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Bangladesh; How Implementing Vertical Farming can Solve Many Problems

In the United States we take food for granted. We have grocery stores full of every food imaginable. What we think of common food is oftentimes delicacies in other countries. We eat food without being grateful for our favorable situation. In some countries, people go days without eating, and when they eat the food is bland and non-nutritional. In the country of Bangladesh, people face problems with food insecurity stemming from multiple causes. While there has been some improvement over recent years, without something substantial being done, Bangladesh will continue to face problems with hunger and food insecurity.

Bangladesh is a small country in southeast Asia that gained independence from Pakistan in 1971. With a land area of about 148,600 square kilometers, or roughly 57,370 square miles, it is slightly smaller than the state of Iowa (Husain and Tinker). The country mainly borders India, however the south eastern tip borders Myanmar/Burma and the southern border is along the Indian Ocean. Bangladesh's land is dominated by alluvial plains (low lying flat ground made by river sediment) and hills in the southeast (CIA). The river sediment makes for fertile soil, which helps fuel agricultural sectors in the region.

Bangladesh is home to over 171 million people, making it the eighth most populous country in the world (WHO). The population in Bangladesh has been steadily increasing and has increased by over 35 million people since 2000. Projections estimate that by the year 2050 the population will be over 215 million people (WHO). The country is not very diverse as over ninety-eight percent of the population is Bengali, and ninety-one percent is Muslim (CIA).

Bangladesh is run through a parliamentary republic system of government (CIA). The parliament consists of 350 members, most of whom are elected in. The other seats are "reserved for women... elected by the parliament itself" (Husain and Tinker). Once elected, members serve in terms of five years. The parliament also elects the president who serves in five year terms as well. Bangladesh also has local governmental systems, split into eight divisions, divided into over 60 districts and 500 small sections called "*upzila* and *thana*" (Husain and Tinker). The *upzila* and *thana* are split into numerous villages, the smallest form of government in the country.

Since the country gained independence in 1971, Bangladesh has had steady economic growth (World Bank). In 2023 the country had a GDP of just over 437 billion dollars, and a GDP per capita of about \$8,200 (CIA). Much of Bangladesh's economy relies on agriculture as its backbone. Due to fertile soil from the rivers, agriculture has been successful, although for a while relied on the monsoon season to adequately wet the soil. Dams and irrigation systems have been built as a response, and the people of Bangladesh are able to thrive on growing rice, jute, and tea (Husain and Tinker).

While things may seem promising in Bangladesh after gaining independence, growing its economy, and housing many people, the full story is a little more upsetting, and the future not as bright. The World Food Programme reports that over 23.6 million people face food insecurity in the country. That's close to one in every seven people in Bangladesh, which is comparable to the United States when it comes to food insecurity. In addition, about "[t]wo in every three children under five in Bangladesh are living in child food poverty" or about 10 million children total ("2 in 3 Children under Five in Bangladesh Face Child

Food Poverty - UNICEF”). This problem is alarming, especially for a new country with a growing population.

What may be even more concerning for Bangladesh isn't just the fact that so many people and children are facing food insecurity, but the country's unsustainable practices in agriculture and food production. Bangladesh has developed a problem that many agriculturalists talk about, and that is the lack of soil conservation, the deprivation of nutrients in the soil, and significant loss of arable land. Along with poor soil management, the country struggles with food waste, something much of the world today fights with.

Just like humans, plants need sufficient nutrients to thrive, which reside in the soil. Without the proper nutrients in the land, they do not grow or produce. According to a study conducted by the Soil Resource Development Institute, “moderate to very severe classes of land degradation took place in around 10.7 million of hectare areas”, which is about 72.5% of Bangladesh (Zahid et al. 54). Studies have found that the soil degradation is a result of a few things such as erosion, waterlogging, salinity intrusion, and misuse of fertilizers (Khan and Shoumik). This is a very alarming statistic for a country who has deep roots in agriculture, and one with a rapidly growing population.

Soil quality degradation is not the only problem with dirt in Bangladesh, they are also losing significant amounts of arable land, or land suitable for cultivation. Over the course of over fifty years since Bangladesh's independence in 1971, the country has lost over 763,000 hectares, or 1,885,400 acres of arable land (World Bank Group). In 1989 the country peaked with having 9,533,000 hectares of arable land, and as of 2021 the country has 8,110,000 hectares, about a fifteen percent decrease. This decrease is alarming. Loss of arable land can be attributed to a few factors including river bed erosion, urbanization, industrialization, and other causes (Akter). With a continuously growing population, the country cannot expect this trend to change on its own, leading to a need for new innovative measures to be taken to prevent more loss, or as a response to the loss.

Unfortunately, Bangladesh faces more problems than just the soil. There is another issue concerning food security, and that is food waste. It's a problem that much of the world struggles with, although not much is done about it. Every year “nearly a fifth of all food produced each year is squandered” (World Food Programme, “5 Facts about Food Waste and Hunger | World Food Programme”). This is food that can be used to feed people in Bangladesh and worldwide. In Bangladesh alone, each person wastes more than 82 kg of food each year, or about 14.1 million tonnes of food total from households in the country (United Nations Environment Programme). Even more food is lost in transportation from the source to the consumer. This is a staggering amount of food that would be enough to solve much of the food insecurity in Bangladesh.

Things might seem irreversible and hopeless in Bangladesh. However we as humans have proven throughout history that we find innovative solutions to insurmountable problems. Through innovative strategies, we can find a way to solve and cope with soil degradation, arable land loss and food waste in Bangladesh.

