1. Elevator Pitch: Pitch your innovation, sharing the essence of your innovation, impact, customers, and business potential.

Food waste is causing significant environmental issues. According to the United Nations' Food and Agriculture Organization, we throw away 1.4 billion tons of food every year. Wasted food is then incinerated or disposed of in landfill with only 30% being recycled (EPA). We aim to resolve the problems. Food waste, through the usage of an anaerobic digester, can be recycled into fertilizers and biogas. We seek to establish a national system with governmental support to collect food waste from various groups and individuals, going from public establishments to individual households. This innovation differs from the existing solutions or company because it plans to include food waste from multiple stages of food production, going from farmland to consumer. In addition, by building the system and ecosystem of treatment, the food waste, the problem doesn't have to rely on the action of individual consumers and retailers.

2. Team: How did your team form? What role will each team member play? What motivates you to make your innovation? What special capabilities, resources, or experiences do your team members bring? Our company name is Food Waste Recycling which stands for food waste-based products.

Although food waste is increasing in volume and disposal costs, in most countries less than 20% is recycled. Surprisingly, unlike other countries, Korea raised its food waste recycling rate from 50% in 2001 to 95% today. Therefore, using Korea as a model, we will provide a platform for recycling food waste. The names of all members of Food Waste Recycling are as follows, Kang Min Baek, Aliyn Jeon, Seunghyun Cho, and Minkyung Kim.

All members would like to gather to contribute to resolving the food waste issue. All members equally contributed to the Food Waste Recycling project in terms of technical concept parts. Since all students in our team are from Korea, we are confident that we will be able to transplant and develop the food waste recycling system for other countries more clearly and in detail.

3. Opportunity: What issue or pain point does your innovation address?

In the age of abundance, food waste is an arising problem. Despite living in a world where 1 in 7 suffer from hunger, we waste 1.4 billion tons of food every year globally. Wasted food is then incinerated or disposed of in landfill rather than recycled. Only 20% of food waste is recycled. As they rot in a landfill, they produce methane, a greenhouse gas that is 25 times more harmful than carbon dioxide. Food waste around the globe produces the same amount of greenhouse gases as one-fourth of cars around the globe. It also requires resources - such as land, capital, or water - the put into not only produce the food have been wasted, but also the treatment of food waste. in the case of water,

agriculture accounts for 70% of water usage: hence when wasting food, water is also getting wasted. 45 trillion gallons of water is wasted every year as we waste 1.4 billion tons of food.

Different measures have been taken to prevent food waste. Many initiatives try to connect consumers with food that soon will be thrown away. For example, apps such as ‘Too Good To Go’ connect consumers with restaurants that are about to expire food. There are several technologies tackling food waste as well. A company named ‘Apeel’ makes an invisible coating on food from agricultural waste to extend shelf life. However, these measures only aim to prevent food waste, and even then, they only focus on specific sources of food waste. It seems that food waste is inevitable as the choices for food increase. Not to mention that food production and retail only account for 25% and 23% of food waste. With our innovation, we aim to tackle inevitable food waste that has been made from all possible sources - from production to households.

4. Innovation: Describe your innovation, its design, and your technology. How does it work? What is new or proprietary about the innovation? How does it meet needs and resolve pain points? What impact does your innovation create for individual users and humankind? Describe qualitatively and quantitatively. How can new or proprietary aspects be protected and made valuable by one or more methods such as a patent, trade secret, copyright, or otherwise competitively defensible configuration?

Our innovation is a food recycling system that plans to create a sustainable food cycle by using an anaerobic digester site and a smart farm. We plan to collect food waste from individuals and facilities nationwide. The collected food waste will then get transported to the anaerobic digester site. The collected food waste is released into a compost pile. This compost pile contains microorganisms their process of fermentation and microbial activity breaks down organic material. Since microbial activity requires water, 60% of the content in the compost pile will be filled with water as an optimal ratio. The chemical processes of micro-organisms release energy as heat. The heat during the process of composting increases the temperature up to 70˚ C. This temperature is responsible for killing unfavorable bacteria consisting of Salmonella, Norovirus, and Campbacter

Secondly, the compost turner and mixer are used to rotate the pile which boosts composting progress and spread microorganisms proportionally. When the color of food waste becomes black and the odor fades, a solid-liquid separator machine is used to gather composted food waste. This food waste is physically broken down through a vertical crusher machine and converted into a form of powder. The vibrating screen machine is used to separate and filter unusable particles for organic fertilizer. At last, a dilute alkali solution such as sodium hydroxide, which is capable of dissolving humus, is mixed with the powder to change into liquid form. The final product form is Humus + NaOH → fertilizer. The qualified products are packaged and sent to the customers.

