Organic Food for Thought: How Larger Countries Can Learn from Smaller Export Countries When it Comes to Sustainable Agriculture

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Abstract:

This paper looks in detail on the Netherlands specifically as the second largest food exporter behind the United States. It looks at how this small country accomplished this feat through sustainable agriculture while producing twice the amount of food with the half the amount of resources. It looks at the current environmental problems that the world faces today and proposes a solution through the framework of the Netherlands agricultural model. It goes in detail on the specific problems the world faces including water scarcity, overpopulation, dependency on fertilizers and pesticides and the Dutch solutions to these specific problems. The paper also delves into the history of the division in the Western world over organic and sustainable agriculture. It looks at how this division allowed a cultural atmosphere to flourish that encouraged to new and innovative approaches to farming. This paper also compares the Netherlands to huge agricultural producers like China and the United States and scrutinizes their farming policies. It proposes that the Netherlands could gain more economic power through the needs of these producers to sustain their growth through imports and how they could threaten the export power of these large countries.

Thesis:

The policies that certain smaller states took in order to better acquire sustainability and create the framework for a more efficient agricultural yield. Smaller European countries have implemented creative and innovative farming policies that have used less land and have become more efficient. The United States uses more land to produce the same amount of food implying

that a change in structural procedures might be advantageous as the population continues to grow.

The world's population as it stands today counts at almost 8 billion people and is steadily rising. One of the biggest problems that we will have to face in the future is trying to feed and sustain this growing population. By the year 2050, the world population is estimated to grow to 10 billion people.[1] A big problem with providing food for a growing population is the finite amount of resources available in our current world. New technology and genetically modified plants are offered as a solution but the world continues to be divided as to whether this is a reliable solution to the problem. Moreover, a huge agricultural yield has to be developed without depleting our water and fossil fuel resources. Although most would assume that these questions would be answered by large countries, food producers like the United States, some of the most innovate results are coming from smaller countries like the Netherlands.

Smaller countries over the past couple of years have developed innovative solutions to this problem and as a result have become huge export giants. These smaller countries like the Netherlands are major exporters and leading the world in sustainable agriculture. Although the organic food movement has grown in recent years in the United States farming is still heavily reliant on genetically modified organisms (GMOs) and bioengineering with more than 70% of American foods containing GMOs especially staple corns like corn and soybean.[2] Another aspect of American farming is the use of mono-cropping, the usage of vast amounts of land for one staple product year after year, depleting the soil from key nutrients. Draining of the soil of its

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[1] "*World population projected to reach 9.7 billion by 2050.*" United Nations Department of Economic and Social Affair, July 29 2015, http://www.un.org/en/development/desa/news/population/2015-report.html.

[2] Orsolya Ujj, "*European and American Views on Genetically Modified Foods."* (The New Atlantis*,* No. 49, Special Section: The Integrity of Science, 2016), 78.

nutritional value requires the usage of fertilizers to replenish the soil.[3] Another effect of mono-cropping is the loss of top soil which has decreased by 43% in the past 30 years.[4] The soil is eroding faster than it can be replenished losing nutrients and speeding up desertification. Desertification is the process by which fertile land becomes desert which is in part due to agricultural practices like over cultivation, overuse of water and overgrazing. The abundance of land in the United States is depleting with the amount of arable land declining forcing the agricultural community to rely on fertilizers and pesticides to supplement for what nature previously supplied. Critics have pointed out the future sustainability of this and view GMOS as a Frankenstein project with unforeseen consequences.[5] Overall, the agricultural community in the United States and the global community need to develop sustainable and innovative solutions to produce huge agricultural yields of food without depleting the amount of land and water available. Ironically, smaller countries that have huge exports with using less land might have the solution to maintaining an increasing global population. Through smaller states trying to take on large exports of food, larger states can take lessons from these smaller states in regards to sustainability and efficiency.

