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The Kyoto Composting Project

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The Kyoto Composting Project

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The Kyoto Composting Project

An Interactive Qualifying Project

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Team Webpage
Abstract

Japan currently uses incineration to deal with the majority of its waste management practices, which has shown to be harmful to the environment. With the large amount of food waste produced and incinerated, the country must search for more sustainable organic waste management practices to better utilize these nutritional resources. In order to both reduce the environmental impact of food waste, and benefit the current state of agriculture in Japan, composting should be incorporated into Japan’s existing waste management systems. Midori Farm, a non-profit organic farm located in Shiga Prefecture, identified this environmental problem as an opportunity to spread sustainability throughout Kyoto. In this project, we worked to not only begin a sustainable composting system for Midori Farm but also to create a network of environmentally active individuals and organizations with the hope of eventually incorporating a composting system into Kyoto’s central waste management practices. We outline four specific approaches to composting and organic farming: building an on-site system, collaborating with Kyoto organizations to create composting systems in Kyoto, buying organic compost from Kyoto-based vendors, and finally advocating for a municipal composting system. Ultimately, the results of this project outline the logistics of creating an on-site composting system for small organic farmers, as well as defining the next steps for Midori Farm representatives to scale this system into the future.
“Anything else you’re interested in is not going to happen if you can’t breathe the air and drink the water. Don’t sit this one out. Do something.”

- Carl Sagan
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# Table of Contents

**Abstract**  
[3]

**Acknowledgements**  
[5]

**Table of Contents**  
[6]

**List of Figures**  
[8]

**List of Tables**  
[9]

**Executive Summary**  
[10]

1. **Introduction to Midori Farms and Composting Needs in Japan**  
   Midori Farm  
   [13]  
   Midori Farm Expectations and Requirements  
   [14]  
   Options for Future Development: Build, Collaborate, Consume, Advocate  
   [15]

2. **Assessment Method for Viable Composting Programs with Midori Farm**  
   Visit to Midori Farm  
   [16]  
   Networking  
   [17]  
   Statistical Analysis  
   [20]  
   Budget  
   [20]

3. **Build: Creating a Composting System at Midori Farm**  
   [21]

4. **Collaborate: Creating a Composting System with Other Organizations**  
   Composting in Collaboration in Kyoto  
   [30]  
   Process Map for Composting in Collaboration  
   [31]  
   Evaluation of Composting in Collaboration  
   [32]  
   Existing Composting Systems in Kyoto  
   [33]  
   Implementation Steps for Composting in Collaboration  
   [37]  
   Dissemination Recommendations for Composting in Collaboration  
   [38]

5. **Consume: Purchasing Compost**  
   Potential Compost Providers  
   [39]  
   Implementation Steps for Consuming Compost  
   [40]  
   [43]

6. **Advocate: Implementing a Composting System with Impact**  
   Importance of a Large Scale System  
   [44]  
   Model Composting Systems  
   [44]  
   Disconnect from Kyoto  
   [45]  
   Help from Other Organizations  
   [45]

7. **Conclusions and Recommendations For the Future**  
   Final Recommendation  
   [47]  
   Timeline  
   [49]
# The Kyoto Composting Project

## Future Projects

Appendix A: Volunteer Interviews

Appendix B: Contact List

Appendix C: Complete Statistical Analysis

Appendix D: Budget Analysis for Composting at Midori Farm

Appendix E: Option Evaluation for Composting at Midori Farm

Appendix F: A Beginner’s Guide to Composting

Appendix G: Waste Contributors

Appendix H: Collaborators

Appendix I: Compost Contributors

Appendix J: Map of Midori Farm in Japan

Appendix K: Map of Midori Farm

Glossary

  - Project Terminology

Bibliography
The Kyoto Composting Project

List of Figures

Figure i: Picture of Midori Farm 10
Figure ii: Pecha Kucha Night presenters 12
Figure 1.1: Compost produced at Midori Farm 13
Figure 1.2: Map of Midori Farm 14
Figure 2.1: A Japanese macaque 17
Figure 2.2: Pecha Kucha presentation 18
Figure 2.3: Food Hub & Labo’s Jujo Farmers’ Market 18
Figure 2.4: Escola community 19
Figure 2.5: Kyoto University vermicomposting system 19
Figure 3.1: Fields A & B to be used for composting 21
Figure 3.2: Composting at Midori Farm process map 23
Figure 4.1: Possible collaborator logos 30
Figure 4.2: Composting process with a collaborator 31
Figure 6.1: A composting bin in Kyoto 44
List of Tables

Table i: Composting technique costs .................................................. 11
Table ii: Midori Farm requirements .................................................. 11
Table iii: Existing program compost costs ......................................... 12
Table 3.1: Further analysis of the Midori Farm requirements .............. 22
Table 3.2: Area of the fields at Midori Farm ....................................... 22
Table 3.3: Total costs for composting at Midori Farm ....................... 24
Table 3.4: Best options for composting at Midori Farm .................... 26
Table 4.1: Grant awards .................................................................. 33
Table 4.2: Kyoto University composting system overview .............. 34
Table 4.3: Escola community overview ............................................ 35
Table 4.4: Nichei Shiga composting system overview ..................... 36
Table 5.1: Project existing system costs ........................................... 39
Table 5.2: Kyoto City Zoo composting system overview ................. 41
Table 5.3: Food Hub and Labo composting system overview .......... 42
Executive Summary

Composting presents itself as a sustainable method of organic waste disposal. Currently used waste disposal methods, such as incineration and landfill storage, are unsustainable due to their significant energy usage and excessive emission of air pollutants. Japan resorts to these environmentally harmful waste management methods for disposing of all combustible waste. Composting has been identified as a way to both offset the negative effects of unsustainable waste management practices and simultaneously create an environmentally useful product.

Midori Farm is a non-profit organization based in Kutsuki, Shiga, with the mission to “bring back the traditional food system to restore the health and environment of Japan” (“Midori Farm”, n.d.). Midori Farm strives to combine modern agricultural methods along with traditional Japanese techniques to grow their crops. To fulfill their goal of restoring the health and environment of Japan, Midori Farm created this project with the aim of creating a sustainable composting system that would supply compost to the farm and save organic waste from incineration.

Structure of the Paper

Our team developed four options which obtain or produce compost. These options have been titled as Advocate, Build, Consume, and Collaborate, and are defined as follows:

- **Build**: Build aims to explain the creation of a composting system located on, and built by, Midori Farm.
- **Collaborate**: Collaborate discusses the creation of a composting system with a partnering individual or organization in or around Kyoto City.
- **Consume**: Consume analyzes the option of obtaining compost from an existing compost system or compost vendor, either for free or at a cost.
- **Advocate**: Advocate takes a less direct approach to the creation of a composting system, and is aimed at rallying the numerous environmental organizations in Kyoto to create a composting system or start composting.

Build

Build involves creating a composting system at Midori Farm. This option is the primary recommendation due to its feasibility and ability to be implemented in the near future. Midori Farm already has a small amount of experience with composting on site, and available land for composting which makes this option stand out. Shown below in Figure i is one of the fields on Midori Farm, where compost has been created and used on site.

Building a composting system on Midori Farm allows for the idea of on-site composting at organic farms to be disseminated in the future. After Midori Farm has implemented a composting system, it would be possible to use Midori Farm’s system as an example for other farms. Especially if Midori Farm undertakes an active role in connecting organic farms and waste contributors located in the city. This growing system could greatly further the wellbeing of organic farming in Japan.
After our sponsor, Chuck Kayser, informed our team that he would ideally receive 10 tons of compost per year from the system, our team performed a budget analysis to identify the costs of various types of composting systems. The results of the budget calculations are shown in Table i below.

### Table i: Composting technique costs

<table>
<thead>
<tr>
<th>Composting Technique</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>¥491,735 first year ¥406,300 following years</td>
</tr>
<tr>
<td>Vermicomposting</td>
<td>¥537,670 first year ¥406,300 following years</td>
</tr>
<tr>
<td>Aerated Static Pile Composting</td>
<td>¥528,190 first year ¥406,300 following years</td>
</tr>
</tbody>
</table>

In addition to the budget analysis, our team performed a statistical analysis in order to calculate the mass of both green and brown waste that would need to be supplied each year, as well as the number of households, supermarkets, and restaurants that would be necessary to supply the amount of green waste. These calculations are shown in Table ii.

### Table ii: Midori Farm requirements

| Mass of Browns Required | 18750 kg |
| Mass of Greens Required | 6250 kg  |
| Households Required     | 39.2 Households |
| Supermarkets Required   | 0.449 Supermarkets |
| Restaurants Required    | 2.854 Restaurants |

After reviewing all of the options that came about from the analysis, our team recommended a number of elements for a composting system.

#### Collaborate

Collaborate involves creating a composting system in the Kyoto area with other organizations such as Escola or Kyoto University. Kyoto has a number of environmentally-minded individuals and organizations interested in working together on sustainability initiatives. By working with these organizations and individuals, a composting facility can be created in Kyoto. Having the composting system located in the city and working with other organizations and individuals allows for a more impactful composting system by using the assistance from other organizations for labor, land, and implementation costs.

Our team investigated a number of organizations to collaborate with, most notably Kyoto University and Escola. Our team identified Kyoto University due to the fact that this organization already produces its own compost, and the number of students working with environmental organizations on campus. Escola is a sustainability group aimed at being completely self-sufficient. By partnering with this organization, Midori Farm might gain access to land as well as volunteers to manage a composting system.

#### Consume

Purchasing or receiving free compost is an option to bring compost to Midori Farm with limited work. By purchasing compost from companies with existing composting facilities, the implementation and maintenance costs are replaced with the cost for the finished product, compost, and eliminates the labor necessary to receive it.

For the consume option, our team identified two main organizations that could provide compost: Kyoto City Zoo and Food Hub & Labo. Kyoto City Zoo is able to provide compost for free to those who apply, however, Midori Farm will not be able to receive enough compost through
The Kyoto Composting Project

this program. Food Hub & Labo would be able to provide enough compost, however 10 tons of compost would cost approximately ¥85,000. This is illustrated in Table iii below.

Table iii: Existing program compost costs

<table>
<thead>
<tr>
<th></th>
<th>Kyoto City Zoo</th>
<th>Food Hub &amp; Labo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Free</td>
<td>¥4,000 / m$^3$</td>
</tr>
<tr>
<td>Distance</td>
<td>42.4 km</td>
<td>47.9 km</td>
</tr>
<tr>
<td>Delivery?</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Advocate

Advocate focuses on raising awareness for the current environmental issues associated with poor waste management and food waste, and uses these issues as a platform to bring the idea of a city-wide composting system to Kyoto City. Through working with other organizations in Kyoto, such as environmental organizations and local universities, having a composting system integrated as a means of organic waste management is feasible. Midori Farm and advocating organizations would have to lobby to large organizations such as the Kyoto City Government. Our team recommends that Midori Farm uses examples of other successful composting systems found in other prefectures, such as the Nichiei Shiga composting system, to showcase the trailing state of sustainable organic waste management in Kyoto. Additionally, a Midori Farm representative should also advocate to the public through presentations and sustainability events (Figure ii).

