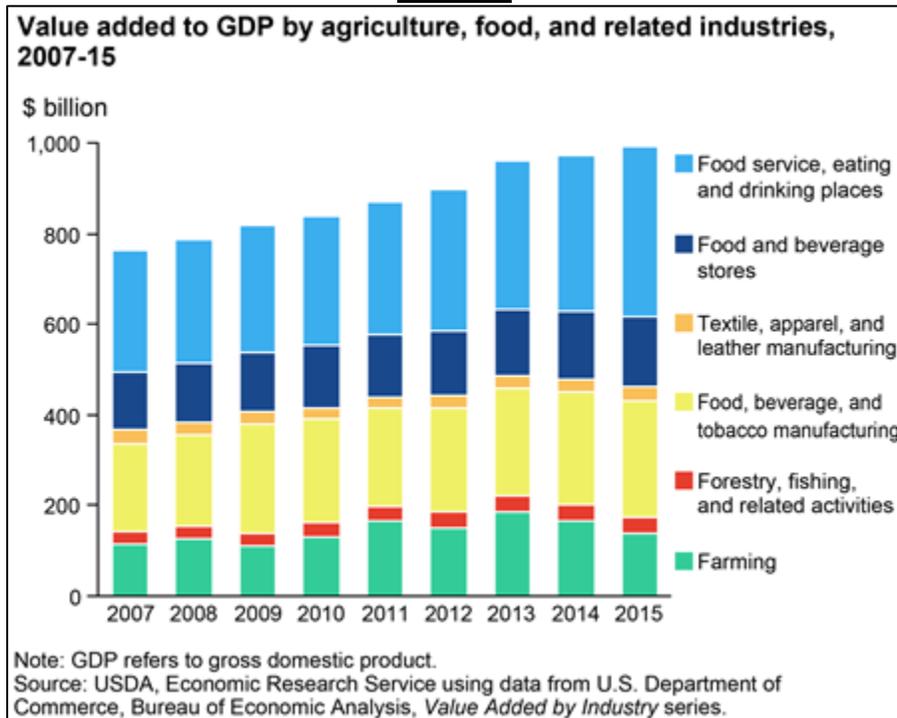


Chart III

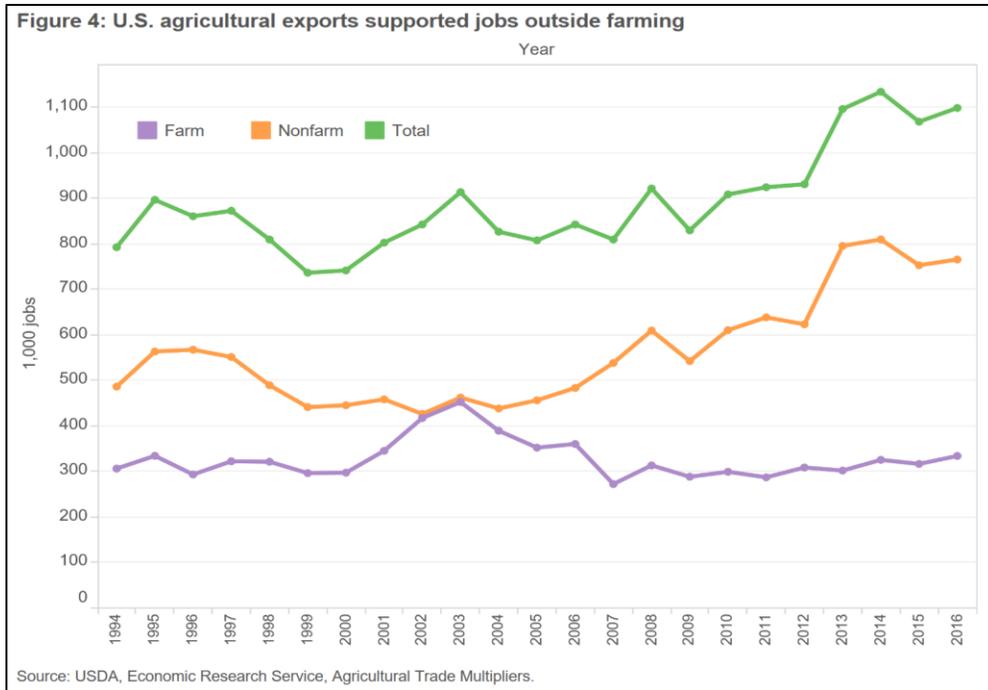
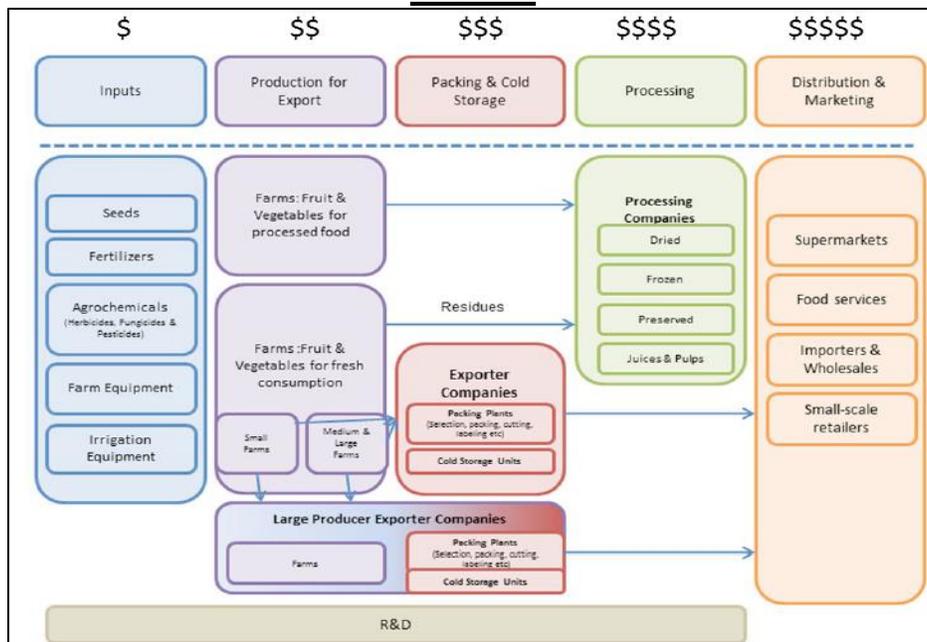