The division in the Western World over agriculture is a new phenomenon that has developed in reaction to industrialized farming, bioengineering and biotech. This division began after WWII with a new narrative developing as Europe was left ravaged and was forced to rebuild.[6] The United States saw the success of industrialization and the benefits of technology

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[3] Noelle Swan, "*Five Major Challenges Facing North American Agriculture."* Seedstock: April 18, 2012, http://seedstock.com/2012/04/18/five-major-challenges-facing-north-american-agriculture/.
[4] Swan
[5] Ujj, 85
[6] Ujj, 80-81

and as such they were more inclined to push for more industrialization and technology in farming and agriculture. The United States subsidized the domestic agricultural sector, imposed tariffs on agricultural imports, and encouraged the switch from small farms to large-scale agriculture.[7] In Europe, the opposite happened with a return to viewing agriculture as a part of the natural landscape and as an escape from industry.[8] The world wars instilled Europeans with a fear of technology and innovation that was unfelt by Americans who came out of both wars marveling at the power of technology. The land and farmers became an integral part of the market and national vision of the future in Europe as they begin to rebuild in the 20th century.[9] Today remnants of these fundamental ideas still hold true as Europe still tries to protect local farming industries from being consumed by the global market and continually values the local tradition of farming as part of a larger community. The cultural framework of the food movement in certain parts of Europe is tied with food sovereignty.[10] Farming is not just a process of producing food but way of life. The cultural meaning of food should be protected through the farming process.

Another aspect of the division was the fact that the historical view of land was fundamentally different. Americans saw and still see land as unlimited and filled with resources because of the continued idea of abundance started by the settlers in the New World.[11] The average number of acres in the United States is 434 per farm compared to the European

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[7] Carmen G. Gonzalez, "*The Global Food System, Environmental Protection, and Human Rights"* (Natural Resources & Environment, Vol. 26, No.3, Complex Systems, 2012), 9
[8] Ujj, 81-82
[9] Ujj, 81-82
[10] Chaia Heller. "*Another (Food) World Is Possible: Post-Industrial French "Paysans" Fight for a "Solidaire" Global Food Policy*." (Anthropological Journal of European Cultures, Vol. 20, No.1, Thematic Focus: Politicking the Farm: Transitions and Transformations in European Agriculture (2011), 89-110.
[11] Ujj, 81-82

equivalent with an average of 35 acres per farm.[12] The United States also views farming as an individual endeavor rather than part of a large community. The United States has a cultural atmosphere that encouraged and facilitated an environment friendlier towards GMOS and bioengineering. Although this fear of technology dissipated and Europe continued to head bravely into the future the mistrust of GMs continued. A reason for its continued criticism is the general mistrust of governmental institutions following the mad cow disease that spread during the late 1980s and 1990s. Although it is not directly related to genetically modified plants or organic farming its spread caused a mass public mistrust of the food safety system.

The reluctance of the European public to accept GMs resulted in specific political and governmental policies that has restricted the production and trade of GMs. These policies include a strict labeling system so that the origin of the products can be more easily traced throughout Europe. The European Union was set up in the post-war period of the twentieth century to stabilize Western Europe and unite the countries politically and economically. The inter-war period saw individual European states acting on behalf of their own individual interests and engaging in economic protectionism hurting global prosperity overall. The European Union united these European states creating a foundation for global prosperity by liberalizing trade and opening the market. This unification called for regulations and laws to be carried out throughout the European Union and enforced by individual member states. The integrated food market of the European Union requires the harmonization of regulations to allow the uninterrupted flow of goods, services, capital and labor.[13] One of the pillars of this harmonization was that regulation

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[12] Ujj, 80

[13] David Vogel and Jabril Bensedrine. "*Comparing Risk Regulation in the United States and France: Asbestos, Aids and Genetically Modified Agriculture*." (French Politics, Culture & Society*,* Vol. 20, No. 1 2002), 22

take a preventive and precautionary principle.[14] The introduction of GMOs into the market became a trade issue as not all member states were in favor of them. Countries called for rules that ensured the labeling and traceability of GMOS and GMO-derived products in line with these precautionary principles.[15] Since then product with as little as 0.9 percent of GMOS needs to be labelled as containing genetically modified ingredients.[16]

The continued division between the United States and Europe when it comes to organic farming is cultural and political. The lack of public support for GMOs is partially due to a lack of scientific literacy when it comes to biotechnology and also lack of media exposure with more support corresponding to a large of quantity of media. The socio-political background also contributes to the division with people who support organic agriculture are more environmental friendly and dislike large multinational agricultural businesses. A contributing factor to views on organic farming is how it is viewed by the public. The American public has pushed for organic farming and sustainable agriculture but not at the same level as European citizens as such farming remains heavily reliant on GMOS and bio-tech to overcome the developing problems in American agriculture.