Figure ii: Pecha Kucha Night presenters

Implementation Steps

For the implementation of a composting system in the Kyoto area, we recommend taking the following steps:

1. Contacting organizations to determine their interest in collaborating toward a composting system
2. Determine sources of green and brown waste
3. Find a method of collecting and transporting the waste to Midori Farm
4. Educate the volunteers

Through these steps, Midori Farm will be able to create a composting system that effectively reduces the waste of Kyoto City. While the processing of waste might be removed from the city, scaling the system with the help of other organizations can create a sustainable composting system for Kyoto.
1. Introduction to Midori Farms and Composting Needs in Japan

Composting presents a method of organic waste disposal with a future. Currently used options for waste management such as incineration and landfill are unsustainable due to their significant energy usage and excessive emissions of air pollutants. Japan resorts to these environmentally harmful waste management methods for disposing of all combustible waste. Japan currently has 1915 incinerators, which process roughly 68 percent of waste post recycling (Hershkowitz & Salerni, n.d.). In 1971, Japan incinerated 74.3% of its waste, highlighting the reluctance to advance from these antiquated and harmful methods of waste disposal (Sakai, 1996, p. 400).

The issues that this project aims to solve are listed below:

- Complete the nutritional cycle between agriculture and food waste
- Present a more sustainable method of organic waste processing
- Provide an organic means of fertilization to organic farms

Japan currently includes organic waste in their combustible waste, along with most plastics and papers. According to Kyoto Prefecture International Affairs Division of the Prefectural Office, about 6.21 million tons of food are wasted every year in Japan, amounting to about 14% of the overall municipal waste ("Kyoto Prefecture", 2018). Considering 61% of Japan’s food is imported, any amount of food wasted is a significant loss to its already limited food resources (Akitsu, 2018). The incineration of food waste causes a significant amount of GHG and dangerous dioxin emissions that represent grave health hazards (Matsuda, 2012, p. 743). On top of this, incineration wastes the nutritional value of the food. Whereas composting allows the food waste to return to an agricultural environment in a form of organic recycling.

Compost is also beneficial to the agricultural world as a replacement to artificial fertilizers for organic farming (Wong, 1998). A study conducted by researchers from Hong Kong Baptist University analyzed the effects of using a manure compost as an alternative to artificial fertilizer in organic farming. The benefits described include increased soil fertility and crop production, as well as improved physical soil properties such as soil porosity and hydraulic conductivity (Wong, 1998).
Midori Farm

Midori Farm is a non-profit organic farm based in Kutsuki, Shiga Prefecture (see Figure 1.2). Their mission is to “bring back the traditional food system to restore the health and environment of Japan” (“Midori Farm”, n.d.). To accomplish this mission, they have taken uncultivated fields and turned them into productive land for organic farming. This transformation displays Midori Farm’s willingness to increase the sustainability of Japan. Now, Midori Farm aims to address the outstanding environmental issues, such as waste incineration, as mentioned in the previous section. Midori Farm strives to combine modern agricultural methods with traditional Japanese techniques in their growing of produce (see Figure 1.1). Because Midori Farm has an ethnically diverse group of volunteers, international knowledge can be combined with traditional Japanese agricultural techniques for successful farming in a modern environment.

As an organic farm, Midori Farm is seeking the most natural sources for farming tools and products. For this reason, they have identified composting as an environmentally sustainable technique to obtain soil supplements and fertilizers. Although they currently have a small-scale composting system at the farm, the compost produced from this system is not enough for an entire year. The project’s goal is to find the most natural, sustainable and feasible solution for Midori Farm to obtain compost. A larger version of each of these maps shown in Figure 1.2 to the left can be found in Appendix J: Map of Midori Farm in Japan and Appendix K: Map of Midori Farm respectively.

To achieve our project’s goal we designed a composting system that processes Kyoto city’s organic waste and makes compost available to organic farms in the surrounding area. Midori farm will likely be one of the first farms to receive compost, but the project might eventually be scaled up to include even more farms. The goal of this project is also to reduce the organic waste incineration in Kyoto city through the rerouting of this waste into our composting system.

Midori Farm Expectations and Requirements

The first steps of this project required the team to understand the goals and expectations of Midori Farm as an organization, and their objectives for this project. Our team conducted meetings with the two sponsor liaisons: Chuck Keyser and Mika Ishikawa.
From these meetings, the following requirements were determined and considered throughout the project analysis, evaluations and comparisons:

- Midori Farm and other similarly sized organic farms require a minimum of **10 metric tons of compost per year**.
- Chuck spends approximately **JP¥68,000\(^1\) per year on fertilizers**.

Additionally, the following expectations of the project were determined during different meetings:

- Research, inform and expose the sponsors to organizations and **initiatives currently in Kyoto**, that could assist the development of the project.
- Create a **list of individuals and organizations** in the Kyoto area interested in assisting the project by either providing waste or helping with logistics.
- Create a **list of existing composting programs**, with the goal of learning about possible existing ideal composting systems in Kyoto.

These expectations would directly contribute to the final deliverable: a list of recommendations and their justification, which would help Midori Farm decide on the type of system to be implemented.

These meetings introduced our team to the sponsor’s willingness to help with inevitable obstacles of the project. To ease language barrier, and simplify the team’s communication with Japanese contacts, Mika Ishikawa assisted with email translations from English to Japanese. Additionally, Chuck and Mika exposed the team to multiple environmental events and organizations in Kyoto, which acted as networking opportunities and spaces to advertise our project to locals and expats.

**Options for Future Development: Build, Collaborate, Consume, Advocate**

Numerous methods can be used to achieve the creation of a composting system in the Kyoto area. As discussed in the previous section, the goal of this project is to obtain compost for organic farmers while reducing the incineration of waste in Kyoto city.

This paper is comprised of 4 distinct chapters that address the creation or implementation of composting in Kyoto in their own unique way. The four chapters that will be detailed are:

- **Build**: Build aims to explain the creation of a composting system located on, and built by, Midori Farm.
- **Collaborate**: Collaborate discusses the creation of a composting system with a partnering individual or organization in or around Kyoto City.
- **Consume**: Consume analyzes the option of obtaining compost from an existing compost system or compost vendor, either for free or at a cost.
- **Advocate**: Advocate takes a less direct approach to the creation of a composting system, and is aimed at rallying the numerous environmental organizations in Kyoto to create a composting system or start composting.

Finally, the paper is concluded with a list of final recommendations, steps and conclusions. These recommendations are the final suggestions on which path to follow. The paper ends with lists of Appendices containing a more dense agglomeration of data. The appendices present various excel sheets containing data such as contacts, collaborators and contributors and are referenced throughout the paper.

\(^1\) Based on currency conversion between USD and JPY on December 11th, 2018
2. Assessment Method for Viable Composting Programs with Midori Farm

The following sections describe each step taken in the data collection phases of our project. In each section, a brief explanation of the purpose of our data collection is provided, as well as how our team used the data to help make our final recommendations.

Visit to Midori Farm

From November 5th to November 9th, the Kyoto Composting Project team visited Midori Farm while staying at the Forest Green Park Memories (グリーンパーク想い出の森). This visit was intended to shed light on multiple different objectives our team had. These objectives were:

- Transportation
- Space and area
- State of the farm
- Volunteers
- Surrounding area
- Wildlife

Through the visit to the farm we hoped to collect data in the form of pictures, videos and notes on these objectives. Most of the relevant collected data can be found in Build: Creating a Composting System at Midori Farm.

Transportation

To better understand the obstacles for transporting waste to and from the farm, the team analyzed the journey to the farm. As identified by Midori Farm, the composting system was expected to produce 10 metric tonnes of compost in one year. As shown in previous calculations, this would require about twice the mass of waste. Because the processing for this system is done at the farm, all the waste needs to be transported to the farm. Because of the system’s dependence on transportation, the team found that analyzing the road to the farm, specifically all the way to Field A, was important. Data was collected in the form of videos and pictures taken on our journey to and at the farm. This data was then put in one centralized location and analyzed. The analysis included determining the width of the road in the narrowest places.

Space and Area

To produce 10 metric tonnes of compost, a significant amount of space is necessary. By visiting Midori Farm, our team hoped to find out whether all the required space was present. By taking pictures and videos of our survey around the farm, we were able to find out the location and space available for this composting system. Once the exact location of the available fields was determined by the visit to the farm, Google Maps was used to determine the exact area of the Midori Farm fields. This data is presented in the Build chapter.

State and Operations of the Farm

Due to the lack of experience of our project team in the agricultural industry, a visit to the farm allowed for a familiarization with farm operations. The team collected pictures, videos and notes on the day to day operations on the farm. Additionally, the team collected information about the state of the farm, such as the buildings and fields of Midori Farm. The objective of this was also to better understand the preparation of Midori Farm toward implementing a composting system.

Volunteers

Early in the project it became clear that a composting system at Midori Farm would require volunteers to operate the system. Therefore, during our visit to Midori Farm, one of the main goals was to determine the operations of the volunteers on the farm and how a composting system would affect them. Two volunteers, Astrid Gudin and Nicholas Haquet, were present at the farm during our visit. They were both interviewed and were asked questions listed in Appendix A: Volunteer Interviews. These
questions were aimed at determining the amount of time volunteers worked on projects at the farm and learning about the operations of the farm. Because a composting system requires a significant amount of time to operate, our team wanted to decide whether more volunteers may be necessary to maintain the new compost pile. Aside from the interview, data on the housing of the volunteers was collected in the form of pictures and notes.

**Surrounding Area**
A composting system produces malodors that can be noticeable from far away. The visit to the farm allowed the team to find the location of nearby farms and residents to later discover how they would be impacted by the smells of a composting system on Field A. Data was collected in the form of pictures and notes. Once the exact location of all the fields was determined, Google Maps was used to further collect data on the location of nearby buildings.

**Wildlife**
In the first meetings with our sponsor, Midori Farm identified the presence of Monkeys on the farm. As identified in previous research papers, wildlife can negatively impact composting operations. Therefore, data was collected in the form of pictures and notes on the presence of monkeys in and around Midori Farm (see Figure 2.1).

**Figure 2.1: A Japanese macaque**

**Taking Pictures and Videos**
The visit to Midori Farm took place early in the project. Therefore, not all data to be collected had been identified. As such a significant number of pictures, videos and notes were taken of objects at the farms, including objects that were not deemed of interest to the project at first.

**Networking**
Midori Farm has identified the need for contacts interested in the creation of a composting system. Due to the limited funds available to achieve the goals of the composting system, a significant amount of additional help will be required. Through networking the team hopes to identify a significant source of individuals interested in the composting system. These individuals or organizations interested in the to-be-implemented composting system are known as partners. Refer to the Glossary to gain a better understanding of the partner definitions.

**Networking through the Internet**
To establish contact with the interested individuals the Kyoto Composting Project team did a significant amount of research using the internet. Individuals interested in waste reduction methods, such as composting, or similar environmental sustainability initiatives, were added to the list. With the help of Japanese search terms in hiragana, katakana and kanji, more contacts were found. Contacts were often contacted to ask them questions about a possible relation to the project goals. If a contact replied, the team questioned the individual or organization about their relevant experience. The contact was also asked about their interest in our project goals. If their experience and relevance to this project was deemed adequate, and the individual was interested in our project. They were included in the contact list that can be seen in Appendix B: Contact List.
Food and Sustainability Conference

Attending sustainability events in Kyoto allowed us to meet individuals interested in sustainable waste systems such as composting. The Food and Sustainability Conference was hosted by Kyoto University’s Faculty of Agriculture school and involved keynote speakers from international universities and Japanese businesses who spoke about food sustainability. The team attended several presentations alongside students interested in sustainability. While our project was not directly related to the topic of this conference, food sustainability, it promoted a better use of food waste. This relation to the conference topic allowed us to contact professors, students and businessmen about their interest in our project. The Food and Sustainability conference ended with a Networking Dinner where we exchanged business cards in order to grow our network. Particularly interested and relevant individuals were sent follow-up emails explaining our project in further detail. These contacts were then added to the Contact List.

