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Republic of Korea, Factor 20: Farm to Market

### Republic of Korea: Increasing Access to Local Markets through Infrastructure Development

The Republic of Korea, more commonly known as South Korea, is located on the southern half of the Korean peninsula. South Korea separated from the Democratic People's Republic of Korea, or North Korea, in 1948. The Armistice Agreement from the Korean War separated North and South Korea until a final peaceful settlement is achieved. The two countries, however, are technically still at war with each other today. "The Demilitarized Zone (DMZ) is a region on the Korean peninsula that demarcates North Korea from South Korea. Roughly following the 38th parallel, the 150-mile-long DMZ incorporates territory on both sides of the cease-fire line as it existed at the end of the Korean War" (History.com). It is also one of the most heavily armed borders in the world. After winning independence, South Korea industrialized to be on the cutting edge of technology. Some examples of technologically advanced companies are Samsung, Hyundai, LG, and Kia. These are internationally recognized companies that many Americans are exposed to every day, yet so few people realize that these companies started in South Korea before they ever went worldwide. Unfortunately, this industrial boom had a detrimental effect on agricultural self-sufficiency. During this period, many poor farmers left rural homes to move to larger, developing cities in search of employment opportunities including manufacturing and government jobs. Many started small family run businesses like grocery stores or restaurants. Eventually, this led to overpopulation in big cities and a demand for imported food to account for the needs of a growing population that local farmers could not support. Due to the number of farmers that moved to the city, South Korea's population was shifted from rural to urban. Foreigners are not a large factor of this shift as South Korea is a mostly homogeneous region, meaning almost everyone in the country is of the same ethnicity.

Although aspects of Korean culture have changed since industrializing, many still manage to tie back to traditional beliefs religiously, culturally, and physically. One example is the farming background that so many families came from. Although a large number of people moved to the cities for employment opportunities, families often had small gardens where they grew vegetables for the household. Another example of this is marriage. Traditionally, marriages were arranged by the parents. Today, many practice a revised form where parents will gather a list of potential partners and the children will have the final say. Although divorce was not tolerated in the past, it is now quite common. Typical families today are nuclear with two children. Education is an important part of childhood. "Koreans have a great reverence for education and 90 percent of South Koreans are literate. Education is free and required between the ages of six and twelve. The great majority of students go on to six more years of middle school and high school. Discipline is strict and children attend school five-and-a-half days per week" (everyculture.com). South Korea also provides universal healthcare in which nearly everyone is covered. There are four branches of the healthcare structure that can be applied for to ensure that access to healthcare is provided.

Korean farmers are unable to keep up with the country's demand since shrinking from predominantly agriculturally based to an urban, industrially focused population. "South Korea relies on imported food to satisfy 70% of their food needs" (Agri-Food Canada). Due to the high demand for imported food, many products come from other countries such as corn, meat, hides, soybeans, milling wheat, and cotton to name some of the major import items. A typical Korean diet includes rice, a staple of most Asian cuisine, vegetables, fish, soy, and fermented vegetables called kimchi. Although Korean barbecue is one of the more popular Korean foods in other countries, it is eaten sparingly in Korea itself. Koreans tend to cook with very little oil, but fast food restaurants still boast greasy, fatty foods nearly everywhere in cities.

South Korea's industrialization caused some of the problem, but it may also be part of the answer. Due to being a mountainous region, the development of large cities took away valuable farmland, decreasing farmers' abilities to produce enough food. As South Korea continues to develop, the already wavering food production could plunge dangerously low. Thankfully, it may not be a problem for long. Recently, the South Korean government has begun exploring options to increase access to locally grown food by bringing the farm to the city. They are attempting this through vertical farming. Vertical farms allow people to grow food inside buildings, not just small herb gardens, but whole crops that can sustain the local population.

With a growing population worldwide, it isn't just South Korea exploring the idea of vertical farms. "Since 1950, the Earth's population has nearly tripled, from 2.4 billion to 7 billion, and the global demand for food has grown accordingly" (Spiegel). "Dickson Despommier, the scientist credited with inventing the idea of vertical farming" (VOANews) believes that one day skyscrapers may not only house people, but also crops to provide food for those people. Because food security is a worldwide issue, many countries and companies fully support the development and testing of vertical farms as a viable source of future food production and self-sufficiency. South Korea's industrial prowess and questionable food security makes it a prime candidate to explore the possibilities of vertical farming and the potential it holds in feeding the world. There are a number of countries experimenting with different methods of food production using vertical farms such as Singapore, Japan, South Korea, Sweden, and even the United States. These countries use different methods to produce their food, trying to increase the crop production as well as making the process economical and environmentally friendly. Paul Marks, a writer for What It Costs, writes about some of these successful farms. Located so near the equator, a vertical farm in Singapore is producing cabbage and lettuce with all natural lighting. The farm uses giant conveyor belts to give each plant the best sun exposure. Alternately, a farm in Japan grows all of its produce using LED's. This allows the farm to grow a wider variety of produce that have different lighting needs.