The percentage of organic farming in the United States has grown in the past twenty years with public opinion swaying towards organics and non-GMOS. The public sway has remained firm as the United States has an abundance of land and resources. The need for sustainable and efficient agriculture has not become widespread despite fatalistic campaigns that suggest the fragility of the American agricultural system. A change in American farming based on policies originating in smaller countries like the Netherlands who produce large exports

[14] Vogel, 22-23
[15] Ujj, 87-88
[16] Ujj, 87-88

would be beneficial for the United States in order to produce enough food to sustain the growing population. This is also necessary as 40% of the United States' yearly food supply is wasted.[17] It is not only the United States that wastes food but global one-third of the world's food supply goes to waste during agricultural production, post-harvest handling and storage, processing, distribution and consumption. [18] One of the biggest problems facing the United States is that the agricultural industry is industrialized and reliant on fossil fuels. Petroleum fuels not only the trucks and farming machinery but also acts as a base for fertilizers and pesticides.[19] The availability of fossil fuels is quickly being depleted as such a switch to a more green-friendly agricultural system would be beneficial in helping maintain the oil reserves that remain. Besides maintaining the oil reserves left by converting to greener ways of producing food could stop global warming. Agriculture is responsible for nearly one-third of greenhouse gases. Consumers especially those living in agro-giants like the United States have become accustomed to having an abundance of food and a variety of produce as such many consumers buy more than they actually eat. The average individual in the United States throws away between 200-250 pounds of food per year. This excessive food waste compromises increases in food production. Unless the average American shifts their mentality and reverses the trend to favor conservation there has to be a shift in agriculture.

One such country that the United States can learn from is the Netherlands. This small country is densely populated with more than 1,300 inhabitants per square mile.[20] The

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[17] Swan, Seedstock
[18] Swan, Seedstock
[19] Swan, Seedstock
[20] Frank Viviano. "*This Tiny Country Feeds the World"* National Geographic, September 2017, https://www.nationalgeographic.com/magazine/2017/09/holland-agriculture-sustainable-farming/.

Netherlands has changed the very nature of sustainable and organic agriculture. The Netherlands is the second largest exporter of food in the globe after the United States.[21] This small European country became an efficient agricultural powerhouse by increasing productivity and agricultural yield without incurring huge costs. The Dutch policies are innovative and creative. They have reduced water dependency, the use of anti-biotics and pesticides and developed stronger seeds that still adhere to the European code on GMOs. They are using the available technology and researching new ways to combat world hunger and produce more food with less resources.

Over the past 20 years, the Dutch have committed themselves to providing food while sustaining their population and have been so successful they are able to export most of their food and still maintain a booming domestic food economy. One of the ways they have changed the agricultural community is by reducing the dependency on water for their key crops. Besides a growing population putting a strain on food resources another threat facing the modern world is water scarcity with more than 1.2 billion people lacking access to clean drinking water.[22] It is a global threat with estimates stating by 2025 two thirds of the world's population may face water shortages.[23] Water is necessary for human life as 70% of our body composition is made of water. Water is not only important in maintaining life but also in agriculture. Agriculture consumes more water than any other source and most of the water is wasted. [24]The Netherlands uses less water by taking new technology like hydroponic farming and applying it on a mass scale. They have reduced their dependency on water by as much as 90 percent.[25] Hydroponic farming is

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[21] Vivano, National Geographic
[22] "*Water Scarcity"* World Wildlife Fund, May 2018, https://www.worldwildlife.org/threats/water-scarcity.
[23] World Wildlife Fund
[24] World Wildlife Fund
[25] National Geographic

growing plants in a nutrient-rich solutions root without soil. Hydroponic farming uses less water by reducing runoff and thus saves money.

Hand in hand with hydroponic farming is greenhouse farming. The Netherlands focuses their farming in climate-controlled greenhouses allowing them to continually export fruits and vegetables that are weather dependent. Greenhouses can grow any crop at any time although traditional grains would be harder to produce. Greenhouse farming is especially efficient in producing fruits and vegetables. Greenhouses use as little as 10% of the water and 5% of the land required by traditional farm fields.[26] As a result, the Netherlands uses fewer resources and is less dependent on fertilizer, pesticides and water. They have almost 175 square acres of greenhouses which are closely controlled by farmers and produce huge agricultural yields.[27] By agricultural yield, they lead the world producing the most tomatoes, chilies, green peppers, and cucumbers per square mile. [28] They also lead the world in producing other fruits and vegetables like pears, carrots, potatoes, and onions.[29] When comparing the Netherlands to large countries like China and the United States they upended previous held bias on the competency and proficiency of smaller countries. The Netherland produces 144,352 tons of tomatoes per square mile. Comparatively, China the world leader in tomato production produces 5.25 tons of tomatoes per hectare. [30] China is an agro-giant but lacks the resourcefulness of the Netherlands. They might harvest huge yields of produce but they could double their results if they adapt the techniques implemented by the Netherlands. They are producing double the agricultural yield with using