PechaKucha Night

Figure 2.2: Pecha Kucha presentation

The PechaKucha night is organized twice a year by the Seeds of Sustainability movement in Kyoto. Our team presented as the “Worcester Polytechnic Institute Students” about our composting project (see Figure 2.2). A crowd between 100 and 150 people consisting mostly of international environmentally conscious expats attended the presentation. During the presentation we advocated for composting as a more sustainable waste management solution to incineration and encouraged individuals to compost on their own. The messages spread from our presentation caused a significant amount of interest in the crowd and prompted later discussions during the networking period of the event. Like the Food and Sustainability Conference, this event brought forward numerous individuals interested in the goals of the project. Business cards were exchanged with the interested individuals who were then added to the Contact List.

Jujo Market

Jujo Market was a farmers’ market organized by Food Hub & Labo, an innovative restaurant that has a large-scale composting plant in place. This market was attended with the purpose of learning more details on the Food Hub & Labo composting facility (see Figure 2.3). This composting facility was added to the list of existing programs, and Kyoto Food Hub & Labo was considered a potential compost vendor for Midori Farm.

Figure 2.3: Jujo Farmers’ Market
Escola Flea Market

Figure 2.4: Escola community

Escola is a self-managed community near Kyoto University (see Figure 2.4). Escola is an open space that can be used to work or reside, as it has a few tatami mats available. This space can also be rented for events, meetings or workshops. Escola has an open garden space where people can grow the food for their use, as well as a small compost bin. The Escola Flea Market was attended with the purpose of learning specifics about the compost bin as well as meeting people interested in the project. During our time there, we learned that maintaining the compost bin is not currently a priority in the community, but a number of members are interested in improving the maintenance. Escola was considered as a potential space to implement the composting system in Kyoto. Additionally, we contacted with Léo Porte, a worker at the Kyoto City Zoo, who talked to us about the composting system in place in the Kyoto City Zoo. The Kyoto City Zoo was considered as an existing composting program and was added to the list.

Frank Nappa’s Farmers Market

Frank Nappa travels weekly from Obama to Kyoto, picking up vegetables and fruits to sell in his market along his journey. He is a well-known person around the Kyoto area, which could be a great opportunity for networking. Nappa’s market was attended with the intent of finding potential collaborators or contributors. The team was introduced to a few contacts that were added to the Appendix B: Contact List.

Kyoto University Vermicomposting System

Figure 2.5: Kyoto University vermicomposting system

Through the Food and Sustainability event, the Kyoto Composting Project team heard about an existing composting system at Kyoto University. Through discussing this system with more contacts we were able to find the individuals responsible for the composting system at Kyoto University. On November 30th, we were able to get a tour of the composting system. The main objective of the visit was to determine the extent and operations of this composting system. Questions were prepared beforehand to create a discussion with the operator of the composting system. Due to the language barrier a translator was required, however, the translator also struggled with English. Therefore, data collection on this system was especially difficult and was largely done in the form of pictures rather than notes taken from the discussion as seen in Figure 2.5. Data was used in the Collaborate: Creating a Composting System with Other Organizations chapter.

Additional Contact Methods

Aside from the Food and Sustainability Conference, the team employed other methods to obtain contacts for the Contact List. First, the sponsor, Midori Farm, was asked for any contacts relevant to this project. Those contacts were then pursued via email and asked about their interest in the project goals. Because we had not spoken to these contacts in-person, the
email included a much lengthier description of our project and its goals. Another method of obtaining more contacts was asking known contacts to identify individuals interested in the projects. All of the contact information was put into a table. This table includes the contacts' name, description, the organization they belong to, their email and any additional information that we considered relevant. The table can be found in Appendix B: Contact List.

Statistical Analysis
For a better understanding of the requirements of the composting, the team completed a few calculations that provided estimates on the topics of transportations, space, area, etc. The calculations are based on numerous statistics, assumptions and averages derived from research papers. The assumptions are listed with the rest of the calculations. These numbers are presented in Statistical Analysis.

Budget
Like the Statistical Analysis, the Budget was meant to provide a better understanding of the monetary requirements for a composting system. Different budgets are presented for the different sections throughout the paper. The budgets change depending on the type of composting system due to varying costs for each. However, each budget is meant to present the financial cost of implementing a specific type of composting system to Midori Farm. The budget is used under the Build chapter as Budget for Composting at Midori Farm.
3. Build: Creating a Composting System at Midori Farm

Build outlines a composting system at Midori Farm. This system will use the resources the farm already has, as assets to increase the system’s feasibility. For example, Midori Farm has already identified an available plot of land to introduce a composting system as shown in Figure 3.1. By building a composting system on Midori Farm, our sponsor has the opportunity to not only provide enough compost for themselves, but to teach other organic farmers how to build their composting system.

While this recommendation initially has less impact, it has the potential to be scaled up to more organic farms around Kyoto. Midori Farm’s learnings from experiences in the creation process can be of great value for the development of a natural, sustainable and successful composting facility on any organic farm. The following section presents information on building a composting system at Midori Farm. It includes a statistical analysis of what is needed to produce 10 tons of compost in a year, a process map for composting at Midori Farm, an evaluation of elements to compost at Midori Farm, and a budget.

Figure 3.1: Fields A & B to be used for composting

The idea for a composting system at Midori Farm was created through an interview with Mika Ishikawa. The process mentioned by her was a potential goal for our project to head towards. Over time, the steps needed to create such a process were determined, and the team proceeded to attend events to find potential collaborators and contributors. Some of these events included the Kyoto University International Symposium on Food & Sustainability, Pecha Kucha Night Kyoto Vol. 32, Jujo Farmer’s Market and Escola Flea Market. These events allowed the Kyoto Composting Project team to network with individuals interested in sustainability and discuss our project.

To evaluate the technical options and aspects of the system, a statistical and budget analysis were done through research utilizing existing information on the internet. This research allowed us to obtain ratios, statistics and prices of composting factors. The observation of inhibiting or assisting factors for the composting implementation on the farm was done during a one week visit to the farm. A more in–depth methodology can be found above in the Assessment Method for Viable Composting Programs with Midori Farm chapter.
The Kyoto Composting Project

Statistical Analysis

To better understand the requirements identified in the previous section, our team performed a number of statistical calculations. These calculations show the amount of space, mass of waste and transportation needed. The calculations are based on the assumptions listed below. A further explanation of this analysis is provided below the assumptions.

Assumptions

The following calculations in the table below were made using the following assumptions:

- 10 tonnes of compost is desired.
- The finished compost has a density of 590 kg/m$^3$ (Khater, 2015).
- The preferred ratio of brown to green waste is 4:1 (as indicated by our sponsor).
- The compost pile volume shrinks by 20% from start to finish (“Windrow Composting”, n.d., p. 7).
- The compost pile mass is reduced by 60% from start to finish (Breitenbeck & Schellinger, 2004).
- The density of leaves is 207.65 kg/m$^3$ (Richard & Skelton, 1990, p. 2).
- The average green waste output by a supermarket is 6 kg/day, 38.1 kg/day for a restaurant and 0.437 kg/day for a household (Yamada et al., 2017, p. 1356).

As observed in Table 3.1 below, the total volume of the compost is significant. This value was determined by using an average density of compost listed in the assumptions. This volume of unfinished compost was determined by using the volume of the finished compost and the shrink factor. Due to the large volume of compost necessary, our team found the total areas of each field on Midori Farm to determine which field would be best suited for the compost pile and waste storage. This data is represented in Table 3.2. To determine the amount of green and brown waste, the total compost mass and a compost pile mass reduction factor was used. The average density for green waste was used for green waste, and the average density for leaves was used for brown waste. Using the average production values of food waste within Kyoto city, the number of required supermarkets, restaurants and households was found. The complete analysis is found in Appendix C: Complete Statistical Analysis.

Table 3.1: Further analysis of the Midori Farm requirements

<table>
<thead>
<tr>
<th>Compost Statistics</th>
<th>(per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Compost Volume</td>
<td>16.94915254 m$^3$</td>
</tr>
<tr>
<td>Unfinished Compost Volume</td>
<td>21.18644068 m$^3$</td>
</tr>
<tr>
<td>Mass of Browns Required</td>
<td>18750 kg</td>
</tr>
<tr>
<td>Mass of Greens Required</td>
<td>6250 kg</td>
</tr>
<tr>
<td>Total Volume of Brown Waste</td>
<td>137.417 m$^3$</td>
</tr>
<tr>
<td>Total Volume of Green Waste</td>
<td>12.16 m$^3$</td>
</tr>
<tr>
<td>Households Required</td>
<td>39.2 Households</td>
</tr>
<tr>
<td>Supermarkets Required</td>
<td>0.449 Supermarkets</td>
</tr>
<tr>
<td>Restaurants Required</td>
<td>2.854 Restaurants</td>
</tr>
</tbody>
</table>

Table 3.2: Area of the fields at Midori Farm (refer to Figure 3.1 for field names)

<table>
<thead>
<tr>
<th>Field</th>
<th>Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field A</td>
<td>1204 m$^2$</td>
</tr>
<tr>
<td>Field 1</td>
<td>52 m$^2$</td>
</tr>
<tr>
<td>Field 2</td>
<td>80 m$^2$</td>
</tr>
<tr>
<td>Field 3</td>
<td>239 m$^2$</td>
</tr>
<tr>
<td>Field 4</td>
<td>50 m$^2$</td>
</tr>
<tr>
<td>Field B</td>
<td>919 m$^2$</td>
</tr>
<tr>
<td>Total</td>
<td>2546 m$^2$</td>
</tr>
</tbody>
</table>
As seen in Figure 3.2 above, to produce compost at Midori Farm, all of the waste must first be transported to the farm. First, the green waste is collected by a Midori Farm employee from supermarkets, restaurants or households. If the waste is collected from households, a bucket system can be used, where buckets are distributed between green waste contributors. Brown waste is collected in the form of leaves from parks, temples or other large green areas. The leaves are collected in the fall and delivered to the farm in one season. Once all the waste is at Midori Farm, Midori Farm volunteers process it until the waste is finished compost.
Budget for Composting at Midori Farm

To find the composting technique which best suited the needs of Midori Farm, the team performed a basic cost analysis of three of the most popular composting techniques. Table 3.3 below shows different composting techniques that could be considered to build the system, with their respective implementation cost, maintenance cost and total cost. In this table, a basic composting technique includes any technique that does not require any additional cost, such as Pile Composting and Windrow Composting. Although, Aerated Static Pile and Vermicomposting can give better and faster results, the budget suggests that a basic system has the most reasonable cost. Further analysis of the budget for all categories of composting techniques can be found in Appendix D: Budget Analysis for Composting at Midori Farm.

The costs outlined in Table 3.3 as well as the characteristics of different techniques helped to determine that Windrow Composting is the recommended option. Windrow composting presents a convenient layout that allows for easy stirring for the large amount of waste that would be processed at Midori Farm every year. Windrow composting is a layout of compost piles where the waste is spread out in long rows.