Chart IV



Source: Gary Gereffi, Karina Fernandez-Stark, Phil Psilos, *Skills for Upgrading: Workforce Development and Global Value Chains in Developing Countries* (Durham, NC: Duke University Center on Globalization, Governance, and Competitiveness, November 17, 2011): 22.)

Chart V

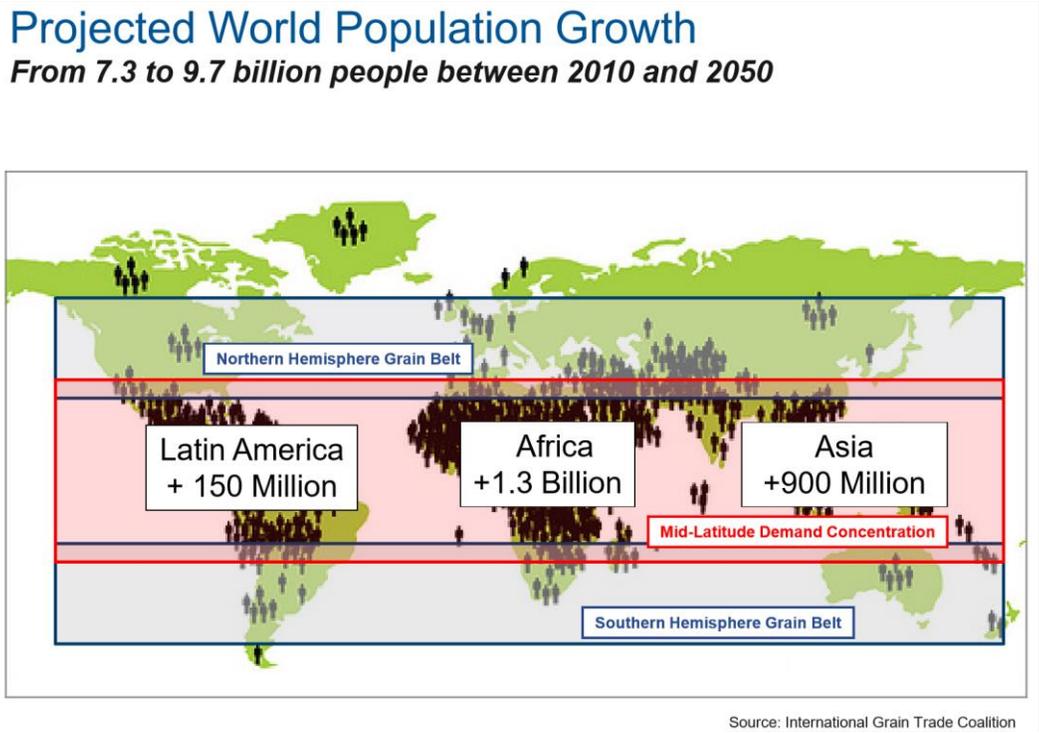