Innovation is nothing new for the agriculture industry. Since the industrial revolution, we have seen immeasurable amounts of advancements in farming and food production. Technology in the industry is more efficient and precise than ever before. One of the newest and most intriguing innovations is vertical farming, and it might hold a solution to Bangladesh's food insecurity stemming from loss of arable land and food waste.

Vertical farming is exactly what it sounds like, growing crops and vegetables on a vertical axis. This typically takes shape in two forms; on shelves stacked on top of each other, or in vertical growing towers. Either way, they are both commonly done with a hydroponic or aeroponic system where the plants are

without soil. No matter which system is used though, it is done in a highly controlled environment where temperature, humidity, and light is controlled artificially.

Vertical farming has a lot to offer for Bangladesh, and could help in solving some of its major problems with food production and insecurity. Starting with overall food production, vertical farming offers exceptionally good results. According to Dr. James Altland, a research horticulturist with the Application Technology Research Unit in Ohio, “for some crops, 10 to 20 times the yield can be obtained per acre in vertical farming compared to open-field crops” (Jiang). Better yields are just the tip of the iceberg if vertical farming is effectively utilized in Bangladesh.

As mentioned above, one of the most concerning problems Bangladesh faces is soil degradation and the loss of arable land. This loss provides less land to be utilized for growing crops. One thing that should be implemented to prevent the quality of the soil from degrading is better use of chemical fertilizers. However this alone will not prevent all the loss of arable land. One factor leading to less arable land is urbanization, and with a growing population we cannot expect this trend to end. However, we can find a way to deal with it and overcome the loss and emerge stronger than before. Once again, vertical farming can help with this. As previously mentioned, vertical farming methods do not use soil at all. Rather, it relies on “methods of soilless agriculture” to grow food (Jiang). This makes up for the loss of arable land. In addition, vertical farming uses up to “99% less land” and has the ability to be put up anywhere due to it being in a completely controlled environment (Eden Green Technology). This leads us to the next major benefit of implementing vertical farming in Bangladesh, and that’s the ability to grow produce inside of urban areas.

Before we get into the details of the next potential benefit, I want you to think about where your produce comes from. Chances are if you are purchasing produce from a grocery store, the vegetables you are buying are a long way from where they were grown. This is especially true in Bangladesh where they import the third largest amount of food out of every country in the world (“Bangladesh Third Largest Food Importer in World: FAO”). Importing so much food is problematic, as it gives food more time to spoil, increasing food waste. If we were to greatly shorten the amount of time that food spends in between being harvested and being bought by the consumer, we can reduce the amount of food waste. Vertical farming has the potential to significantly reduce that in between time. Since vertical farming takes up much less space, and it occurs indoors in a controlled environment, it can be implemented into urban areas, where they will “minimize transportation distances, reducing the likelihood of spoilage and waste” (Tabibi). This is especially relevant for Bangladesh due to their increased urbanization. By implementing vertical farming into urban areas, we can reduce the amount of food waste that occurs from the time the produce is harvested to the time it reaches the consumer.

While vertical farming may seem like the solution to Bangladesh’s problems, it is not without its drawbacks. The biggest red flag comes from its lack of profitability. Due to the process being in a controlled environment, oftentimes with artificial lighting, input prices are very high (Tabibi). As a result, the question arises of who would fund vertical farms in Bangladesh?

The first and easiest solution to this problem would be from private investors who see the real potential in vertical farming. While from the outside vertical farms could seem like a failing business idea, it is crucial to realize that this technology is relatively new. With more advancements sure to come, vertical farming becomes more affordable and profitable for businesses. Another solution that applies to Bangladesh especially is government funding. As a country growing in both population and economic strength, the government of Bangladesh has made initiatives to grow their economy and better its people, such as Vision 2041 and Delta Plan 2100.

Vision 2041 is an initiative that started in 2021 with goals of improving the Bangladesh economy, raising overall GDP, and improving the lives of its population. In a report made and published by the General Economics Division from the Government of the People's Republic of Bangladesh about "Making Vision 2041 a Reality", it contains a section that discusses "SUSTAINABLE AGRICULTURE FOR FOOD SECURITY" (General Economics Division (GED) and Government of the People's Republic of Bangladesh 65). In this section they talk about how Bangladesh aims to increase its food security and sustain it into the future. It addresses many of the problems that vertical farming could solve, including the "Depleting Land Available for Agriculture" (General Economics Division (GED) and Government of the People's Republic of Bangladesh 72). The report also emphasizes the importance of the "adoption of new technologies" for the country's food stability (General Economics Division (GED) and Government of the People's Republic of Bangladesh 80). This report and the Vision 2041 initiative tells us that the government of Bangladesh wants to improve the lives of many, and wants something like vertical farming. Through funding from the government, vertical farming can be implemented into the country, improving the lives of its citizens, and eventually becoming a profitable piece of its economy.

Ultimately, Bangladesh is a country that- like many others- faces problems leading to food insecurity. Amongst these issues are degrading of soil quality, loss of arable land, and food waste. However, with an innovative solution such as implementing vertical farming, Bangladesh can reduce the effects of these problems. By turning towards vertical farming, the country can combat the issues at hand and adapt with a more sustainable food system. With proper implementation, Bangladesh can not only reap the benefits, but become a leader in agricultural innovation for our world.

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