<table>
<thead>
<tr>
<th>Composting Technique</th>
<th>Implementation Cost</th>
<th>Maintenance Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>¥85,435</td>
<td>¥406,300</td>
<td>¥491,735 first year ¥406,300 following years</td>
</tr>
<tr>
<td>Vermicomposting</td>
<td>¥131,370</td>
<td>¥406,300</td>
<td>¥537,670 first year ¥406,300 following years</td>
</tr>
<tr>
<td>Aerated Static Pile Composting</td>
<td>¥121,890</td>
<td>¥406,300</td>
<td>¥528,190 first year ¥406,300 following years</td>
</tr>
</tbody>
</table>

The costs in Table 3.3 were converted from USD to JPY and rounded up when necessary to account for uncertainties.
Evaluation of Elements for Composting at Midori Farm

A composting system at Midori Farm has many possible options for various elements pertaining to the system. Appendix E: Option Evaluation for Composting at Midori Farm provides the complete list of justifications for all options that were considered for the following elements:

- Processing location
- Composting technique
- Storage of waste
- Origin of greens
- Origin of browns
- Waste containers
- Transportation
- Labor

A brief summary of these elements is shown in Table 3.4 below. Most of the choices were made based on being the cheapest but still the most effective option.

As mentioned previously, windrow composting represents a good option of composting technique. This convenient layout would allow volunteers to easily stir the different piles without difficulty. Windrow composting is also one of the cheapest options. Additionally, the row layout is very doable on the fields of the farm that would be dedicated to compost, since they are thin but conveniently long.

Leaves were selected as brown waste for this system due to their widespread availability in the fall. Currently, leaves in Japanese cities are mostly incinerated, giving more incentive to use this as brown waste. Because the leaves can only be harvested during a single period each year, they need to be stored for an extended duration of time. The method of leaf storage selected was a simple pile, in which the leaves can start to compost on their own if they are not manipulated. For example, the farm is inaccessible during the winter. This season would be a time where this type of storage could be an advantage.

The green waste for this composting system will likely originate from Midori Farm’s current Teikei customers, since there exists a relationship with these customers already. The brown waste will be collected in the form of leaves from a Takashima city leaf program. This program is convenient because of the proximity of Takashima city to Midori Farm. For both green and brown waste, many alternative sources of waste are possible. Relying on multiple sources or waste rather than just one is possible. Alternative sources of green and brown waste can be found in Appendix G: Waste Contributors. This system can rely on multiple different sources of green and brown waste if required.

Green waste will be collected with 1.3 gallon buckets. On average, this volume is adequate to hold one week’s worth of green waste. These buckets would then be collected at a centralized exchanging location such as a farmer’s market. Buckets can then be emptied into a single, larger container for easier transportation. To transport the green waste to Midori Farm, Chuck Kayser’s car presents the cheapest option. During the time at the farm our team noticed the road to access the farm is very narrow. It can only fit one medium sized car at a time. Chuck’s car is reasonable size that has been proven to fit in the road. To transport the large quantity of leaves in the fall, a large truck will likely be required. However, the size is limited as it must be small enough to fit through the narrow mountain roads.

The processing of the waste to compost will be accomplished by Midori Farm’s volunteers, as they present the cheapest and most accessible form of labor. Alternative options and justifications are listed in Appendix E: Option Evaluation for Composting at Midori Farm.
### Table 3.4: Best evaluated options for composting at Midori Farm

<table>
<thead>
<tr>
<th>Composting Technique</th>
<th>Storage of leaves</th>
<th>Origin of greens</th>
<th>Origin of browns</th>
<th>Waste containers</th>
<th>Transportation</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended option</strong></td>
<td>Windrow composting</td>
<td>Pile of leaves</td>
<td>Teikei customers</td>
<td>Takashima city leaf distribution program</td>
<td>1.3 gallon buckets</td>
<td>Sponsor’s car</td>
</tr>
<tr>
<td><strong>Justification</strong></td>
<td>Cheapest, Stirring is manageable</td>
<td>Will start composting, No maintenance requirements</td>
<td>Already have a close relationship</td>
<td>Close to the farm, Appropriate contact information exists</td>
<td>Size is realistic for 1 week of waste</td>
<td>Convenient, Cheap</td>
</tr>
</tbody>
</table>
Education on Composting

For the composting system to succeed, people involved in the processing of compost must understand the basics and purpose of composting. From our team’s interviews with two volunteers stationed at Midori Farm, the data indicated that the average volunteer that came to work at Midori Farm had little to no past knowledge on the composting process, and anything that experienced volunteers knew was learned during their time on the farm. The questions asked in these interviews can be found in Appendix A: Volunteer Interviews.

Because the volunteers had little to no knowledge of composting upon beginning work on Midori Farm, our team identified that creating a guide to the basics of the composting process is beneficial for new volunteers to understand the importance of their work and what compost does for the soil. The guide itself can be found on the right, and the PDF can be found here. This pamphlet can also be found in Appendix F: A Beginner’s Guide to Composting. This guide includes the definition of composting, the materials necessary to create a compost pile, and the maintenance requirements for a healthy compost pile. Although this pamphlet only includes basics for composting, the one-page format could be applied to create different campaigns to promote the creation of a composting system.

Putting more weight into education is a good strategy for the dissemination of the idea of building a composting system in other organic farms in the Kyoto area.
Implementation Steps to Build a Composting System

Building a composting system at Midori Farm is the most feasible method to accomplish our project goal. This composting system is feasible due to the fact that many requirements for a composting system have been solved. Still, many steps need to be taken to build a composting system at Midori Farm. As the implementation process develops, these steps are likely to vary. All participants in the implementation process should be flexible to the potential changes of the procedural steps. The steps are outlined below and are expanded upon further in this section.

1. Obtain brown waste
   a. Contact organizations
2. Obtain green waste
   a. Contact individuals/organizations
3. Secure an exchanging location
4. Setup the facility
   a. Mark windrows
5. Setup the system logistics
6. Start composting

1. **Obtain brown waste:** The preferred brown waste by Midori Farm is fallen leaves. The first step would be to get as many leaves as possible from different places during the autumn. Once again, this involves contacting a lot of people, mostly locals. A few of the browns could be collected from Takashima City, as they give away their waste to farmers. This location is convenient due to its proximity to Midori Farm, as the drive between the locations takes approximately 30 minutes by car. Other locations such as hotels or resorts in this area could also be brown waste contributors. Kubo-san, the manager of Forest Green Park Memories (グリーンパーク想い出の森), can be contacted by email at h-kubo@gp-kutsuki.com.

   Once leaves are collected, they can be transported to Midori Farm. This will likely happen in our sponsors’ car through multiple trips throughout the fall. If all the leaves for a full year of composting can be obtained with one trip, Midori Farm should consider renting a truck. Once the leaves are at the farm, it would be a good idea to lay them out in a pile on Field B, which can be seen on the Midori Farm map in Figure 1.2. Because leaves will compost with or without green waste, this step should be accomplished first. (Appendix E: Option Evaluation for Composting at Midori Farm)

2. **Obtain green waste:** During the events that the team attended in Kyoto, we noticed that presenting the project raised a lot of interest. Several Kyoto residents approached the team, asking where they could bring their waste and when. Most people are open to the idea of Midori Farm or any organization taking their green waste. A list of interested individuals and organizations will have to be maintained. (Appendix B: Contact List)

3. **Secure an exchanging location:** Ideally, green waste contributors would donate their waste to Midori Farm every week. For this exchange to be smoother, making the meeting point a weekly event, such as a farmers’ market, would be highly beneficial. A flexible drop off location could also be a potential solution and an opportunity to expand to different communities.

4. **Setup the facility:** Once waste contributors have been determined, the compost processing facility can be built at Midori Farm. Field A can be the designated spaces for the system. Once the land is determined, the windrows can begin to be set up by digging multiple rows in Fields A (shown in Figure 1.2). These markings should not be too deep, just enough to be able to keep track of the windrows. Although Midori Farm has most tools necessary for all farming activities, it would help to make sure that Midori farm has all of the tools needed to turn the compost pile.

5. **Setup the system logistics:** For the implementation of the bucket system, a
Midori Farm volunteer would have to either buy the appropriate amount of buckets or communicate to green waste contributors that they will bring their waste in their own container. A larger green waste container should be purchased as well, to allow for the collection of the green waste. Locations and times should be set up for waste drop off. A Midori Farm volunteer should maintain an easy way of communicating with all participants at once to send reminders, cancellations or any relevant information. For example, an email alias with all participants or interested people could be set up.

6. Start composting: Once the waste is dropped off by the green waste contributors it can be brought to Midori Farm. From here, all steps to be taken can be found in the process map in Figure 3.2. To keep the compost organized and healthy it would be helpful for volunteers to keep a list with dates for when each pile was last stirred and when the next stirring date should be. Volunteers should stir new waste every day for about two weeks and once every two weeks after that.

Dissemination Recommendations After Building a Composting System

Although the creation of a composting system in Shiga prefecture is limited to Midori Farm at first, this system has tremendous potential to grow. The creation of such a large scale system by a small organic farm could potentially be a motivator for others to either contribute to the system, or collaborate with Midori Farm to create their own. Once the system is in place at Midori Farm, it could set an example for other small organizations and organic farms, making resources more accessible to upcoming composters. The dissemination of this composting system requires active outreach by Midori Farm. News of the composting system should be spread through events such as farmers’ markets, or sustainability talks. Some of the relevant contacts that were found during these types of events and their contact information can be found in Appendix B: Contact List.

A system can be created by Midori Farm to connect residents and organizations, who are willing to contribute waste, with organic farmers. This system would allow other organic farmers to undergo a similar process to Midori Farm for this system. If the logistical aspects are figured out, organic waste could easily be routed from residents to organic farms.

The dissemination of this project ties in closely with the Advocate chapter of the report. By collaborating with locals or Japanese speakers interest could accumulate towards a city wide composting system in Kyoto. If the system grows big enough, with enough individuals involved, a dialogue should be opened with the Kyoto City Government. More details on advocating will be discussed later, in the Advocate chapter of the paper.
4. Collaborate: Creating a Composting System with Other Organizations

Collaborate involves creating a system in the Kyoto area along with other organizations. Kyoto and its surrounding area currently have a number of environmentally-motivated individuals and organizations, such as Kyoto University's School of Agriculture, Escola, and Nichiei Shiga (Figure 4.1), who are interested in working together on sustainability initiatives. To reduce the impact of food waste incineration, a composting system can be created in collaboration with these organizations around Kyoto. These organizations might already have a composting system or a network of organic waste sources in place. The benefit of collaborating with environmental organizations lies in the decreased cost of a composting system due to the resources that the organizations might have. Additionally, the impact of the composting system created by Midori Farm might increase due to collaboration with other organizations. By collaborating with other organizations the number of people involved and affected by the project increases. This grows the environmental impact of the project exponentially. For the greatest environmental impact, collaborating with other organizations might be the best option. Below, collaborators that will be discussed can be seen.

**Figure 4.1: Possible collaborator logos**

*Kyoto University*  
*Nichiei Shiga*

A composting system can be created by Midori Farm within Kyoto city. One might expect that this recommendation would be placed in the Build chapter. However, creating a composting system in Kyoto has significantly more requirements than building a composting system at Midori Farm. A composting system will have to be designed and implemented with a significant amount of help. Therefore, the system was placed in the Collaborate chapter. To create a composting system in Kyoto, a location and a source of labor will have to be found. Both of these would ordinarily require significant sums of money that Midori Farm does not have. However, with a collaborator who has access to these resources, these requirement might be satisfied with little extra cost.