Chart VI

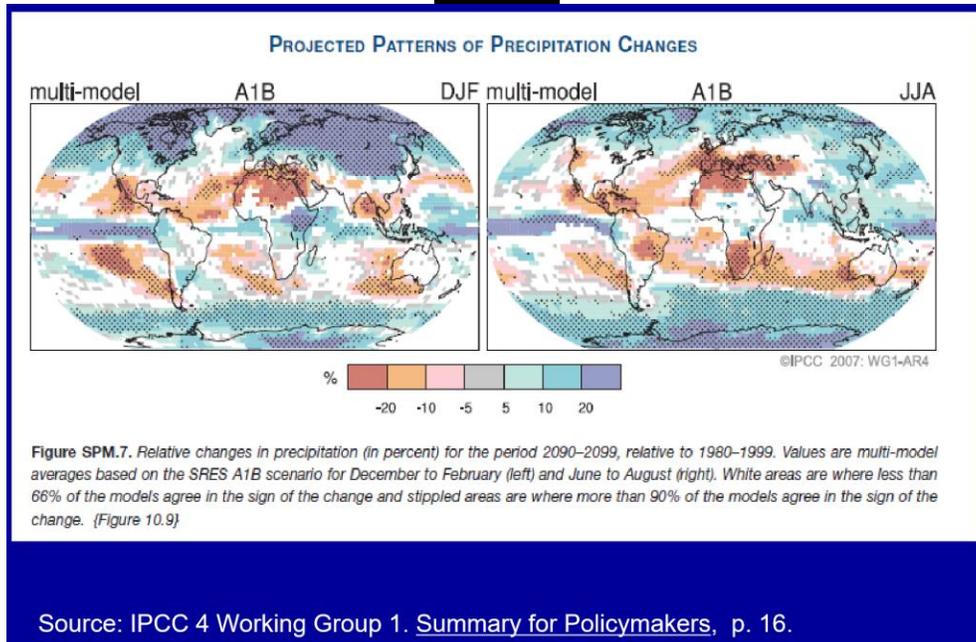


Chart VII

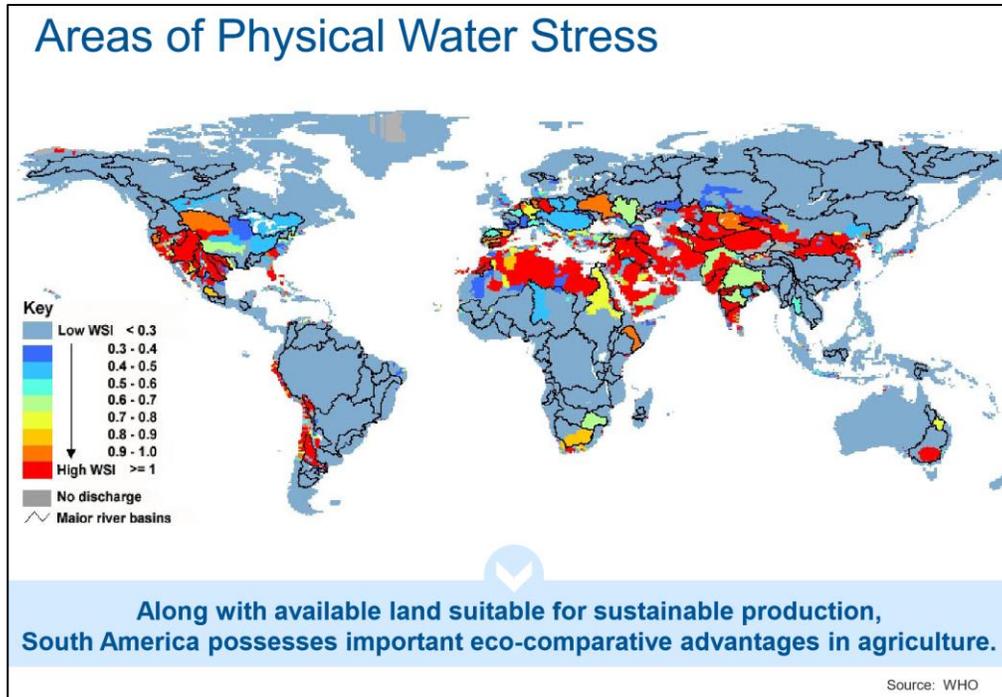


Chart VIII

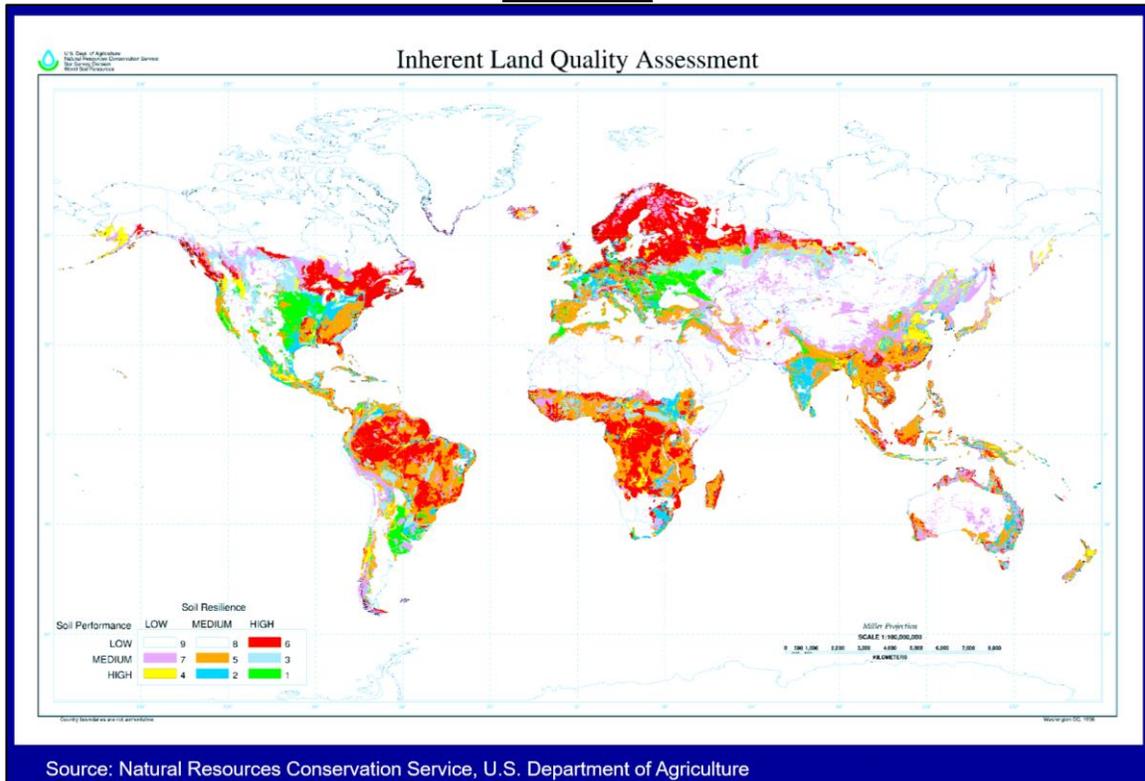


Chart IX

Projected Population Growth to 2050 (millions)

Region	2017	2050	Change	Percent
World	7,536	9,846	+2,310	+ 31
High Income	1,263	1,325	+ 62	+ 5
Low Income	6,273	8,520	+2,247	+ 36
