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Kazakhstan, Factor 6: Sustainable Agriculture

Kazakhstan and No-Tillage Farming: Implementation of Sustainable Agricultural Practices

Perhaps one of the most interesting places in the world is Central Asia. Torn between modernity and the Soviet Era, this region encounters issues that few other countries do due to their history and location. Kazakhstan, specifically, is one of increasing importance with their “full-court press” to eventually become a world player. Kazakhstan emerged from the Soviet Union in 1991 and consequently struggled in finding its position in the market-based world. Over two decades later, Kazakhstan is one of the most promising and prosperous countries in the Central Asian region, though it is still wrought with problems. Exporting natural resources, such as fossil fuels and metals, has been the main focus economically; agriculture being the next largest product category, with wheat being the largest subcategory. Agriculture historically has been a large part of Kazakhstan, especially in the Soviet days under the Virgin Lands program. Agricultural land comprises the majority of Kazakhstan and there is great potential for agriculture to bring economic prosperity and food security to both the country and Central Asia, where much of the agricultural exports go to. However, in the status quo, agriculture is not the effective entity that it could be. As a matter of fact, Kazakhstani agricultural practices, both on a commercial and subsistence level, have created dire environmental issues in addition to the problems that climate change is causing. Consequently, parts of the environment are extremely degraded and overall yields are now extremely volatile—an issue for the rural families dependent on the land, the Kazakhstan economy, and the other Central Asian countries reliant on Kazakhstani agriculture. From this, it is clear that a change in agricultural practices is needed. A focus on sustainable agriculture can address the environmental issues, both by compensating for the current degradation and even reversing the damage in the long run. Focusing specifically on no-tillage agriculture would provide substantial change without a burdensome implementation process. Thus, a move towards sustainable agriculture, particularly the practice of no-tillage farming, is warranted.

Life in Kazakhstan still is heavily influenced by the Soviet past. In rural areas, the average family size is six (“Gender Survey”). Families have strong ties to extended families because relocation is rare. In these families, the men are the primary earners while the women attend to more domestic affairs (“Republic of Kazakhstan”). Farmers in these rural areas live on plots ranging from 0.5 hectares to 30 hectares. In continuation with the Soviet practice, collective style farms are also still common, with land being split among many families (Lamar). Because of this sharing, subsistence farming, especially in concerns to crops, is not common. Many families will come together to both grow food for themselves and then make a commercial profit from their farming. On any agricultural land, wheat and cattle are generally the focus. Family farming, when for subsistence purposes, accounts for 85% of Kazakhstan’s cattle. This, in addition to the great amount of wheat growing, often means that the average Kazakhstani’s diet is skewed towards being heavy in meats and carbohydrates (“Gender Survey”). This diet is not high in fruits and vegetables. In the winter, local fruits and vegetables can be especially scarce while imports are cost-prohibitive, making produce largely unavailable during this harsh Kazakhstan season unless a family preserves the summer produce (“Republic of Kazakhstan”). On these plots, men are generally in charge of land levelling, tillage, and irrigation, while women are in charge of planting and weeding. Farming often is not the only source of rural Kazakhstan income. Many pick up part-time employment and half of men and a third of women will attend secondary education, usually unrelated to agriculture (“Gender Survey”). One major issue confronting rural families, apart from the skewed nutrition, is the lack of indoor plumbing (“Republic of Kazakhstan”). Many have neighborhood taps that their water comes from and it is not always sanitary. Other issues also stem from gender inequality. Rural Kazakhstan is often patriarchal. In a study done of gender inequality, 51-94% of people, depending on the rural district,

believe, that in reality and practice, only men have access to an agricultural market and are allowed to make major decisions in concerns to the agriculture (“Gender study”). For the millions living in the rural parts of Kazakhstan, the deterioration of the environment due to agricultural practices is a public health issue. The degradation of air, water, and land has led to high levels of pollution, causing disease (Jones). This is especially devastating in Kazakhstan where both rural and urban citizens lack access to proper medical facilities. Most hospitals do not have modern equipment and supplies, thus making it the patient’s burden to locate the medical supplies needed. For the rural population, this makes it incredible tough to find medical care (“Republic of Kazakhstan”). While the average rural Kazakhstan family is not destitute, there are still issues that need to be confronted, with much of the welfare problems linking back to the agriculture turmoil.