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[26] Gretchen Vogel. "*Upending the Traditional Farm"* (Science, New Series, Vol. 319, No. 5864, Feb. 8, 2008), 752-753
[27] National Geographic
[28] National Geographic
[29] National Geographic
[30] "*Farming the World: China's Epic Race to Avoid Food Crisis*." Bloomberg News, May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/.

half as many resources. Another aspect of the Dutch production is the continued push for newer ways to produce more food with the leading technology at their hands. An example is a farm in the Netherlands with 36-acres of greenhouses with tomato vines rooted in fibers spun from basalt and chalk.[31] Farmers are taking the technology available to reshape the world in which they live in and becoming incredibly successful.

A staple of the Netherlands farming is the development of non-GMO seeds. Dutch firms produce seeds that do not introduce any new genes and can defend themselves naturally from pests.[32] The seeds that they produce have also been known to help produce large agricultural yields without costing as much to develop as GM seeds and do not have to go through the strict regulatory process that is required for GM seeds to be used in food in Europe. This non-GMO fruit and vegetable seeds are one of their main exports and are distributed throughout the world. The Dutch government unlike other European countries take a much more rational approach to GM seeds however the cost to develop GM seeds outweighs the necessity as they do not produce a large amount of grains. The Dutch government has stated that "given the same area of land used for agriculture in the Netherlands, the GM crops currently available are not particularly attractive for Dutch farming."[33]

They have also eliminated the need for chemical pesticides on plants and the use of antibiotics on livestock. As a small nation that lives in close proximity to livestock there is a real fear about bacterial outbreaks in livestock. It has become a routine in the developed world to add antibiotics in animal feed to increase growth and prevent the spread of infections. This has

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[31] National Geographic
[32] National Geographic
[33] "*Restrictions on Genetically Modified Organisms: Netherlands*", Library of Congress, May 2018, https://www.loc.gov/law/help/restrictions-on-gmos/netherlands.php#_ftnref15.

become hotly debated issue as studies suggest that this routine has allowed for the development of superbugs which are resistant to antibiotics. There is a real danger that these superbugs could spread from animals to humans. Since 2006, the EU has banned the use of antibiotics to act as growth agent but the Netherlands, a leader in exporting meat, has reduced the need for antibiotics entirely.[34] The drive to remove antibiotics came after a MSRA outbreak spread from Dutch pigs to other animals and people. A law was implemented that required an animal to be inspect by a veterinarian before being administered antibiotics.[35] They also implemented an agricultural practice of keeping livestock clean and separate so as to provide a collective resistance to bacteria strains. Strict regulation in administration of antibiotics has surprisingly not has a negative effect on the export of meats and their profits. Data has showed that by reducing the usage of antibiotics in livestock it has also eliminated drug-resistant bacteria in livestock.

The Netherlands adapted these protocols and excelled to the point that they were able to become exporters on a massive scale. They pose a threat to major exporters who do not see them as major competitors in the global market. The Netherlands is an anomaly compared to the other top exporters in the world. These exporters are the United States, Germany, Brazil, France and China. These countries have large tracts of land which is required for producing large amounts of food commodities. The United States remains as the top exporter but comes in third when it comes to producing food being beaten by India and China. The reason China and India produce more food but don't export is that that they have such large populations they end up consuming much more of their own products. Although China, India and the United States produce much

[34] Rachel Keeton "The World's Second-Biggest Food Exporter Declares War on Livestock Antibiotics." Next City, July 2014, https://nextcity.org/daily/entry/netherlands-food-producer-is-eliminating-livestock-antibiotic.
[35] Keeton, Next City

more food than the Netherlands they have more readily available resources not only total land but large farming populations.