East & S.E. Asia	2,269	2,346	+ 77	+ 3
South Central Asia	1,956	2,510	+ 554	+ 28
Sub-Saharan Africa	1,021	2,193	+1,172	+115
Latin America/Carib	643	783	+ 140	+ 22
N. Africa & W. Asia	499	771	+ 272	+ 55

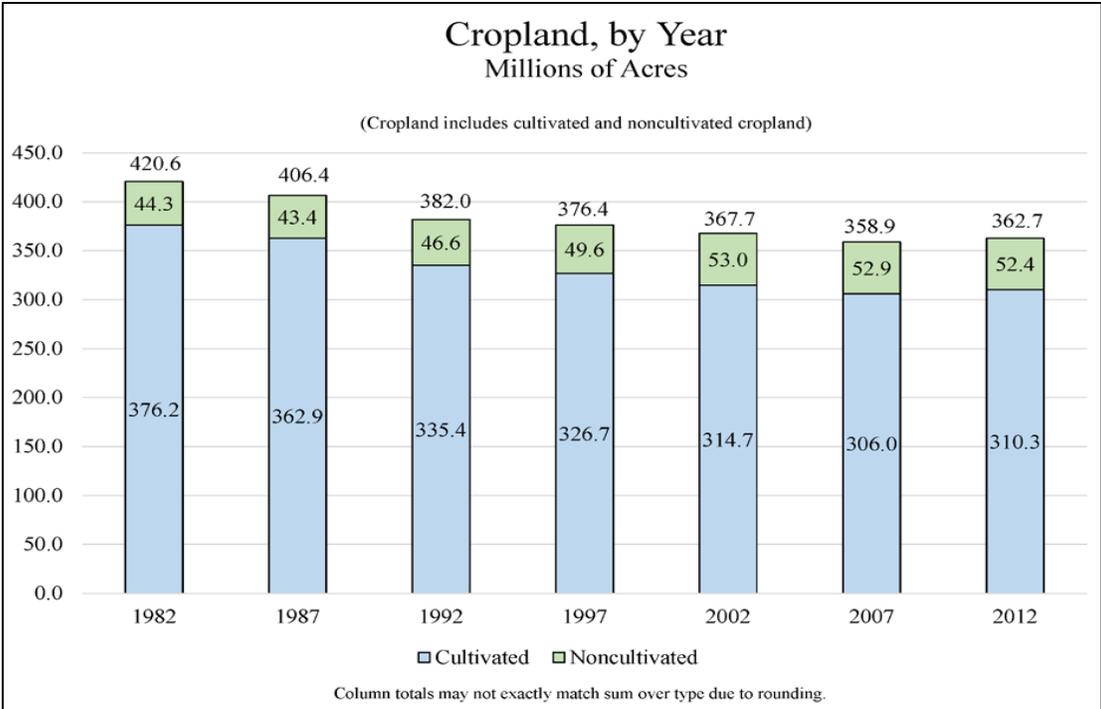
Source: Population Reference Bureau. 2017 World Population Data Sheet.