Also, the fermentation of food produces by-product gasses such as methane. These gasses could be

used as an energy source to fuel electric trucks for transportation. As well as saving money from using gasoline, the company would minimize carbon dioxide to be added into the atmosphere which is beneficial when using carbon credit. A carbon credit is paid for a permit to emit greenhouse gasses that saves money from buying extra credits and gaining profit by selling permits to other private companies.

Compared to original products or ideas, we plan to tackle the whole food cycle. Food waste from all steps of food production will be included when we collect our waste, which will then be reborn into new food through the usage of digesters and smart farms.

Each component of our innovation works to resolve pain points. Starting from an anaerobic digester, it helps to recycle food waste, which would have been dumped into a landfill, and reduce the emission of greenhouse gas methane. Our innovation solves environmental problems and at the same time gives great economic benefits. If profits are made from processing methods that previously only incurred costs, it will greatly contribute to the national economy. Smart farms specifically help in this urbanized society. A traditional farm requires a large amount of land and can be inefficient, while a smart farm uses less land and allocates resources more efficiently through the usage of data and technology. Therefore, through smart farms in cities, it will be possible to reduce excessive transportation-related costs and environmental pollution and to supply higher-quality crops.

Our innovation offers a new paradigm of the food waste cycle by expanding and connecting existing technologies. While anaerobic digester exists on small scales, it has never been done on a nationwide scale. By connecting the anaerobic digester and its product - fertilizer and biogas - with smart farms and waste collecting, we plan to address most concerns in the food cycle.

In some cases, each unit itself has already been commercialized. However, no case in the world combines all of these into one supply chain like our innovation. Certainly, it is necessary to protect our technology with patents, etc., but, like successful companies such as Amazon, it is necessary to build barriers to entry and create a convenient system that consumers have no choice but to use. And showing consumers the expandability of our innovation and products will make our business competitive and sustainable in the long run. To this end, we plan to build an ecosystem that covers not only the food waste supply chain but also crops produced in smart farms and foodstuffs processed in factories.

5. Validation and Progress: How have you validated your innovation, technology, or processes? What progress have you made in developing your innovation?

Starting from an anaerobic digester, we embarked on our mission to create a completely environmentally friendly cycle of food waste. To do so, we investigated how each part of innovation could be reused or structured. From an anaerobic digester, we realized that one of its byproducts, biogas, can be used to fuel our transportation method. Next, we expanded on its other product, fertilizer. We realized that fertilizer can be both sold and used by ourselves. In terms of using it ourselves, due to limited space in urban places and the need for increased efficiency, we decided on connecting smart farms. Throughout the process, our main concern has been regarding the plausibility of our innovation. We had to make sure if our innovation could be possible in real life due to its big scale, which is where we dived into case studies. We investigated various food waste disposal systems in different countries, anaerobic digesters, and smart farms. We realized that the food waste disposal system doesn't exist in many countries and they do not segregate their food waste at disposal unlike how we expected it to be. However, we found an even better solution to this problem; including different sources of food waste as well as large institutions. Half of the food waste occurs even before reaching someone's household, from production to retail. With this information, we thought our innovation can still be done by focusing on other sources of food waste first, which also will reduce the money needed for transportation as we are getting larger amounts of food waste in one place. Large institutions such as schools and food factories have come to mind for the same reason. Especially with places such as schools and companies practicing food segregation at their disposal, the transition from dumping all the waste at the same time to waste segregation will be easier. Until then, we decided to focus on large institutions and different sites of food waste. Another problem we ran into was funding. As our understanding of cost increased, we soon realized that we can't afford our innovation, especially the digester site, just by existing funding and revenue from our products. We discovered funding for the food waste disposal system was quite lacking for many countries including the US where $800,000 was divided among 11 recipients in 2022. We also discovered that our innovation was unfit for this funding as our company is not a nonprofit company. So, we realized that we would have to make a direct partnership with the government through MoU similar to how South Korea is doing. Then we are trying to see if our company can get a partnership and promote it.

6. Market: Describe your customer and your target segments. What is important to them? What is the size of the opportunity? Is the buyer or payer different from the customer in this market? Describe the industry ecosystem.

For our innovation, we have multiple types of customers. The most obvious customer who pays for our innovation would be the government. Our innovation must be funded by the government. How much funding we can receive will be largely dependent on which country we are going for. For example, in the US, the Environmental Protection Agency highly supports individual digesters through funding. However, even in the US, the need for a nationwide food waste disposal system has not been emphasized enough. To enter the market and get large funding from the government, we would

have to prove the need for our innovation by showing the environmental cost it can save. Our innovation should be cost-effective compared to potential competitors in both the long run and short run to secure our partnership in the long run. Other indirect customers would be citizens or taxpayers. With their disapproval, our innovation would be hard to implement. To continue the partnership, the satisfaction of citizens should be reached. To do so, our innovation should be convenient. In most countries, food waste is thrown away along with other general waste. The change to start separating food waste should be easy and convenient for people to follow. The last customers will be people who buy our end product. Along the process, we will have more fertilizers than our smart farm requires as well as produce from the smart farm. We can sell this product to public entities and individuals at a cheaper price. Also, as part of the partnership, we could give our products to the government. For example, Danny Kluthe farm is providing electricity to Nebraska Power District in return for funding they are receiving.