The idea of having a composting system inside the city as opposed to on Midori Farm has a number of advantages. First, the proximity to the residents allows for less transportation between waste sources and the composting process. This reduces the environmental impact of transporting waste and makes the logistics easier. Secondly, transporting the finished compost to the farm, as opposed to the waste, is significantly more efficient. This is due to the fact that compost represents the final product, and is lighter than the water-filled waste. Lastly, the potential for a composting system to grow and impact many different individuals in the city is much more significant as compared to the other systems.

This section has a process map, to visualize the composting system, a budget, to analyze the cost and tables listing recommended collaborators. The tables are prioritized with the most feasible and likely collaborator, Kyoto University, in first.
The Kyoto Composting Project

Process Map for Composting in Collaboration

Figure 4.2: Composting process with a collaborator

As shown in the process map for a composting system in collaboration above in Figure 4.2, the composting system is more complicated, due to the added step of transportation of finished compost. First, the green waste is collected in a manner similar to that of a composting system at Midori Farm. The waste can be collected from restaurants, supermarkets and households, then collected at the collaborator location. Brown waste is collected from brown waste contributors, such as parks, temples and leaf collection services, in the surrounding area and brought to the collaborator location. There, the waste is processed into compost. This compost then has to be brought to the farm and used for agriculture.
Evaluation of Composting in Collaboration

The evaluation of composting in Kyoto was completed with a number of assumptions for collaborator resources. In Gion, a major tourism hub in Kyoto, the land price per square meter has almost tripled over the past 10 years (“Standard land…”, 2018). Land in Kyoto is incredibly expensive, and purchasing land for use in a composting system is not feasible. Therefore, the composting system in Kyoto will likely take place at a location belonging to a collaborator. The second assumption is based on labor, which can also be a significant cost if an employee needed to be hired.

According to the professor at Kyoto University who maintains the Kyoto University vermicomposting program, approximately 2–3 hours of work is necessary each week to produce 4–5 tons of compost per year. However, it must be kept in mind that a portion of this time is used to sort the worms from the compost, as the Kyoto University system uses vermicomposting. Based on this, it seems that the total time necessary to maintain a 10 ton compost pile would likely be approximately 3–5 hours each week, including turning, watering, and adding organic waste to the pile. As such, the assumption is made that Midori Farm can acquire volunteers or already active employees to run the composting system. The rest of the evaluations are comparable to those found in the Evaluation of elements for composting at Midori Farm section. For example, transportation of the waste to and from the collaborator processing location is still the cheapest with the sponsor, Chuck Kayser’s car. The same applies to the recommended composting technique, windrow composting represents the cheapest and thus the best option.

The budget for a composting system in Kyoto is highly variable due to unexpected costs arising from the location and labor. Other than the location and labor costs, a composting system in Kyoto should have the same costs as the system defined in Build, assuming the systems are the same size.

Assuming that a collaborator is found that can supply both land and labor, the only implementation cost is likely to arise from the waste containment system and storage systems. Additionally, depending on which composting technique is used, extra costs may arise.

Grants to Compost in Kyoto

To alleviate the cost of a composting system inside Kyoto city, Midori Farm and the collaborator may be able to apply for waste related grants issued by the Kyoto City Government, displayed in Table 4.1. The municipal government has two grants of interest. The first, is awarded to organizations which process leaves during the fall. This grant is the most applicable to a composting system in Kyoto city, as it meets the guidelines. The second grant is issued to organizations who dispose of waste of a specific number of households in Kyoto City. However, this waste might not include food waste. The last grant applies to organizations or households that purchase recycling or composting containers. This grant is especially useful if the composting system in Kyoto will include an implementation cost. More grants that Midori Farm may be eligible for can be found by clicking here.
### Table 4.1: Grant awards

<table>
<thead>
<tr>
<th>Grant (click link for more information)</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization Composting fallen leaves</td>
<td>¥50,000, first year, ¥10,000 following years</td>
</tr>
<tr>
<td>Organization that handles waste</td>
<td>¥10,000 per month</td>
</tr>
<tr>
<td>Organization or households that install compost containers</td>
<td>Subsidy</td>
</tr>
</tbody>
</table>

### Existing Composting Systems in Kyoto

The following systems or organizations were found as potential collaborators for a composting system in or outside of Kyoto. Each has distinct advantages to offer. The organizations listed in the tables below are prioritized, with the first being the most applicable to the goal of Midori Farm. More potential collaborators may be found in the future as Midori Farms continues to expand its composting system.
**Kyoto University Composting System**

**Table 4.2: Kyoto University composting system overview**

<table>
<thead>
<tr>
<th>System Description</th>
<th>Composting Experience</th>
<th>Benefit for Midori Farm</th>
<th>Contact Information</th>
</tr>
</thead>
</table>
| A vermicomposting program operated for research purposes to track the population of worms in compost. Produces 4 – 5 metric tons of compost from only 20% of leaves harvested from the Kyoto University campus. | This system is maintained weekly by one person who takes great care of the worms and the whole process. Leaves are successfully composted with worms only and no green waste put into the mix. Because the system is vermicomposting, the compost is expected to be extremely fertile. | Kyoto University presents itself as an excellent collaborator because it has room to grow. The compost produced is given out for free, which is a great opportunity for Midori Farm. This system is also an opportunity to obtain some of the 80% of leaves remaining, if they are meant to be incinerated. | Contact Person: Misuzu Asari  
http://www2.ges.kyoto-u.ac.jp/members/asari-misuzu/  
Email: mezase530@gmail.com |
### Escola

**Table 4.3: Escola community overview**

<table>
<thead>
<tr>
<th>System Description</th>
<th>Composting Experience</th>
<th>Benefit for Midori Farm</th>
<th>Contact Information</th>
</tr>
</thead>
</table>
| Escola is a sustainability group aimed at being completely self-sufficient. | Escola has a compost bin currently in place that is not very big. The food waste produced is simply put in the bin. At the moment the bin is not very well maintained, but several members are interested in improving this. | By partnering with this organization, Midori Farm might gain access to land as well as volunteers to manage a composting system. | Contact Person: Léo Porte  
Email: leomer.porte@gmail.com |

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3 (本町エスコーラ (Honcho Esukora), n.d.)
Nichei Shiga Composting System

Table 4.4: Nichei Shiga composting system overview

<table>
<thead>
<tr>
<th>System Description</th>
<th>Composting Experience</th>
<th>Benefit for Midori Farm</th>
<th>Contact Information</th>
</tr>
</thead>
</table>
| Nichiei Shiga is a commercial composting system located near Kido, Shiga prefecture. Residents can register to the system, have their kitchen waste collected and obtain free compost in exchange after a few months. | This is a large-scale centralized composting system with an incredible environmental mission. | While this system is not in Kyoto city, it can still be considered as a collaborator due to its extensive innovation. This system can also be an opportunity for Midori Farm to provide kitchen waste in exchange of compost in the case of having more green waste than can be processed. | http://www.nichieishiga.co.jp/contact/  
本社 (Head office): 077-592-1061  
レンタル事業部直通 (Direct rental business division): 077-592-0785 |

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4 (Nichiei Shiga Home, n.d.)

5 A centralized composting system is a large-scale system with very large requirements, including technological, financial, infrastructural and organizational.
Implementation Steps for Composting in Collaboration

For the creation of a composting system in collaboration with another organization, the following steps will have to be taken:

1. Contact potential collaborators
2. Meet the following processing requirements:
   a. Find a location
   b. Determine a composting technique
   c. Find a source of labor
3. Meet the following logistics requirements:
   a. Transportation of compost to Midori Farm
   b. Transportation of waste to the compost processing location
   c. Source of green waste
   d. Source of brown waste
4. Application for grants

1. **Contact potential collaborators:** To produce a composting system with a collaborator, a deal will have to be made between Midori Farm and an interested organization. The first step a Midori Farm representative should undertake is to contact the listed organizations to discuss a composting system. Once these conversations have taken place, this system can proceed to the next step. The processing requirements in the next step should be kept in mind while contacting organizations. Partnership with multiple organizations for the success of this composting system is possible. For example, one organization might offer land for the system, while another can contribute volunteers. We recommend contacting multiple organizations. **Appendix H: Collaborators** can be used to find additional collaborators.

2. **Meet processing requirements:**
Creating a composting system in collaboration with organizations will mean more processing requirements will have to be met. The following items should be addressed before proceeding:

   1. Location
   2. Composting technique
   3. Labor

Some of these requirements might already be met by collaborating with specific organizations.

3. **Meet logistics requirements:** When the composting location and other processing requirements are determined, logistical aspects should be met. The following should be considered:

   1. Transportation of waste to the composting system

4. **Application for grants:** If the composting system is located in Kyoto City, the collaborators and Midori Farm can apply to the grants listed in **Grants**. This will help to offset the cost of implementing or maintaining the composting system. Grants should be appropriately researched before applying, ensure that the application of the grant is completed on time. Some grants will only be issued for the year following their application. Midori Farm should not rely on these grants to create a composting system in collaboration.
Dissemination Recommendations for Composting in Collaboration

The largest benefit of this composting system is the potential to impact the residents of Kyoto City. Additionally, a composting system in the city is easier to scale up as many companies are willing to donate waste. The biggest problem with accepting waste is the need to transport it to the composting location. A composting system inside the city lessens this problem. The following recommendations are made to disseminate a composting system in Kyoto:

1. Advertise the system on social media
2. Engage the public in environmental and sustainability events
3. Contact environmentally conscientious organizations to ask for assistance with the system

Kyoto contains a significant amount of individuals and organizations interested in environmental initiatives. Creating a composting system in Kyoto that is open to volunteers and organic waste, will likely result in an influx of both waste and volunteers. This will allow the composting system to grow even larger. By maintaining a large social media presence, the possibility arises for an even larger following and impact of the composting system.

The possibility arises to tie this composting section in with the Advocate solution. A successful composting system in the heart of Kyoto city will be a great motivator for the Kyoto City government to create a large scale composting system. Therefore, a collaborative composting system in Kyoto could be seen as a trial for a larger implementation.
5. Consume: Purchasing Compost

Purchasing or receiving free compost presents another option to bring compost to Midori Farm. Although the project was originally created with the goal of producing a sustainable composting system, our team identified another feasible, short-term solution to satisfy the need for compost: purchasing compost from vendors. When the goal of the project shifted to making compost accessible for organic farms, the possibility of purchasing compost as opposed to creating a new composting system stood out for the reason of its substantial economic benefits.

The implementation of a composting system, independent of the composting technique that is used, always has a significant cost and labor requirement for the system’s success. In the case of building a composting system at Midori Farm, our sponsor would likely have to pay for the initial investment costs of the system, as well as any costs that would manifest overtime, most notably the constant transportation of organic waste to and from the composting site. However, purchasing organic compost from a vendor that produces compost in much larger quantities would decrease the investment our sponsor would have to make to receive compost. Thus, our team searched for any organic compost vendors in the Kyoto and Takashima City areas that would sell and deliver large quantities of compost for a low price. Although this option is the least impactful, from a social aspect, this system has the highest chance to succeed due to its potentially quick implementation. This success could lead to the formation of a larger community of organic farmers in need of better, more sustainable, natural and accessible means of obtaining compost, which could be a very beneficial change for Japanese agriculture.