Chart X



Source: Carl Hausmann, "Strategic Issues for Food & Agriculture in 2100, En route to a 11.2 Billion Person" Presentation, National Defense University, January 30, 2018

Chart XI



Source: U.S. Department of Agriculture, Summary Report: 2012 National Resources Inventory, Natural Resources Conservation Service, Aug 2015, p2-2

Chart XII

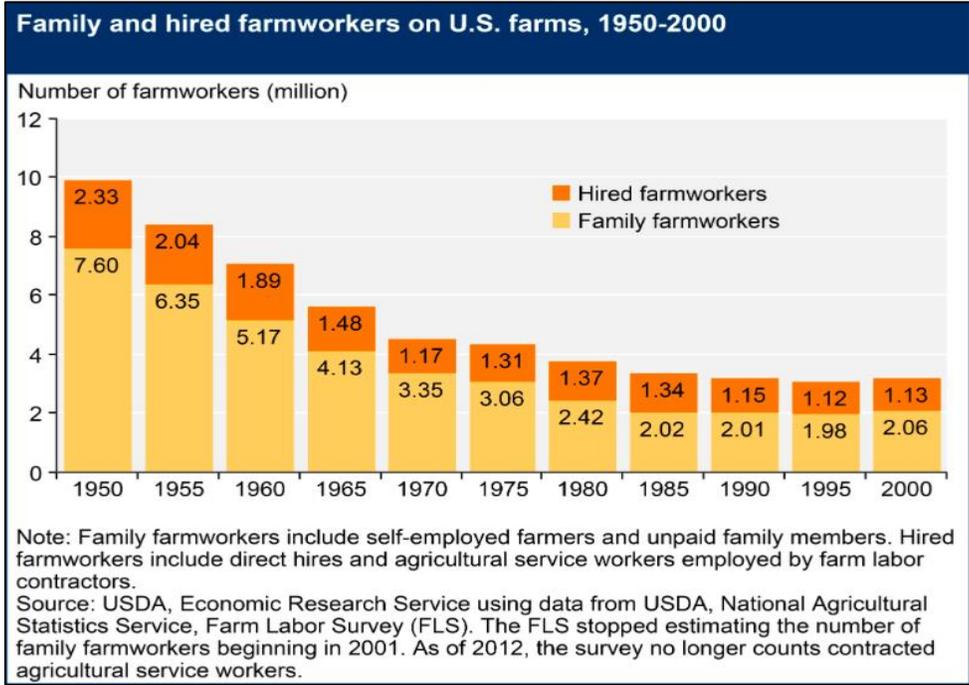


Chart XIII

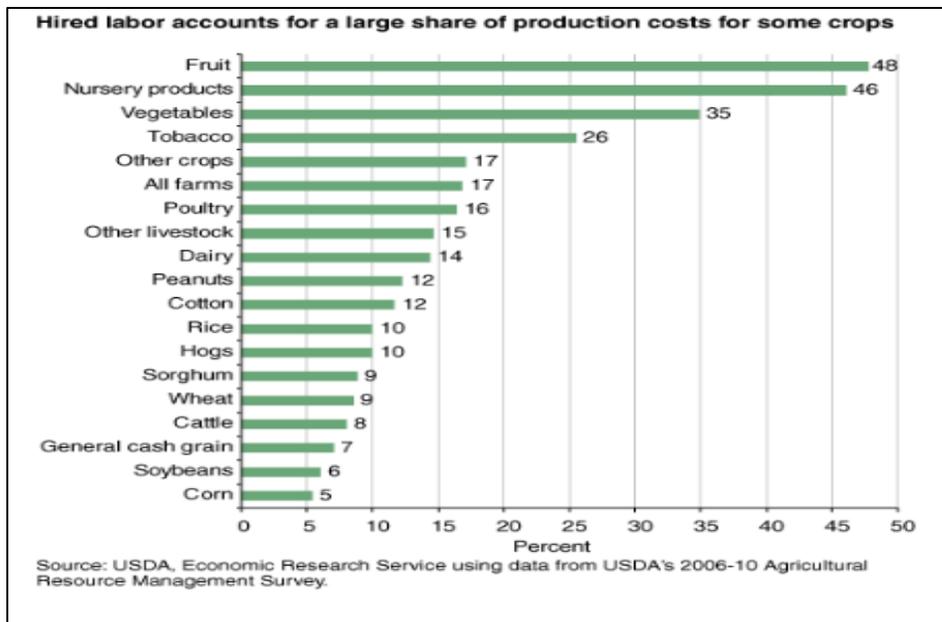


Chart XIV

Our top 10 markets account for roughly 75% of exports.