Agriculture in Kazakhstan is a highly variable entity playing an important regional role. Kazakhstan has 2.7 million km² of land devoted to agriculture, 77.4% of the overall land, yet only 8.9% of which is arable land suitable for growing crops (“Kazakhstan”). The majority of Kazakhstan’s agricultural land is devoted to pastures, though it is its crops that prove especially important. Recent estimates point to 18 million hectares (180,000 km²) being used for, or at least attempted to be used for, wheat production (“Kazakhstan Agricultural Overview”) In recent years, Kazakhstan has emerged as one of the world’s top wheat exporters, providing crucial food to other Central Asian countries that face harsher food security issues than Kazakhstan itself. Kazakhstan grows between 10-17 million tons each year, upwards of 2 to 8 million tons of which will be exported (“Kazakhstan Agricultural Overview”). This disparity in yield is due to climate volatility exasperated by environmental degradation from a lack of sustainable agriculture.

Out of every five years, two of the years will be of severe droughts for Kazakhstan (“World Bank”). While the climate spells issues alone for productivity, the problems grow exponentially with the current environment degradation. Though many agricultural practices have risen to compensate for the weather, they provide short term solutions that are harmful in the long run. Even in non-drought years, agriculture production will vary around 27 percent from year to year (“World Bank”). The traditional farming crop rotation, which included inactive time for fields, used in Kazakhstan for generations has been widely put out of practice in interest to get more lucrative harvests growing. Crop diversity has fallen, with now 85% of crops across Kazakhstan being cereal crops, the majority of which is wheat (“World Bank”). In an attempt to irrigate during drought seasons, two major rivers in Kazakhstan have been diverted and are quickly drying up, leaving behind heavy buildups of natural salts both in the river bed and fields (“Kazakhstan”). In turn, this has made the Aral Sea into a third of its previous size due to being dried up (“Kazakhstan- CACILM”). Reduced tillage, however, has been on the rise, with 60% of fields using this technique in 2009. Being generally less harmful than normal tillage because it does not disturb the land as much, it still has its issues because it then requires clearing the land through heavy herbicide usage, subsidized by the national government (“Kazakhstan Agricultural Overview”). The costs of these harmful practices are extreme—an estimated 700 million dollars (in US dollars) are lost per year with “poor households paying the highest price” (“Kazakhstan- CACILM”). This is often due to the high costs associated with compensating agricultural practices to the environmental degradation. The monetary burden is one more easily met by richer households than the poorer ones. It is also a cost that the government needs to help front. The average amount of money the Kazakhstan government spent on agriculture in 2014 was 166 billion Kazakhstani Tenges (approximately 471 million US dollars) (“Kazakhstan Ups”). In comparison, other nearby countries’ governments such as Kyrgyzstan spend less than 10 million US dollars on agriculture investments (Lowder). The environmental degrading practices might be alleviating the climatic effects on agriculture in the short term, but they are slowly turning around the alleviation and promise to create issues of their own in the near future.

While Kazakhstan has gone far in alleviating food insecurity issues, full security has yet to be attained. The future does not show a promising sign either. Availability of food is determined on the year and precipitation. Projections point to the future where crop yields are reduced 50-70% because of decreasing precipitation (Baigozha). Quality of food is under regulated, with 78% of food standards that need

updating from their 1928 origins, especially those concerning agriculture processing (Aigarinova). Kazakhstan has yet to maintain a high self-sufficiency in concerns to food. It is extremely dependent on other countries, such as Russia and China, for sugar, sausage, dairy products, and fruits and vegetables (“Kazakhstan”, “Self-Sufficiency”). The national government plays a heavy role in ensuring availability and affordability of food. So while Kazakhstan currently has partially fulfilled food security (with only self-sufficiency and perhaps quality subtracting from this), this may not last much longer as climate volatility increases with climate change and destructive agricultural practices continue to degrade the environment. Furthermore, Kazakhstan’s agricultural output is a major stabilizing force in Central Asia, with Kazakhstan’s impoverished neighbors, such as Tajikistan, Kyrgyzstan, and Uzbekistan, being extremely dependent on Kazakhstan’s wheat (“World Bank”). In a season of low agricultural productivity, Kazakhstan might not have full food insecurity, but its neighbors living on Kazakhstan’s agriculture could very well be in a dire state of food insecurity. What happens in Kazakhstan exponentially impacts other Central Asian countries. Thus, a solution is needed to create fuller food security in the status quo and to ensure food security in the future for Kazakhstan, and in turn, Central Asia.