Vertical farms have several benefits to offer South Korea as well as the rest of the world. Vertical farms provide an area to grow food even if the soil is not ideal for food production. There is no need to put the plants in the ground, let alone the soil. Crops can be grown using hydroponics, aeroponics, or even aquaponics. Hydroponics uses mineral water to supply the necessary nutrients to the individual plants. Hydroponics also uses 90% less water than traditional farming techniques. Aeroponics uses a mist of mineral rich water rather than just sitting in water, to saturate the roots of plants and can use 40% less water than hydroponics. Aquaponics is the process of raising fish and using the waste as food for the plants. The fish can also be sold on the market when matured. Many vertical farms also use large scale dehumidifiers to recapture evaporated water and recycle it back into the system for reuse, furthering the water sufficiency. This is great for areas with droughts or low rainfall because it uses much less water than traditional farming techniques. Because there are so many options, vertical farms can utilize the watering technologies best suited to that farm and the population it provides for. If the farm is located in a rural, less accessible area, aquaponics can be used to provide a supply of fresh fish where there normally wouldn't be. More urban farms can employ aeroponic techniques to save money and water, thereby creating more affordable produce.

Many vertical farms use natural light to grow produce, using slow moving conveyor belts to rotate the plants, ensuring even sunlight. Some vertical farms, however, use specialized lights customized to the plant being grown to give the plant optimum photosynthesis. This allows workers to give the plants more day and night cycles, further increasing the rate of production compared to normal farming techniques. This manufactured lighting, however, creates a very high operating cost. This cost is also increased by climate control in the building. Such costs decrease the appeal of vertical farms in some areas. There are some vertical farms that have come up with solutions. Thermal heating and cooling can provide climate

control, while solar panels can provide energy for lighting. Another option would utilize organic waste to generate electricity. Organic waste comprised of uneaten food, yard waste, and sewage would be decomposed and turned into methane gas, which is then burnt to provide clean energy. “Vertical farms would be designed to purify sewage into fresh water and to generate electricity using decomposed byproducts. Maximizing resources in this fashion would allow the farms to be self-sufficient and reduce their total carbon output” (what it costs). By implementing creative and innovative ideas, vertical farms would not only be finding better ways of providing energy and heat, they would be blazing a trail for green energy on a large scale.

A major downside to vertical farms today is the cost to build and maintain the facility. The estimated cost to build a vertical farm from the ground up including irrigation systems, plant bed structures, lighting systems, and other necessary equipment for a skyscraper-sized farm, capable of feeding more than 50,000 people, is estimated around \$83.7 million. Many vertical farms, however, repurpose old buildings into the highly productive vertical farms we see today, saving much of the estimated cost. Even if a building were built for the estimated amount, the food produced from the farm in the first seven years would cover the initial investment. The government could also play an integral role in defraying some of the cost. They could bring the importance of building vertical farms to the forefront of discussions by openly advertising the benefits it would provide the people. They can increase public support by planning public education days, hosting fundraisers, and showing people how the process would work. By making vertical farming a public endeavor, the government can more easily provide grants and funding for the construction of vertical farms and the clean power sources they would require. These power sources would not only benefit the farms, but also the surrounding community. If sewage and organic waste systems were to be integrated into a vertical farm, the organic waste system could not only provide energy for the farm, but the surplus energy could also be sold back to the city for commercial use. Sewage would be filtered into clean water, which then could also be sold back to the city for public use. Then the farm would not only be self-sufficient, but would also bring in revenue to earn a profit which could be used for agriculturally centered public education. In the future, vertical farms may also provide community gardens for city residents to grow their own food, further expanding the community education aspect of vertical farming.

South Korea currently has a small three story vertical farm in Suwon, which is just outside of Seoul, South Korea’s capital and largest city. It is producing lettuce with LED lighting and hydroponic water systems. This small scientific experiment was launched to test the success of vertical farms in South Korea and whether or not it would be a viable option for food production like it was in other countries. When people enter the building, they must first go through an “air shower” to keep outside bacteria from influencing the experiment. Food is grown on the second and third floors while the first floor serves as a kind of classroom to teach people about agriculture and vertical farms. The experiment has been successful so far and is a promising taste of the potential that vertical farms hold not only for South Korea, but the rest of the world as well.

Vertical farms are very promising for the future of agriculture because they can be customized to the area it is in and the food being grown. Countries no longer have to worry about natural disasters such as drought or disease. Produce can be grown safely and successfully without use of pesticides. The reduced distance from markets decreases emissions from trucks transporting the food and also reduces the risk of spoilage on the way to stores. The reduced transportation cost and higher yield rates would also greatly lower the cost of the produce, making it a more appealing option to the public as well. This makes growing food more economical, greener, and also safer for the consumer. There is no runoff from fields polluting streams and rivers, and there is no need for large farm equipment that uses gas or diesel. The best option for agricultural success is also the best for the environment.

Vertical farms are the best option for South Korea's food security because it maximizes the use of space and productivity to provide healthy, local food to communities. It also holds the potential to give energy and water back to the community while reducing the waste that is dumped into landfills and pollutes the land around it. The small amount of arable land will not be a barrier to food availability anymore, soon whole crops could be grown in the middle of town and sold in markets nearby. Water conservation would take on a new meaning as the previous 70% of freshwater that originally went towards agriculture decreases exponentially thanks to the efficiency of vertical farming techniques. The opportunities that vertical farms offer communities holds the potential to improve the entire country, eventually saving money and even giving money back. There would be less need to import food from other countries and may even allow the extra produce grown to be sold back to the countries originally bought from. It would also decrease the cost of conservation efforts because less waste would be produced and thrown away, damaging the environment. In the end, vertical farms are a perfect solution because they can adapt to the needs of the community, even in the ever changing concrete jungles of South Korea.

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