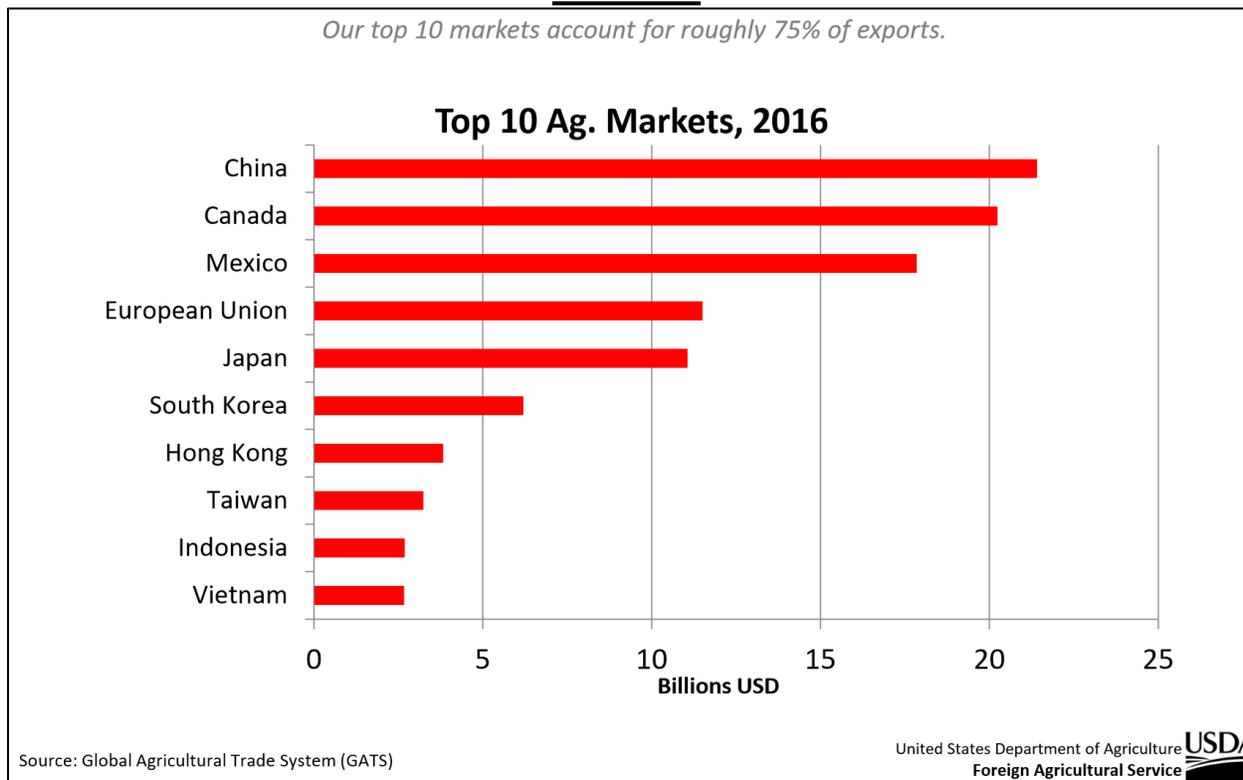


Chart XV

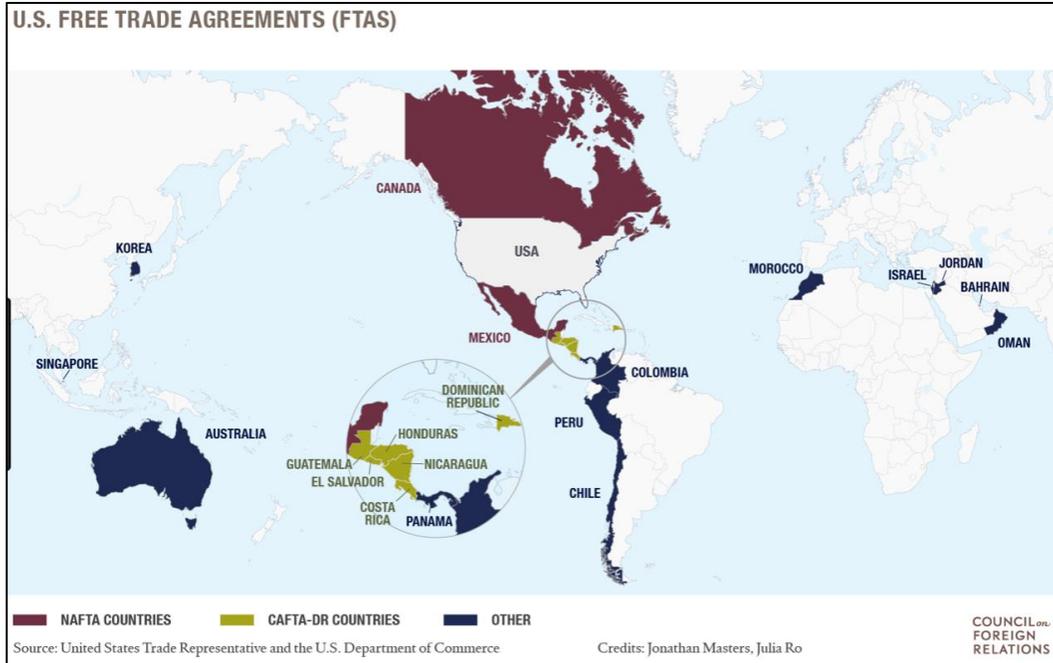
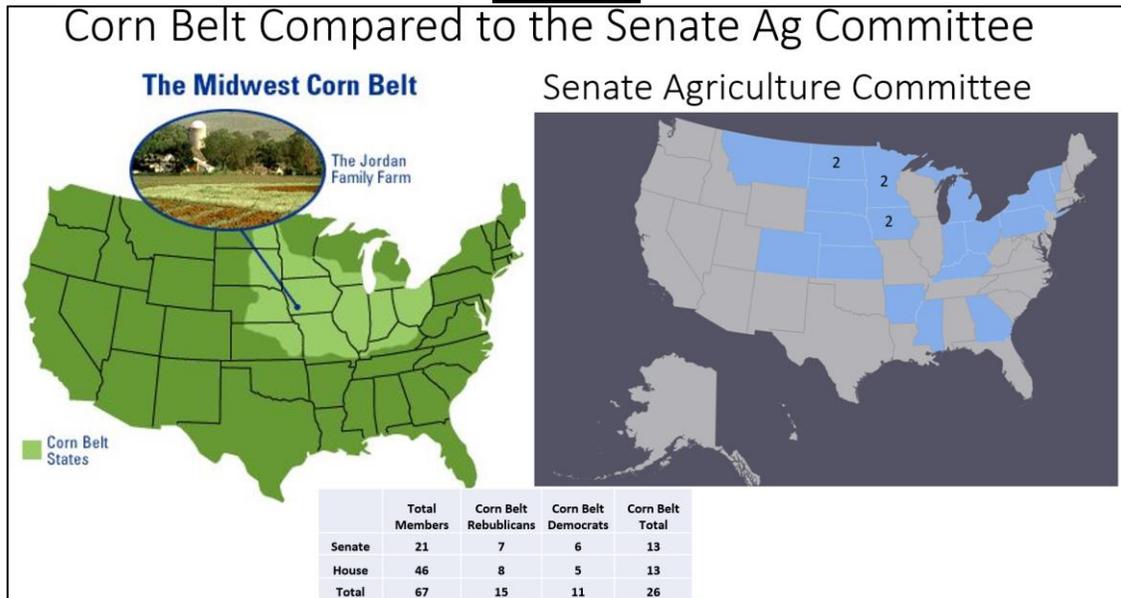


Chart XVI



Source: Statistics on the Congress agriculture committees comes from the two committee’s websites; “United States Senate Committee on Agriculture, Nutrition, & Forestry” *US Senate* <https://www.agriculture.senate.gov/about/membership> (accessed 10 Apr 2018) AND “House Committee on Agriculture” *US House of Representatives*, https://agriculture.house.gov/about/committee_members.htm (accessed 10 Apr 2018). The Corn Belt image was taken from a google images “Corn Belt” search https://www.google.com/search?q=corn+belt&source=lnms&tbn=isch&sa=X&ved=0ahUKewjxz-XGooXbAhUqh-AKHSihBcIQ_AUICigB&biw=1280&bih=615#imgcr=demdHuPIkm-YUM (accessed 10 Apr 2018)