This system was devised from one of the goals of the project, which was to create a list of all existing composting systems in the Kyoto area. The research was done on the internet, but we quickly found that the language barrier was difficult to overcome. To solve this issue, our team decided to attend events to talk to people interested. As mentioned before, we attended both Jujo Farmers’ Market and Escola Flea Market, during which we learned about the two composting systems recommended for consuming in the sections above. During these events we talked to people involved in both systems. Our sponsor helped with translations at Jujo Farmers’ Market. The information from these conversations was recorded by notetaking and eventually presented in Table 5.1: Kyoto City and Food Hub & Labo Composting Systems Overview and Evaluation. Although these are the main methods that were relevant to this section of the report, some methods from other sections helped to get to this point. The associated methods used in the project can be found in the Assessment Method for Viable Composting Programs with Midori Farm chapter.

<table>
<thead>
<tr>
<th></th>
<th>Kyoto City Zoo</th>
<th>Food Hub &amp; Labo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Free</td>
<td>¥4,000 / m³</td>
</tr>
<tr>
<td>Able to Supply Compost in Bulk?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Distance</td>
<td>42.4 km</td>
<td>47.9 km</td>
</tr>
</tbody>
</table>
Potential Compost Providers

When researching different composting facilities in the Kyoto area, the determining factors considered included location relative to Midori Farm, cost of the compost, and availability of the necessary 10 tons of compost per year. Although the team did not find options that benefitted Midori Farm in every one of these aspects, two compost sources were identified as the most suitable. The tables below give an overview of both composting systems, outlining the main parts essential to the systems’ processes as well as the determining factors mentioned previously. These determining factors are the most important to be considered when evaluating any future means for Midori Farm to obtain compost.

As can be seen in the tables below (Table 5.2 and Table 5.3), both Kyoto Zoo and Food Hub & Labo’s composting facility are located at relatively the same distance from Midori Farm, indicating that neither one is better based on this fact. However, while Kyoto Zoo gives out compost for free, the cost of 10 tons of compost from Food Hub & Labo would be approximately ¥85,000 per year. This is assuming the compost would be purchased at the "¥5000 for getting 1 m³ delivered" price point, with 17 m³ being enough to deliver 10 tons of compost as stated earlier in our calculations (Statistical Analysis). Despite the price, 10 tons of compost per year can be guaranteed by Food Hub & Labo, which is not the case for Kyoto City Zoo. Midori Farm needs to consider which factor is most important and choose accordingly. Another option is to get involved in both systems, which would reduce the overall cost and could still guarantee 10 tons of compost in a year. Alternative options to these two recommendations are possible as well. They are listed in Appendix I: Compost Contributors.
## Table 5.2: Kyoto City Zoo composting system overview

<table>
<thead>
<tr>
<th>Description</th>
<th>The Kyoto City Zoo processes the manure produced by its animals to produce compost. After the compost is processed on-site, the compost is made available to farms who apply to the program.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td>Animal manure</td>
</tr>
<tr>
<td><strong>Origin of waste</strong></td>
<td>Zoo animals</td>
</tr>
<tr>
<td><strong>Composting technique</strong></td>
<td>Composting tumbler</td>
</tr>
<tr>
<td><strong>Mixing frequency</strong></td>
<td>Continuous turning</td>
</tr>
<tr>
<td><strong>Amount</strong></td>
<td>Varies, not enough to give Midori Farm 10 tons per year</td>
</tr>
<tr>
<td><strong>Time for finished product</strong></td>
<td>Two weeks</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>Free when signed up officially</td>
</tr>
<tr>
<td><strong>Transport to Midori Farm</strong></td>
<td>Pickup at zoo</td>
</tr>
<tr>
<td><strong>Contact Information</strong></td>
<td>Léo Porte</td>
</tr>
</tbody>
</table>
### Table 5.3: Kyoto Food Hub and Labo composting system overview

<table>
<thead>
<tr>
<th>Description</th>
<th>Kyoto Food Hub &amp; Labo is an innovative restaurant in Kyoto City that also produces compost that is made available for sale.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>Leaves, cuttings, food producer waste</td>
</tr>
<tr>
<td>Origin of waste</td>
<td>Food shops (Green Waste), gardeners (Brown waste)</td>
</tr>
<tr>
<td>Composting technique</td>
<td>Three–pile composting</td>
</tr>
<tr>
<td>Mixing frequency</td>
<td>Mixed every day for the first two weeks then every two weeks for the remainder</td>
</tr>
<tr>
<td>Amount</td>
<td>2000 tons per year</td>
</tr>
<tr>
<td>Time for finished product</td>
<td>Six months</td>
</tr>
</tbody>
</table>
| Cost        | - ¥100 for 1 kg packaged  
- ¥300 for 15 kg packaged  
- ¥4000 for picking up 1 m³  
- ¥5000 for getting 1 m³ delivered                                                                 |
| Transport to Midori Farm | Pickup at facility or delivery to the farm                                                                                   |
| Contact Information | [https://www.facebook.com/foodhuban dlabo/](https://www.facebook.com/foodhuban dlabo/)                                    |
Implementation Steps for Consuming Compost

Purchasing and receiving compost is one of the simplest solutions to solve Midori Farm’s need for compost. However, this solution has little environmental impact. Therefore, the two sections below outline the steps to consumption as well as a plan for social growth. The consume option should be seen as an opportunity to create a more impactful solution, aside from just getting compost.

1. Contact compost vendors to confirm the type, availability and price of the compost.
2. Find transportation to move the compost to Midori Farm.

The following are a few steps that Midori Farm could take to start obtaining compost in a socially significant way.

1. **Spread the word:** Start by talking about this specific idea to people in events such as farmer’s markets. During the time in Kyoto, the team noticed a large disconnect between people with similar ideas and environmental initiatives in Kyoto. Usually, people know each other and their general occupation, but they don’t know of specific ideas or upcoming projects. Sharing this project would likely help the network grow and give others the space to share any knowledge that could potentially result in Midori Farm getting involved in a new composting system. As was mentioned earlier in the report, by attending different events, our team was able to get contact information and learn about related environmental initiatives.

2. **Get involved officially:** Having a more structured involvement with the Kyoto City Zoo composting program could provide a more steady flow of compost for Midori Farm, which is very beneficial economically. Once officially registered, it would be a good idea to discuss the exact amount provided to be able to calculate additional yearly costs required to obtain compost elsewhere. The following website has steps on how to get involved officially in the program: [https://www5.city.kyoto.jp/zoo/lang/en/](https://www5.city.kyoto.jp/zoo/lang/en/).

3. **Test different options:** To produce crops successfully, Midori Farm should try to use high quality organic compost whenever possible. For this reason, as more potential providers are found, it would be a good idea to buy small amounts of compost before deciding to buy the required amount, 10 metric tonnes. Another option could be to diversify and reach this amount by combining products from different facilities.

4. **Form strong connections:** Part of building a network with people in the Kyoto area could be to maintain constant contact with them. These strong connections could be formed and result in learning more about environmental initiatives in the Kyoto Area. The team started developing this database, and all information collected can be found in the Contact List.
6. Advocate: Implementing a Composting System with Impact

Thus far, the other recommendations have been given with the short-term goal of finding a way for our sponsor to receive compost. While these recommended systems may be successful in achieving this goal, the problems of scaling these small solutions into long-term, sustainable solutions for Kyoto City still stand. For change to be possible, a small organization like Midori Farm needs substantial help from a larger entity to create a larger composting system with more impact. By introducing these ideas to Kyoto City Government, a more impactful composting system might be implemented throughout Kyoto city.

Importance of a Large Scale System

While the goal of finding a sustainable source of compost for Midori Farm is obtainable through the implementation of small scale composting systems, the social change brought about by smaller systems is limited. In order for substantial social change to be made, a city-wide composting system should be developed in Kyoto. Rather than develop the system with the goal of producing compost, the system would work towards the goal of limiting the food waste incinerated in Kyoto as much as possible. If a system like this were to be mandated by Kyoto City Government and incorporated into the already rigorous trash collection system, the overall environmental footprint left by Kyoto residents could be significantly reduced, which is a main goal of Midori Farm’s mission.

![Figure 6.1: A composting bin in Kyoto](image)

Kyoto City has attempted to implement composting systems throughout the city in the past. Kyoto seems to have an existing program which allows communities to have composting machines, as shown above in Figure 6.1, installed in the community, as long as a number of community members show interest (生ごみのコミュニティ堆肥化, (n.d.). After speaking to Kyoto residents about this, many people have never heard of this program nor seen any of these machines around Kyoto. Given these circumstances, our team was unable to identify whether any of these machines are currently actively being used around the city or not. If these machines are inactive, bringing back this system and having more of these machines installed will be a step forward for Kyoto City, but the system still has substantial room for improvement.

Model Composting Systems

When proposing a change as significant as the development of a city-wide composting system, showing other successful systems may be the best way to prove to Kyoto City that this change is beneficial. With this in mind, our team researched existing composting programs in surrounding prefectures to be used as examples of successful systems in the future.

The best example of an existing composting system in a neighboring prefecture that was found was Shiga Prefecture’s Nichiei composting facility. Although many of the details are lost in translation, Shiga’s composting program allows residents to leave their organic waste in designated composting bins around the prefecture. The waste is then collected regularly, processed in a centralized facility, and delivered to organic waste providers who are interested in receiving the finished compost. More
information on this system can be found on the facility’s website found [here](#).

Other prefectures in Japan also contain composting systems that handle the organic waste of a large population. Kanagawa has a system that can handle 410 tons of organic waste, in the form of sludge, in a month to form 3 metric tons of compost per day (Madokoro, Motohori, & Hirose, 2001, p. 71). Some international cities, such as Seoul, boast sustainable organic waste management systems. Seoul has a pay–as–you–throw system where “food waste must go in standard waste bags that are purchased by the consumer, or a chip– or RFID–based” (Yu, 2012). This system has led to a reduction in food waste between 10–30% and reuse of organic waste (Yu, 2012). As mentioned before, Kyoto city has no comparable organic waste management program.

**Disconnect from Kyoto**

Our team has identified three major points of disconnect that prevent Midori Farm from bringing large scale initiatives to Kyoto Government. The most notable points leading to this disconnect are:

- Cultural and language barrier
- Location
- Organization size

The most difficult barrier that needs to be overcome in order for ideas to be brought to Kyoto City Government is the cultural difference and language barrier. Although our sponsor has resided in Japan for 21 years, there remains a large cultural difference between any member of the expat community and a native Japanese person. As the majority of those involved in Kyoto City Government are from Japan, it may be difficult to have ideas brought forward by an expat like our sponsor would be taken into consideration on a city–wide level. Additionally, even after living in Japan for a significant amount of time, the inherent language barrier between expats and native Japanese speakers still exists. Japanese is an extremely difficult language to learn, and even years of experience in conversational Japanese is not enough to communicate on a respectable, professional level.

An additional factor leading to the disconnect between Midori Farm and Kyoto is location. Although our sponsor personally is a Kyoto resident, Midori Farm is located in the mountains of Shiga Prefecture, outside of Takashima City. Because Midori Farm is not actually located in Kyoto, it may be difficult for our sponsor to represent himself through an organization that seemingly has no direct connection to Kyoto.

The third factor leading to a disconnect between Midori Farm and Kyoto is size. Currently, Midori Farm is run solely by our sponsor, with the help of a couple volunteers that rotate throughout the year. Without a larger number of members, it seems unlikely that Kyoto City Government would take potential initiative ideas from Midori Farm into consideration.

**Help from Other Organizations**

Given these points of disconnect, our team recognized the need for Midori Farm to collaborate with larger, sustainability–centered organizations who are already well–established in Kyoto. As a result of our networking efforts throughout our time in Japan, our team has identified two organizations that could potentially be very useful in helping bring a city–wide composting initiative to Kyoto City Government: Escola and Food Hub & Labo. Our team has identified these two organizations due to their existing involvements in environmental initiatives in Kyoto, as well as their larger size and substantial member involvement.