China has a farming workforce estimate of 315 million laborers to put that in perspective the total population of the United States is 325 million.[36] China dominates with being the world's biggest producer, importer and consumer of food. China has already been struggling with the task of feeding an over populous nation as their population staggers towards 1.5 billion people. Although, the China has a huge population and therefore a large workforce its growth rate is in fact declining to 0.39%.[37] This growth rate will continue to decline as China's demographics are skewed due to their one-child policy adapted in the 1970s. In both China and India, men outnumber women by 70 million. These skewed demographics have long term effects not only culturally socially and politically but also on the future of food production. The fertility rate in China will decline and this will put a further economic strain on China as they are reliant on a rural populous population to sustain their production model.

China's domination is dependent on its land remaining fertile and the continued growth in population remaining rural. They could be further threatened if their population continues to move further into the city and similar to the rest of the world they will face a large aging population and fewer people entering the workforce albeit on a slower pace. The sustainability of their food system is fragile and unviable. Despite the fact they dominate the global market in terms of food production when compared to a huge exporter like the Netherlands it is clear that they are wasting resources and putting an undue strain by not adopting sustainable agricultural policies.

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[36] Bloomberg News
[37] Bloomberg News

An argument can be made that the United States is not the clear hegemon anymore compared to the rapid economic growth made by China and its dominance when it comes to food production. The economic boom allowed China to invest in land reforms and produce more food like meat shown in the countries increased protein consumption. The economic boom brought with it some side effects including the loss of land by the construction of factories to support the export economy, fields polluted by water and chemicals soaking the soil.[38] It is hard to see China surpassing the United States if it maintains its extractive political institutions and production policies as its economic growth will most likely not be sustained.

China is reliant on a variety of factors besides demographics and population growth one being the fertile land in the eastern and southern regions of the country**.** Only 15% of its total land area can be cultivated and most of its land supports the production of vegetables and fruits not traditional grains.[39] Another way to look at it is China only has 0.2 acres of land per citizen including those that have been effected by the pollution due to the export economy boom. China would benefit the most from implementing the policies adapted by the Netherlands. China could double its harvesting of vegetables and fruits by transforming their traditional farming system. China is already searching for ways to reinvent its current systems of production and private enterprise and have already spent billions on developing these new technologies.

The problem is that China is stuck on the goal of being self-sufficient in harvesting grains. Despite being the most prolific producer of food, China imports most of their grains from the United States. The United States leads the world when it comes to harvesting grains like corn and wheat. Companies like Monsanto have a monopoly on producing GM seeds like corn which

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[38] Bloomberg News
[39] "Arable Land" World Data Bank, May 2018, https://data.worldbank.org/indicator/AG.LND.ARBL.ZS.

are high successful and produce large yields. The corn also only responds to a certain type of fertilizer and pesticide. These seeds are so lucrative and sought after that Chinese spies were caught stealing these corns and prosecuted for stealing trade secrets.[40] This was not just a case of international rival companies but international economic espionage. The Chinese government backs these operations as continue to fail in becoming self-sufficient. Their plan over the past few years to boost domestic production by paying farmers to grow these crops and then store the excess has not worked.[41] In response to this incentive, farmers saturated their fields with fertilizers and pesticide to encourage growth in these staple grains.[42] The fertilizer consumption in China per hectare of arable land between 2002-2014 is triple that of the United States.[43] It succeeded in producing a surplus of grain but China exhausted its resources and caused significant ecological damage as a result.

China needs to improve its system to producing more green agricultural products and preserve the little farmland they have left. China lost 6.2 percent of its farmland between 1997 and 2008.[44] In the same report form the UN Food and Agriculture Organization is that 20% of the remaining arable land is contaminated. If China made the switch to greenhouse farming they could circumvent the problem of polluted farmland. Studies by the Chinese government in 2014 showed that some vegetable plots were dosed with high levels of heavy metals.[45] The problems with domestically produced food in China shows an opportunity for the Netherlands and other