Kazakhstan’s status quo response to food insecurity is a long and arduous plan. They seek to accomplish food security by 2050, however the current actions towards that have not been successful. The Kazakhstani government is focusing on crop diversity, however there have been great resistance from the farmers and the authorities in charge of making crop diversification happen (Oshakbayev). Other plans under the program have been met with similar resistance.

Addressing climate volatility would be a long and internationally complicated pursuit, so a focus on smart agricultural practices would be a more immediately rewarding endeavor for Kazakhstan. Alleviating agricultural issues could be easily done with a wider practice of sustainable agriculture. Kazakhstan is already a major implementer of reduced tillage farming, restricting the destructive preparation of the soil before seed planting. This should have helped alleviate many of Kazakhstan’s environmental degradation issues already but haven’t due to incorrect reduced tillage practices and heavy herbicide usage. This attempt towards sustainable agriculture should be continued in its implementation, with an eventual move towards complete no-tillage agriculture. In its current state of reduced tillage agriculture, a simple solution towards better practices would center on the herbicide usage. The government of Kazakhstan is a heavy subsidizer of the herbicides. An immediate fix to this would be to reduce the subsidies used for herbicides, thus making it more expensive to use the chemicals and hopefully encourage less usage of them. In this scenario, the subsidies can continue to go to work for the farmers by being of use in concerns to precision methods of application for herbicides, helping to ensure responsible herbicide use.

A small simple fix, however, will not do much to address larger overarching environmental concerns nor would help achieve greater yields for Kazakhstan. A larger movement toward no-till agriculture is needed. No-tillage agriculture, in practice, stops the plowing or tillage of land but does not prepare the land by the heavy application of herbicides, unlike Kazakhstan’s reduced tillage agriculture in the status quo. The plant residue from the previous year remains on the field rather than being turned over or cleared. Instead of plowing, a disk or a chisel is used to create a narrow furrow just big enough for the seeds to be planted in (“No-Till Agriculture”). No-till agriculture would deal with many issues contributing to the land degradation. The usage of this form of agriculture would actually reduce the need for herbicides in the long term, as weed germination would be more restricted because the plant residue would prevent sunlight from reaching fast-growing weeds. The irrigation issue would also be improved as no-tillage farming creates better soil that retains water for longer periods of time. In Kazakhstan particularly, this will be effective. Forty percent of Kazakhstan precipitation comes from the snow in the winter, which can be trapped by the plant residue left behind in no-tillage agriculture (“No-Till: A Climate Smart”). This is a crucial water saving opportunity during Kazakhstan’s dry years and will help to stop the destructive drying up of local bodies of water. No-tillage agriculture can even address the water pollution issues in Kazakhstan as the plant matter will absorb excess fertilizer, preventing the

nutrient leaching that pollutes the waters. Ultimately, no-tillage agriculture, with the plant residue left behind, replenishes the soil's organic material, providing food for soil microbes, in turn creating a more fertile soil requiring less fertilizer and producing higher yields ("No-Till Agriculture"). These benefits from no-tillage agriculture can and will help to compensate for the environmental problems and have the potential to reverse the issues in the status quo if applied to the whole country.

Agricultural hardships, apart from the environmental issues, also stem around a general decrepitness of farming equipment. No-tillage farming is extremely less reliant on equipment than regular agriculture, thus saving the costs otherwise needed to eventually replace the machinery. This in turn will also affect the herbicide usage. Much of this decrepit equipment has been repurposed into herbicide sprayers, largely unprecise, thus contributing to the chemical issue (Friedrich). Purposely switching attention to a no-tillage, less herbicide approach would bring relief to this.