Chart XVII

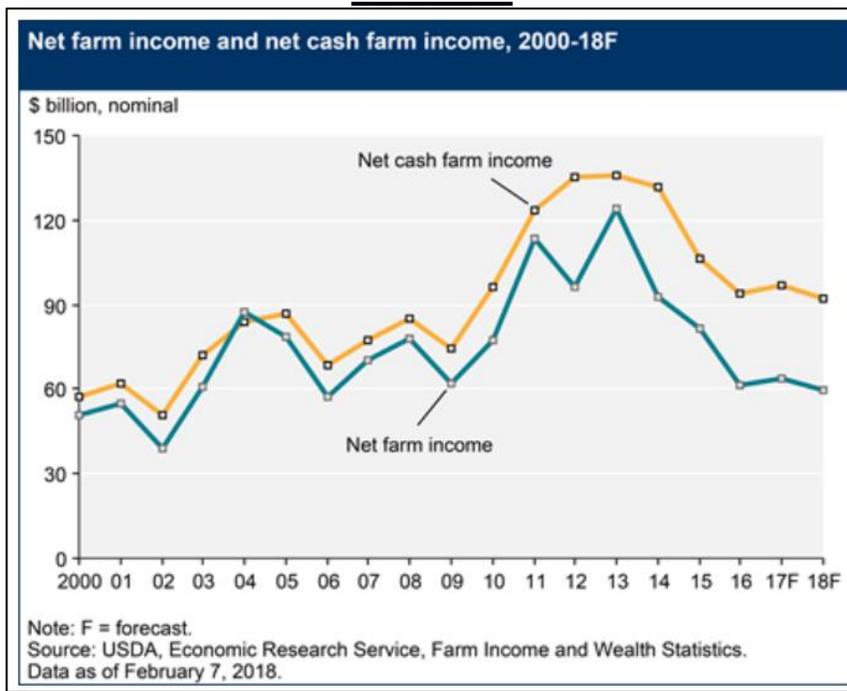
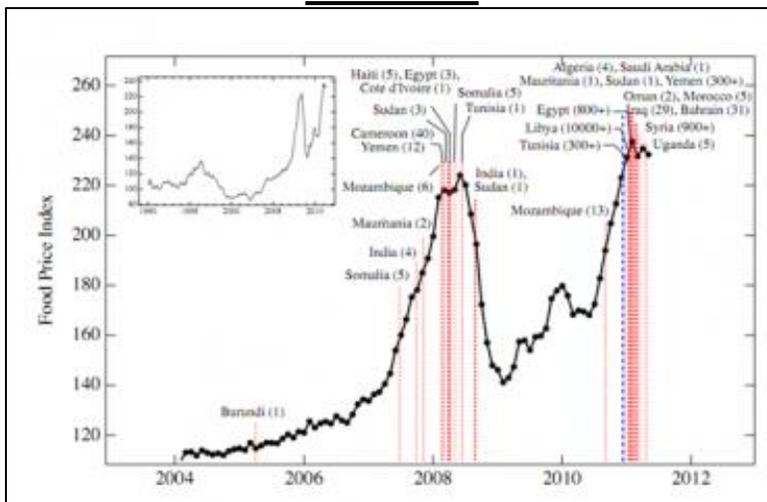


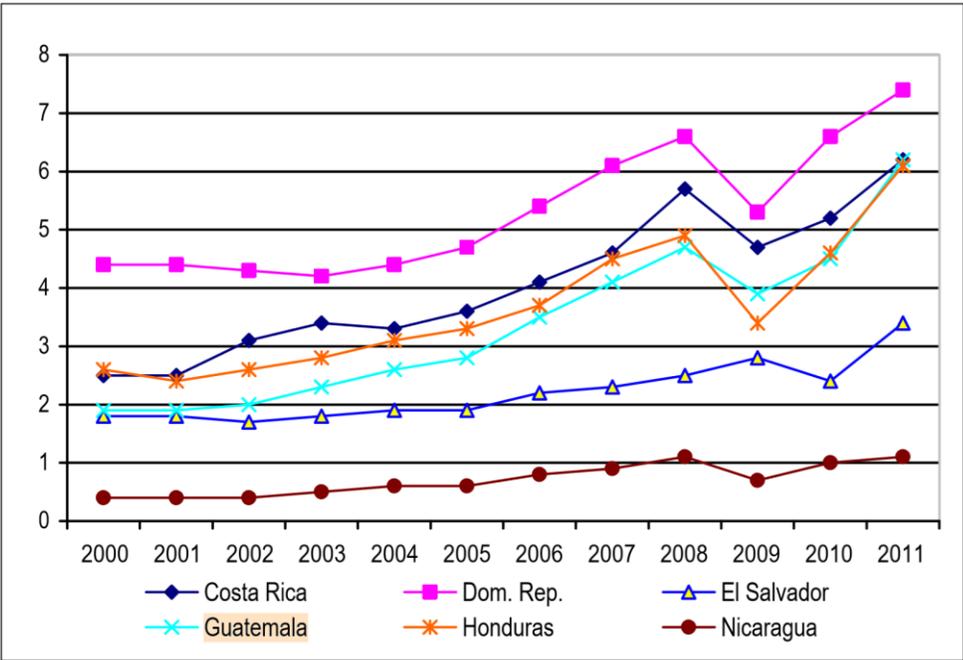
Chart XVIII



Source: www.google.com

Chart XIX

Figure 3. U.S. Merchandise Exports to CAFTA-DR Countries (2000-2011)
(in billions of dollars)



Source: CRS from U.S. Department of Commerce data as presented in Global Trade Atlas.

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