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[40] Del Quentin Wilber, "The saga of the Chinese spies and stolen corn seeds: Will it discourage economic espionage?" Los Angeles Times, October 2016, http://www.latimes.com/nation/la-na-seeds-economic-espionage-20161031-story.html.
[41] Bloomberg News
[42] Bloomberg News
[43] UN Food and Agriculture Organization
[44] UN Food and Agriculture Organization
[45] Bloomberg News

small countries as the public look elsewhere to satisfy their diets. The Netherlands could pose a threat to the United States with the Chinese public becoming more inclined to buy imported goods. If China does not improve its farming practices it will have no choice but to import everything. China already has begun to do this as the country bought 106 million tons of cereals and soybeans in 2016.[46] This demand in imports could increasing the purchasing power of the Netherlands making it a strong contender in the world stage when it comes to the future of sustainable agriculture. This seems even more likely taking in the current political climate with China being less likely to trade with the United States. The Trump administration is demanding a $100 billion cut in the $375 billion annual trade deficit and imposing tariffs on $150 million in Chinese goods.[47] These tariffs and trade deals have not been cemented yet but if a trade war does develop between the United States and China, the Netherlands could benefit in exporting food goods to China as a result.

China has been slowly investing in new technologies like micro-irrigation and using drones in a similar way to the Netherlands to disturb pesticides.[48] These farms are unfortunately a small minority as the average plot per laborer is 0.5 hectares.[49] In comparison the average plot per worker in the United States is 73 hectares.[50] This means that even if individual farmers wanted to take on new technologies and apply to it their land they would most likely not have enough to make it an efficient and productive operation. As mentioned the vast majority of the population remains rural which helps drive the amount of food produced but also delays

[46] Bloomberg News
[47] Keith Bradsher, "*China Is Set To Take a Hard Line on Trump's Demands*" New York Times, April 2018, https://www.nytimes.com/2018/04/30/business/china-trump-trade-talks.html.
[48] Bloomberg News
[49] UN Food and Agriculture Organization
[50] UN Food and Agriculture Organization

efficiency and productivity as companies are not allowed to acquire larger tracts of land thus not allowing them to adopt more eco-friendly policies on a larger scale. China might be years behind the Netherlands when it comes to large high-tech farms

The 21st century has shown that the world is highly connected not only through the Internet but through increased globalization that means that a bad harvest in one country can have a drastic effect in another country on the other side of the world. Global cooperation is necessary as the amount of resources on the Earth continue to dwindle. This means an international level of shifting towards greener practices in agriculture. It would be lucrative to have the world in agreement when it comes to farming as the problem continues to grow in the latter half of the 21st century.

Large export countries can draw important lessons on the future of agriculture by implementing the procedures taken by the Netherlands on a larger scale. Large export countries are not the only ones that can take advantage of the procedures implemented by the Netherlands. A U.N report stipulated that farmers in developing countries could double their food production by shifting to more sustainable methods. These sustainable agricultural practices could drastically decrease world hunger and remove developing countries from being at the whims of the developed world.

The United States is slowly implementing these technologies into the agricultural industry but faces a variety of problems. Smaller countries like the Netherlands have the added advantage of being smaller and socialist allowing widespread implementation to be easier. The cost of converting the industry would require a large budget. Large corporations like Monsanto, Purdue, and Tyson have a vested interest in maintaining the current farming system which is heavily reliant on GMOS, pesticides, fertilizers, and hormones for livestock. These corporations

have large lobbying operations that maintain the status quo when it comes to food production. The United States government could shift this status quo by phasing out agricultural subsidies that benefit wealthy farmers and corporate agri-business and incentive environmentally friendly cultivation practices.[51] It could also help strengthen the organic farming that it is already out there and enable farmers who do practice sustainable agriculture to capture more of the consumer dollars and thus giving incentive to continue these practices. A shift like this would be beneficial but also costly. A federal overhaul would be the most effective but adding more incentive to huge agribusinesses to shift would be more likely. The United States is still very efficient when compared to the larger agricultural producers like China and India but with a growing population and finite resources it needs to be even more efficient and productive.

Smaller European countries like the Netherlands have implemented creative and innovative farming polices that have used less land and have become more efficient and sustainable. The United States uses more land to produce the same amount of food implying that a change in structural procedures might be advantageous as the population continues to grow. The world faces myriad of problems from overpopulation, water scarcity, reliance on GMOS, fertilizers, pesticides and antibiotics in livestock. The Dutch have come up with solutions to these problems and are taking steps to bring about more productive and efficient agriculture. As a small state, they have not only produced enough food for their own use but have become export giants threatening traditional agricultural producers like the United States and China. Although they do not produce as much food as these large export economies they are dismantling previously held bias about small states by producing huge agricultural yields with half as many resources. They are producing more efficiently and productively and it would be beneficial for

[51] Gonzalez, 10-11

not only large exporters but developing countries to follow their example. It can be stipulated that as the need for more food grows the Netherlands will be the leader in greener and more sustainable ways of meeting this need.