Additionally, our team recommends that Midori Farm continue to build connections with the local universities in Kyoto, specifically Kyoto University and Ritsumeikan University. Through our team’s networking experience’s, it became
clear that many attendees of sustainability events in Kyoto are university students looking to get more involved off-campus. Collaborating with university students in efforts to advocate towards Kyoto City Government will certainly help to portray the concern from the younger generations in Kyoto.
7. Conclusions and Recommendations For the Future

The Kyoto Composting Project is just getting started. Based on the research conducted and the contacts made, community members are extremely interested in a composting system in Kyoto. Many organizations and individuals have expressed their concern with the state of the environment worldwide, and their willingness to help. With the help of these individuals and organizations, substantial improvements to Kyoto's waste management systems are possible. The Conclusion contains a final list of recommendations and a timeline of actions that should be implemented to continue this initiative into the future.

Final Recommendation

Based on the results we found, building a composting system at Midori Farm is the best option in the short-term for Midori Farm as an organization. This option is the least expensive, and has the least requirements to be satisfied, therefore making it the easiest to implement in the near future. As outlined in the Build: Creating a Composting System at Midori Farm chapter, creating a composting system at Midori Farm is most feasible because of the availability of land and volunteers. Additionally, this composting system still has enough social impact to be considered as a meaningful composting system. Building a composting system at Midori Farm is also practical because the compost is produced at the farm and requires less transportation of products. Lastly, a composting system at Midori Farm has the potential to be scaled and brought to other farms. If Midori Farms assumes an active social role in the system, as discussed in the Dissemination Recommendations section of the Build chapter, then creating a larger composting system is possible, especially when acting as a connection between waste contributors and organic farms such as Midori Farm.

A composting system in Kyoto would be ideal, however, would pose a significant challenge. Creating a composting system inside Kyoto city reduces the need for the transportation of waste and volunteers and increases the exposure of the system, as the system will be more accessible to Kyoto residents. By reducing the need for the extensive transportation of waste, environmental emissions are also reduced. Still, many more challenges have to be overcome by creating a composting system in the city. We recommend that creating a composting system in the city should be done with another organization, a collaborator. Ideally, a collaborator who has access to a plot of land or volunteers should be chosen. Creating a composting system with multiple collaborators is recommended. Due to the added step of processing compost at the collaborator location, an additional transportation method must be taken into account. While a composting system in Kyoto city might be more effective, it presents a challenge. Therefore, we recommend building a composting system at Midori Farm.

Following the extensive research for a composting system in the Kyoto, the team found that Kyoto city contained a significant number of environmental initiatives. Organizations that were non-governmental as well as government-sponsored were numerous and spread around the city. These organizations, such as Escola or ‘Do You Kyoto?’ have their own mission and environmental programs. Some organizations, such as Kyoto University or Food Hub & LABO, even have their own composting system. While creating a composting system at Midori Farm, might be the recommended option, we encourage Midori Farm to partner with organizations that can assist.
The Kyoto Composting Project

We found that many individuals and organizations are willing or candidates for donating their waste to a composting system. Supermarkets and residents around Kyoto can be approached for their green waste. Collecting brown waste is more difficult due to the short time available to collect. More waste contributors can be found in Appendix G: Waste Contributors. Waste contributors will need to be selected carefully for both a composting system at Midori Farm or a composting system in Kyoto.

Midori Farm identified the benefits of and the need for compost. After researching around Kyoto, we discovered numerous commercial and non-profit organizations offering compost both for free and at a price. These organizations are expanded upon and listed in Consume: A Plan for Compost Purchasing. Purchasing compost is a definite option alongside creating a composting system. If not enough compost is produced by Midori Farm’s own system, additional compost can be purchased.

Advocating presents a solution that Midori Farm should engage in to produce a composting system that is larger and more impactful. The power and resources of Midori Farm and this project are limited. However, by working together with Kyoto city’s numerous environmental organizations, Midori Farm can advocate to the Kyoto City Government, or another large corporation, to create a composting system. When advocating, Midori Farm should research and contact existing composting systems in other Japanese cities to learn more. Although this solution might result in a more impactful composting system, one that reaches a majority of Kyoto city’s population, it will take a long time. While we recommend building a composting system at Midori Farm, advocating can be done simultaneously. A functional composting system which is using Kyoto’s waste, will likely act as a good motivator and evidence of the functionality of a composting system. More can be read about advocating in the chapter Advocate.
The Kyoto Composting Project

Timeline

This report contains a significant amount of conclusions and results which culminate into many recommendations. This section aims to concretely explain and outline all the recommendations and convert them into action points. The timeline section is divided into Next Month, Next Season, Next Year, and Long Term. These divisions each handle the actions to take in that specific time period.

**Next Month**

The following tasks should be completed as soon as possible to get a head start on the composting system implementation.

1. **Choose brown and green waste contributors and collaborators:** Use the resources located in this paper to compile a more concentrated list of organizations that would be useful to a composting system of Midori Farm’s choice.

2. **Contact the above organizations/individuals:** Determine their interest in creating a composting system with Midori Farm, or supplying resources to the composting system.

3. **Obtain brown waste:** With the autumn season coming to a close, Midori Farm should try to obtain as much brown waste as possible in the form of leaves from listed contributors within the next month.

**Next Season**

During the winter season, Midori Farm will be closed and work on the farm will stop. This obstruction provides an opportunity to plan the logistical requirements of this system.

1. **Decide on a source of green waste:** First, a source of green waste should be locked in. Confirmation should be supplied by both parties, Midori Farm and the contributor, that composting will resume in the spring.

2. **Decide on a source of brown waste:** Regardless of the fact whether brown waste was brought to the farm, a permanent brown waste contributor should be found that can supply small amounts of waste at regular intervals or once per year.

3. **Apply for grants:** If a composting system in Kyoto City is chosen, Midori Farm should apply for the grants in the winter. However, some grants may require an active system to be issued.

4. **Determine compost suppliers:** If the Consume system is chosen, the winter season would be appropriate to find sources of compost. Midori Farm may also find compost vendors even if building its own composting system. Especially if the compost is free, Midori Farm should consider applying for the compost.

5. **Buy materials for the composting system:** Depending on what composting system is chosen by Midori Farm, the materials to run the composting system should be purchased. For a composting system at Midori Farm, a large bucket to transport the green waste to Midori Farm should be bought. Tools to maintain the composting system, such as rakes, forks and spades should be purchased.

6. **Outline land for the composting system:** At the end of the winter season, Midori Farm should travel to the composting location and outline where all the composting will take place. Land should be reserved and marked for the composting operation.

7. **Choose volunteers:** Depending on the location of the system, volunteers will have to be chosen.

8. **Choose transportation:** Depending on the type of system, transportation methods for the compost or the waste might have to be arranged.
Next Year

1. **Start collecting waste:** Green and brown waste should start being collected in the early spring and transported to the farm.
2. **Educate volunteers:** Midori Farm volunteers will have to be educated on maintaining a composting pile and its importance to the farm.
3. **Advertise the system:** The system should be advertised to various environmental organizations in an attempt to recruit more collaborators, volunteers and waste contributors.

Long Term

1. **Start advocating:** Once the composting system is operational, Midori Farm, and its collaborators, should step to the Kyoto City Government and lobby for a better means of organic waste management.
**Future Projects**

As our research only encompassed the preliminary steps necessary for composting to become widespread throughout the Kyoto area, our team has recognized several potential initiatives which could be pursued in future projects, dealing with primarily composting education, as well as the advocacy for and the implementation of a large scale composting system in Kyoto.

A project with the goal of educating both Kyoto residents and organic farmers about composting is a very feasible and necessary idea. For composting to eventually be widespread throughout Kyoto, composting and its benefits must become well known to those interested in composting, and the average Kyoto citizen. Composting is not a widespread practice in Japan, and aside from environmentally aware citizens, most people in Kyoto do not have the knowledge or necessary resources on how to begin composting on their own.

With proper education, these people may begin composting on their own, or even join existing initiatives around Kyoto. Even for those who are not interested in starting composting, an education platform that included information on the declining environmental situation would hopefully get people thinking about the importance of environmental initiatives.

Additionally, future projects should focus on advancing the advocacy portion of our project. One of the most noticeable issues that our team found while networking during the project was that many people are interested in environmental sustainability initiatives, but a severe lack of communication between these individuals and groups was evident. As this project has already compiled a list of contacts, a future project should create a more efficient means of communication that would allow for a combined effort to produce change, as opposed to every organization or person working on their own to produce results. This could potentially be accomplished through the development of a website or Facebook group specifically for this purpose, or simply strengthening Midori Farm’s social media presence in Kyoto.

After a more efficient means of communicating information is developed that allows for organizations to work together more efficiently, future work should be dedicated to the development of a proposal to bring towards Kyoto City Government for the implementation of a large scale composting system.

Finally, we recommend the continuation of our project. Midori Farm will require a significant amount of help in building any composting system. There are many logistical and processing requirements that must be met for the system to function. Many individuals and organizations have to be contacted to obtain their compost or organic waste. This project has a tremendous amount of potential to impact the environment of Japan through sustainable waste management.
Appendix A: Volunteer Interviews

The following questions were asked to volunteers during our team’s time visiting Midori Farm. The first set of interview questions were asked to one volunteer who had been at Midori Farm for several months, while the second set of questions were asked to a volunteer who had just recently arrived to begin his work.

Questions for Experienced Volunteer:

1. What made you want to volunteer for Midori Farm?
2. What were your expectations coming to Midori Farm?
3. Have your expectations been met?
   a. Why or why not?
4. Do you enjoy working for Midori Farm?
5. How much did you know about farming?
   a. How much do you know now?
6. How much did you know about composting?
   a. How much do you know now?
7. What is the process you follow for composting at Midori Farm?
   a. What are some flaws in this process?
   b. What would you improve?
8. What is your daily routine at Midori Farm?
9. How much time do you spend working every week?
10. What projects have you worked on at the farm?
   a. How long have you worked on this project?
   b. How much longer do you think it will take to finish?
11. What are some past projects that succeeded?
12. What are some past projects that failed?
   a. Why did this project fail?
   b. What is the relationship between Midori Farm and the surrounding residents?

Questions for Inexperienced Volunteer:

1. What made you want to volunteer for Midori Farm?
2. What were your expectations coming to Midori Farm?
3. How much do you know about farming?
4. How much do you know about composting?
5. What is your expected daily routine at Midori Farm?
6. How much time do you think you will spend working every week?
7. What projects do you think you will work on at the farm?
8. What is the relationship between Midori Farm and the surrounding residents?
Appendix B: Contact List

The following is a list of contacts compiled over the course of our team’s time in Kyoto. The following contacts have expressed interest in our project specifically, as well as working with Midori Farm on other projects in the future.