Though not strictly no-tillage farming, using cover crops throughout the winter months will provide extra protection to the soil. Most beneficial would be bio-tillage radishes, otherwise known as Daikon radishes or Japanese radishes ("Radishes"). These radishes are planted in the late summer after the main crop has been grown. As they grow, their tubers drill into the soil. In typical usage, the radishes are left to die over the winter months, their leaves providing ground cover while the hole left behind by the radishes allow for drying of the soil in the spring and even a place to let seeds be grown when planting season does come, essentially providing the benefit of tilling without the harms. However, these radishes could even be harvested in late autumn to provide added food to the local markets. The radish tops could be left behind if additional ground cover is needed. The benefits of no-tillage farming will grow exponentially with the introduction of cover crops. Soil erosion—a major issue contributing to water pollution and soil degradation—is halted through the usage of cover crops, which hold the soil with their roots to prevent the erosion ("No-Till Agriculture"). Herbicides are even more unnecessary as the cover crops prevents weeds from growing by further reducing the sunlight reaching the weeds. And, all the fertility benefits from plant residue left behind are even greater when the cover crops are included ("No-Till Agriculture"). Though these cover crops provide profit to farmers in the long term due to less of a need to buy herbicides, fertilizer, and equipment, some resistance from farmers could be met with the encouragement of cover crops due to the added cost. Thus, here again would be a viable place to be an alternative for the herbicide subsidies. The price of seeds for cover crops could be subsidized by local or national governments.

The benefits of no-tillage agriculture could expand upon the reversal of the current environmental degradation. The climate volatility is a major issue that is the central cause behind the agricultural variability and the subsequent environmental degradation. Climate change will continue to wreak havoc on the agricultural sector of Kazakhstan, including the furthering of decreased precipitation. Though combating climate change effectively requires an international solution, Kazakhstan can approach trying to deal with localized contributions to climate change. No-tillage agriculture would actually be a potential way to fight climate change via carbon capture sequestration, or CCS (Blanco-Canqui). The data on this is limited, however some studies are pointing to no-till agriculture's ability to increase carbon capture, primarily from carbon dioxide, the major greenhouse gas contributing to climate change. While this will not stop the increasing climate volatility for Kazakhstan, it could help mitigate some of it, especially when used widespread through Kazakhstan.

Socially, no-till agriculture has the potential to be a driving factor. It will, firstly be more labor intensive, primarily in concerns to weed removal. This is generally done by women laborers ("Gender Survey"). Even if there is an increase in weeds, there is the potential to open up more jobs for women in larger farms employing workers, thus helping gender equality in Kazakhstan.

Sustainable agriculture, especially no-tillage farming, has been proven beneficial in practice. Globally, conservation agriculture, of which no-tillage farming is often employed, has been in use across 95 million hectares, often showing favorable results (Lamers). Specifically within other areas in Central Asia, no-

tillage techniques were tested and shown to be compatible to the region while producing similar or higher crops yields along with savings on production costs (“Conservation Agriculture”). In 2012, three Northern regions of Kazakhstan tried no-tillage agriculture. The result, just in that year, was an additional 0.7 million tons of wheat, a 30-40% yield increase. That is enough for 5 million people to be fed for a year (“No-Till: A Climate Smart”). Introduction of no-tillage agriculture can a long way to tackling the issue of food insecurity, particularly in the impoverished region of Central Asia. This potential is one recognized by numerous entities involved in Kazakhstan; The national government, the World Bank, the Food and Agriculture Organization, and the International Maize and Wheat Improvement Center all are playing a vital role in the status quo in Kazakhstani agriculture and can help encourage the final jump to no-tillage agriculture. There is no shortage of evidence or support for a move towards more sustainable agriculture in Kazakhstan.

The largest resistance to sustainable agriculture will be the lack of awareness and education on these techniques. Education is already relatively widespread in Kazakhstan and it simply a matter of having agricultural education available, even on a secondary educational level. Some organizations have already been involved in providing education of no-tillage agriculture to Central Asia. These include ICARDA, CIMMYT, Tashkent Institute for Mechanization, and a UNESCO Khorezm project at the university of Urgench, though attendance by famers has been low (Lamers). Both more educational opportunities in Kazakhstan and encouragement for attendance would help increase the attendance. Encouragement could easily be found in the form of the government who already provides incentives to farmers. Some of these funds could be used for education. In addition, the use of tax credits if a farmer attends an educational session would encourage the attendance. Previous endeavors, like the reduced tillage switch, have been found to be accepted when the government provides monetary incentives. These incentives can go one step further by now being used for complete no-tillage farming.