Methodology:

The methodology used was researched based and qualitative following a system of analysis beginning with the current problems facing the modern world which is how to feed a world that continues to grow at an exorbitant rate. It then follows scholarly articles to explain the division in the Western World over organic agriculture and the cultural atmosphere it created giving the framework for how a country like the Netherlands could develop into an export giant. A variety of current sources were used to analyze the food systems in large countries like the United States and China and then used to make a comparison to smaller countries with huge food exports specifically the Netherlands. I looked at the technological advancements and the strides taken by the Netherlands in regards to sustainable agriculture and then looked at how they tackled specific issues like water scarcity, weather dependent crops, dependency on fertilizers and pesticides, antibiotics in animals and maintaining the use on non-GMO seeds.

The thesis also used current reports from the UN and other reputable sources to analyze the ecological and environmental problems that threatened food security to provide the background to understand the reasoning behind the Netherlands strides in agriculture. I also analyzed the threat that smaller countries like the Netherlands pose to larger countries when it comes to export power comparing it to large agricultural exports whose viability is in question especially China who produces the most agricultural product but lacks efficiency. I stipulated that the Netherlands might rise in export power as China looks to import more food and the

current political climate has them looking to other sources besides the United States. I also observed that the Netherlands went against traditional bias of the roles that smaller countries predominantly take. I used all this information to draw conclusions about the future of sustainable agriculture and how these larger countries could change their public policies to allow for a larger agricultural yield with using half as many resources.

Bibliography

Bradsher, Keith. "*China Is Set To Take a Hard Line on Trump's Demands*" New York Times, April 2018, https://www.nytimes.com/2018/04/30/business/china-trump-trade-talks.html.

Del Quentin Wilber, "The saga of the Chinese spies and stolen corn seeds: Will it discourage economic espionage?" Los Angeles Times, October 2016, http://www.latimes.com/nation/la-na-seeds-economic-espionage-20161031-story.html.

Gonzalez, Carmen G. "*The Global Food System, Environmental Protection, and Human Rights"* (Natural Resources & Environment, Vol. 26, No.3, Complex Systems, 2012), 9

Heller, Chaia. "*Another (Food) World Is Possible: Post-Industrial French "Paysans" Fight for a "Solidaire" Global Food Policy*." (Anthropological Journal of European Cultures, Vol. 20, No.1, Thematic Focus: Politicking the Farm: Transitions and Transformations in European Agriculture (2011), 89-110.

Keeton, Rachel "The World's Second-Biggest Food Exporter Declares War on Livestock Antibiotics." Next City, July 2014, https://nextcity.org/daily/entry/netherlands-food-producer-is-eliminating-livestock-antibiotic.

Orsolya, Ujj "European and American Views on Genetically Modified Foods." *The New Atlantis,* No. 49, Special Section: The Integrity of Science (2016): 77-92.

Noelle Swan, "*Five Major Challenges Facing North American Agriculture."* Seedstock: April 18, 2012, http://seedstock.com/2012/04/18/five-major-challenges-facing-north-american-agriculture/.

Vogel, David and Jabril Bensedrine. "*Comparing Risk Regulation in the United States and France: Asbestos, Aids and Genetically Modified Agriculture*." (French Politics, Culture & Society, Vol. 20, No. 1 2002), 22.

Vogel, Gretchen. "*Upending the Traditional Farm"* (Science, New Series, Vol. 319, No. 5864, Feb. 8, 2008), 752-753.

Arable Land" World Data Bank, May 2018, https://data.worldbank.org/indicator/AG.LND.ARBL.ZS.

"*Farming the World: China's Epic Race to Avoid Food Crisis.*" Bloomberg News, May 22, 2017, https://www.bloomberg.com/graphics/2017-feeding-china/.

"*Restrictions on Genetically Modified Organisms: Netherlands*", Library of Congress, May 2018, https://www.loc.gov/law/help/restrictions-on-gmos/netherlands.php#_ftnref15.

"*World population projected to reach 9.7 billion by 2050.*" United Nations Department of Economic and Social Affair, July 29 2015, http://www.un.org/en/development/desa/news/population/2015-report.html.

Water Scarcity" World Wildlife Fund, May 2018, https://www.worldwildlife.org/threats/water-scarcity.