7. Competition: What competes with your innovation, and how does your innovation compare? What are the advantages and disadvantages of your innovation? What is your positioning?

Our innovation will face competition with various individual anaerobic digester sites as well as the current food waste disposal system. There are plenty of small individual anaerobic digester sites that recycle food waste. For example, Danny Kluthe farm has made a partnership with Nebraska's power district where they would sell recovered electricity from their manure. These digesters, however, are usually for their farms or facilities. It differs from our innovation as our innovation serves to create a full loop of food waste to food by recycling food waste from various places to fertilizer, and finally back to food. We would also have to compete with existing food waste disposal systems depending on the country. If the company has an existing food waste disposal system, we would have to compete with the company that manages the waste disposal system to get a partnership and grant from the government. For example, in South Korea, food waste is collected separately by a government-sponsored company to get reused for animal feeding. For those countries, we would have to compete with existing companies to get the government's grant. Even without a special system for food waste, like in many countries, it would require a considerable amount of effort as we would need people to start separating food waste from other waste. Overall, our innovation requires a large amount of work and heavily relies on support from the government to be successful.

8. Go-to-Market: How will you attract and sell to customers? Who are the best initial or pilot customers? Is the market best served through direct sales, distribution, licensing, strategic partnerships or other strategies?

Our customers will essentially be everyone that makes food waste and the government. One of our

necessary partners, or customers, will be the government. Our innovation would require a partnership with the government since our facilities will be costly. It is only through the government that our land site and anaerobic digesters can be bought and built. Apart from sponsorship from the government, we hope to include as many aspects as possible, going from individual households to large institutions. Our initial customers will be large institutions, especially public corporations. Because transportation of food waste will be costly, getting a large amount of food waste will save potential costs. It would also be easier to form partnerships as they are owned by the government. We then hope to expand our customers to private corporations, and finally individual households.

9. Business Model: What are your key revenues and costs? What are the pricing and costs to deliver one product or service unit?

Our revenue largely consists of food processing costs, fertilizer sales costs, carbon credits, and methane sales costs. And costs include facility investment costs and land purchase costs, which are initial costs, and transportation costs and fertilizer manufacturing costs, which are fixed costs. First, in the case of Korea, where food waste treatment is separated, the average collection fee is $70 per ton and the cost of fertilizer is estimated at around $500 per ton. When food waste is processed, only 20% of its weight becomes fertilizer. Methane is also produced at this time, which is 0.12 cubic meters per kilogram of food waste. Additionally, the carbon credit and heat energy generated at the same time are difficult to calculate, so they are excluded from this calculation.

In the case of cost, it is assumed that the initial investment cost, such as facility construction and land purchase cost, varies greatly by country and region, so it is approximately 5 to 30 million dollars. The cost of anaerobic bacteria is set at a fixed cost of 0.5 million dollars, including initial research and subsequent cultivation costs. In the case of transportation cost, the depreciation of the truck purchase cost was applied to estimate the transportation cost per 1 ton of food waste at around 10 dollars (based on a 20km movement). Lastly, labor costs are also reflected in the processing cost per ton at $60. (assuming 3-5 tons processing per person per day).

Based on this calculation, a profit of 100 dollars per ton of food waste is created, and additional carbon credits and biogas are produced. Therefore, it is estimated that at least 50,000 to 300,000 tons of food waste must be turned into fertilizer to recover the initial investment.

10. Fundraising: What funds do you need to get started, and how will you use these funds? How much will it cost to develop the product and roll it out? What different sources will you pursue funding, and why are these a fit?

Funding a company requires several methods and specific processes. Among the various funding

methods, since our business is related to the public interest, we are going to focus on receiving support from national institutions rather than VC or cloud funding methods. For example, the United States Environmental Protection Agency funds more than $4 billion to assist entities related to protecting the environment and health. Since this program supports public works related to the environment, our project can be selected. For funding requests, an initial proposal should be completed consisting of a project description and estimation of potential positive environmental results. For the basic setup cost for our project, an estimation of $900,000 is required. The financing plan covers equipment, transportation, and space costs for ongoing operations. In addition, funds would be gained by applying for official grants to other Government agencies and participating in competitions or programs sponsored by the national organization.