The implementation of no-tillage agriculture would be easily encouraged using the same techniques that the national government used in switching Kazakhstan from tillage to reduced tillage agriculture. The government provided higher subsidies on wheat that was grown on reduced tillage land than the wheat grown with conventional tillage. This provision led to a greater, wide spread acceptance of reduced tillage agriculture, seen especially in practice, with 60% of fields being reduced tillage (“Kazakhstan Agricultural Overview”). A similar technique could be used to facilitate a jump to complete no tillage agriculture. Wheat grown with reduced tillage could continue to be given a higher subsidy for wheat than conventionally grown wheat, but in addition to that, no tillage wheat could receive an even higher subsidy. If such a move was able to make 60% of the country adopt reduced tillage agriculture within years, it could easily be used to accomplish the same but with the better technique of no-tillage agriculture.

Funding for a no-tillage system and other such conservation processes like cover crops and tillage radishes would not be a problem. First, no-tillage systems substantially minimize overall growing costs because of not have the need to buy fuel for machinery and the labor to use these machines (“Advantages and Disadvantages”). Whatever funds that would needed to be used to buy bio-drill radishes could be taken from the money saved with a no-tillage system. Investments from outside organizations can also drive innovation and change within Kazakhstan. In recent decades, the government and the people have been skeptical about allowing foreign investors to be directly involved in agriculture, an entity primarily controlled by the government. However, recent changes made to the Land Code, which governs land ownership, now allows foreigners to rent and own agricultural land, a move particularly meaningful for China, who has been looking to become more involved in Kazakhstani agriculture (“Kazakhstan’s Land”). This has created concerns among citizens that there might be loopholes that will help the rich in Kazakhstan while hurting the lower classes. This is one such area resistance that no easy solution can help as the government in Kazakhstan is particularly harsh against dissent from citizens. More transparency from the government can help address the protests. Despite these potential issues, the changes are predicted to stimulate innovation. Additionally, loosening the hold the government has on the agriculture

industry has the potential to help grow agricultural public-private partnerships in the country, believed to be particularly effective at driving innovation. The European Bank for Reconstruction and Development invests in these agriculture public-private partnerships, among other things that their 7 billion USD have been used for (Charkrabarti). The recent changes and investments in Kazakhstan have great potential to drive innovation that will further be needed to continually meet the demands of food security and to create a more sustainable agriculture vision for Kazakhstan.

Kazakhstan's partial food security hangs in the balance with the dual threats of climate change and environmental degradation. If current practices continue, Kazakhstan's prosperity relative to the region could be lost. Famine would spread across both the country and the rest of Central Asia. The current predictions for a world with increasing climate change issues point to additional problems that would further exacerbate food insecurity for Kazakhstan. The synergistic effects of the threats of climate change and environmental degradation will undoubtedly be a major issue. The attempt for this nation to become fully developed and be on the same level as other international powers would be reversed, especially without Kazakhstan's ability to export as much wheat as it does in the status quo to have a competitive edge. Similar issues would be seen in the other nations in Central Asia, like Uzbekistan, Tajikistan, and Kyrgyzstan, but perhaps on even a worse level given that they already experience worse problems than Kazakhstan. Poverty and subsequent issues stemming from it would be rampant. Starvation and malnutrition would be common without the life-saving wheat from Kazakhstan. If true food security wishes to be attained for Central Asia, it is up to Kazakhstan to act on creating a better future for both itself and the region as a whole. Within Kazakhstan's power, it would be most beneficial to address the widespread environmental degradation as a result of their agricultural practices in the status quo. Sustainable agriculture, especially via no-tillage agriculture, will allow Kazakhstan to continue their agricultural pursuits, even on an international level, despite the environmental concerns and will provide the chance for a reversal of the harmful situation if implemented in the long run. Apart from securing food security for Kazakhstan and the region, no-tillage agriculture will help mitigate the widespread issue of climate change. On balance, sustainable agriculture will bring immense benefits to Kazakhstan. Given the additional feasibility of such a switch, there is no question if these agricultural practices should be implemented. Through an immediate trend to sustainable agriculture can Kazakhstan find full food security in the status quo and ensure it for the future.

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