<table>
<thead>
<tr>
<th>Contact Name</th>
<th>Description</th>
<th>Organization</th>
<th>Contact Information</th>
<th>Notes</th>
<th>Method of Contact</th>
<th>Benefits for Midori Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misuzu Asari</td>
<td>Professor, Food and Sustainability Event Organizer</td>
<td>Kyoto University</td>
<td><a href="mailto:mezase530@gmail.com">mezase530@gmail.com</a></td>
<td>Organizer of the Food and Sustainability Event in Kyoto University. A professor at Kyoto University who has done significant research on waste reduction. Associated with Kyoto University’s composting program.</td>
<td>Kyoto University Food and Sustainability Event</td>
<td>Point of contact to either collaborate with or receive finished compost from the Kyoto University Composting Program.</td>
</tr>
<tr>
<td>Robin Rauner</td>
<td>International Undergraduate Student</td>
<td>Ritsumeikan University</td>
<td><a href="mailto:robinrrauner@gmail.com">robinrrauner@gmail.com</a></td>
<td>An individual who is very interested in helping with this project, possibly as a volunteer or helping students acclimate to the project in general.</td>
<td>PechaKucha Night</td>
<td>Potential volunteer at the farm or replacement for Mika for next year’s students in this project.</td>
</tr>
<tr>
<td>Yokomine San</td>
<td>Organic Egg Farmer</td>
<td>N/A</td>
<td>090-8756-0302</td>
<td>Organic egg farmer located north of Ibaraki City in Osaka. Interested in giving his chicken manure away to help clean up his own farm.</td>
<td>Frank Nappa's Farmers Market</td>
<td>Potential organic chicken manure contributor.</td>
</tr>
<tr>
<td>Kubo-San</td>
<td>Manager</td>
<td>Forest Green Park Memories Resort, Kutsuki</td>
<td><a href="mailto:h-kubo@gp-kutsuki.com">h-kubo@gp-kutsuki.com</a></td>
<td>Manager of Forest Green Park Memories Resort. Informed us about the composting system at the resort, where they compost their food waste and sell the compost. He said they don't have a specific use for the leaves and that Takashima City</td>
<td>Forest Green Park Memories Resort</td>
<td>Manager of a resort in close proximity to Midori Farm that could potentially supply large quantities of dead leaves for composting.</td>
</tr>
<tr>
<td>Name</td>
<td>Role</td>
<td>Contact Information</td>
<td>Description</td>
<td>Event</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>---------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Steven McGreevy</td>
<td>Doctor at Kyoto University, Environmental worker</td>
<td><a href="mailto:srmcgreevy@chikyu.ac.jp">srmcgreevy@chikyu.ac.jp</a></td>
<td>has a program to give leaves to farmers that need them. Main organizer of the FEAST project, while not directly involved in a composting project, this individual is very involved in the Kyoto sustainability movement.</td>
<td>Kyoto University Food and Sustainability Event</td>
<td>Very knowledgeable of composting and agriculture, recommended several existing composting facilities to look at in other prefectures.</td>
<td></td>
</tr>
<tr>
<td>Jerome Floerke</td>
<td>PechaKucha Presenter</td>
<td><a href="mailto:bffnarajapan@gmail.com">bffnarajapan@gmail.com</a></td>
<td>Has a sustainable/organic farm in Nara that hosts education events for nearby people. Uses compost in his personal garden.</td>
<td>PechaKucha Night</td>
<td>Could provide information on how he managed to get free wood chips delivered to him from the Nara Government, which could be applied to get leaves from Kyoto.</td>
<td></td>
</tr>
<tr>
<td>Raymond Kunikane Terhune</td>
<td>PR/Social Media Representative</td>
<td><a href="mailto:comms@mail2.adm.kyoto-u.ac.jp">comms@mail2.adm.kyoto-u.ac.jp</a></td>
<td>Knowledgeable of Kyoto University's programs and professors. Expressed interest in building connections between Midori Farm and Kyoto University.</td>
<td>Pecha Kucha Night Kyoto</td>
<td>Could help in getting involved with the Kyoto University Composting System.</td>
<td></td>
</tr>
<tr>
<td>Kumiko Nishijima</td>
<td>Professor</td>
<td><a href="mailto:nishijim@kyoto-sika.ac.jp">nishijim@kyoto-sika.ac.jp</a></td>
<td>Busy Professor who is interested in volunteering and composting at Midori Farm on weekends.</td>
<td>PechaKucha Night</td>
<td>Potential volunteer for the farm.</td>
<td></td>
</tr>
<tr>
<td>Nami Yamamoto</td>
<td>Owner of an organic farm</td>
<td><a href="mailto:yamamotonami@gmail.com">yamamotonami@gmail.com</a></td>
<td>An organic farmer that has a Teikei system similar to Midori Farm. Has a small composting process on her farm and is not directly assisting the project, but is interested in how Midori</td>
<td>Kyoto University Food and Sustainability Event</td>
<td>A point of contact to start building a large community around the idea of creating a composting system.</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Position/University</td>
<td>Contact Information</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximilian Spiegelberg</td>
<td>Environmental worker, Former Kyoto University Student</td>
<td><a href="mailto:spiegmax@chikyu.ac.jp">spiegmax@chikyu.ac.jp</a></td>
<td>Individual who works for the FEAST project and started an urban farm with composting at Kyoto University.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Motoki Akitsu</td>
<td>Professor, Vice-dean of Division of Natural Resource Economics Kyoto University</td>
<td><a href="mailto:akitsu@kais.kyoto-u.ac.jp">akitsu@kais.kyoto-u.ac.jp</a></td>
<td>One of the organizers of the Kyoto University Food and Sustainability Event.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulysse Baeta</td>
<td>Student, Doshisha University</td>
<td><a href="mailto:ulysse2jade@yahoo.fr">ulysse2jade@yahoo.fr</a></td>
<td>Part of the Ecological Association at Doshisha University.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryo Iwahashi</td>
<td>PhD Student, Kyoto University</td>
<td><a href="mailto:iwashashi.ryo.48v@st.kyoto-u.ac.jp">iwashashi.ryo.48v@st.kyoto-u.ac.jp</a></td>
<td>Presenter at the Kyoto University Food and Sustainability Event. Presented about split organic farming.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maeda Asuka</td>
<td>Kawasaki City Civil Servant</td>
<td><a href="mailto:maeda-as@city.kawasaki.jp">maeda-as@city.kawasaki.jp</a>; <a href="mailto:30genryo@city.kawasaki.jp">30genryo@city.kawasaki.jp</a></td>
<td>Individual at the Food and Sustainability Conference who was associated with creating the composting subsidy program in Kawasaki city. Only speaks Japanese.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Farm will develop a composting system. Kyoto University Food and Sustainability Event

Could provide a small amount of land or information on this purpose for Midori Farm's composting system.

Potential contact point for future collaboration with Kyoto University.

Interested in possibly volunteering for the composting system in the future.

Student that may know other students in the environmental program who are interested in collaborating for a composting system.

Example system in Kawasaki city could serve to advocate for a similar system to the Kyoto City Government.
# Appendix C: Complete Statistical Analysis

The following is a numerical analysis performed by our team to determine a number of requirements to produce 10 tons of compost, including amount of green and brown waste, as well as number of households, supermarkets, and restaurants that would be needed to supply this amount of waste, and more.  

## Compost Statistics

<table>
<thead>
<tr>
<th>Compost necessary per year</th>
<th>10000</th>
<th>kg / year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost Density</td>
<td>590</td>
<td>kg / m³</td>
</tr>
<tr>
<td><strong>Compost Volume</strong></td>
<td>16.94</td>
<td>m³</td>
</tr>
<tr>
<td>Shrink Factor</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td><strong>Unprocessed Compost Pile Volume</strong></td>
<td>21.18</td>
<td>m³</td>
</tr>
<tr>
<td>Ratio of Greens to Browns</td>
<td>1:3</td>
<td></td>
</tr>
<tr>
<td>Compost Mass Remainder</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td><strong>Mass of Browns Required</strong></td>
<td>18750</td>
<td>kg</td>
</tr>
<tr>
<td><strong>Mass of Greens Required</strong></td>
<td>6250</td>
<td>kg</td>
</tr>
</tbody>
</table>

## Generation Statistics

| Food waste generated per day per household | 0.437 | kg/day/Household |
| Food waste generated per day per supermarket | 38.1  | kg/day/Supermarket |
| Food waste generated per day per restaurant | 6     | kg/day/Restaurant |
| Food waste generated per year per household | 159.50| kg/year/Household |

## Waste Volume Statistics

| Density of Green Waste | 514 | kg/m³ |
| Total Volume of Green Waste | 12.15 | m³/year |
| Volume of Loose Dry Leaves Needed | 137.40 | m³/year |
| Volume of Shredded Dry Leaves Needed | 90.29 | m³/year |
| Total Volume of Waste | 149.56 | m³/year |
| Volume of Bucket | 1.3 | Gallons |
| Weight of Bucket | 2.52 | kg |
| Days to fill bucket | 5.78 | Days |
| Buckets Needed per Year | 2470.93 | Buckets |
| Buckets per Month | 205.91 | Buckets |
| Buckets per Week | 47.517 | Buckets |

## Leaf Statistics

| Leaf Density, loose and dry | 230 | lbs/yd³ |
| Leaf Density, shredded and dry | 350 | lbs/yd³ |
| Leaf Density, loose and dry | 136.45 | kg/m³ |
| Leaf Density, shredded and dry | 207.64 | kg/m³ |

---

6 Citations can be found in Statistical Analysis
### Area Statistics

<table>
<thead>
<tr>
<th>Area</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Composting field</td>
<td>1204.75 m²</td>
</tr>
<tr>
<td>Field 1</td>
<td>52.22 m²</td>
</tr>
<tr>
<td>Field 2</td>
<td>80.39 m²</td>
</tr>
<tr>
<td>Field 3</td>
<td>239.49 m²</td>
</tr>
<tr>
<td>Field 4</td>
<td>50.21 m²</td>
</tr>
<tr>
<td>Additional Rice Field</td>
<td>919.74 m²</td>
</tr>
<tr>
<td>Total Farm Area</td>
<td>2546.8 m²</td>
</tr>
<tr>
<td>Leaf pile radius</td>
<td>6.10 m</td>
</tr>
<tr>
<td>Leaf pile area</td>
<td>116.99 m²</td>
</tr>
<tr>
<td>Compost pile radius</td>
<td>3.03 m</td>
</tr>
<tr>
<td>Compost pile area</td>
<td>28.99 m²</td>
</tr>
<tr>
<td>Field Max Length</td>
<td>30 m</td>
</tr>
<tr>
<td>Field Max Width</td>
<td>20 m</td>
</tr>
</tbody>
</table>

### Transportation Statistics

<table>
<thead>
<tr>
<th>Location</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kyoto Downtown to Midori Farm</td>
<td>80</td>
</tr>
<tr>
<td>Driving</td>
<td>Minutes</td>
</tr>
<tr>
<td>Large Semi Trailer</td>
<td>90</td>
</tr>
<tr>
<td>Small Truck</td>
<td>47</td>
</tr>
<tr>
<td>Small Japanese Truck</td>
<td>2.87</td>
</tr>
<tr>
<td>Packing Efficiency</td>
<td>0.7</td>
</tr>
<tr>
<td>Large Semi-Tailers Required</td>
<td>2.37</td>
</tr>
<tr>
<td>Small Trucks</td>
<td>4.54</td>
</tr>
<tr>
<td>Kei Trucks</td>
<td>74.44</td>
</tr>
<tr>
<td>Transportation Time Large Semi-Tailers</td>
<td>379.85</td>
</tr>
<tr>
<td>Transportation Time Small Trucks</td>
<td>727.38</td>
</tr>
<tr>
<td>Transportation Time Kei Trucks</td>
<td>11911.90</td>
</tr>
<tr>
<td></td>
<td>Minutes</td>
</tr>
</tbody>
</table>
Appendix D: Budget Analysis for Composting at Midori Farm

These tables outline the projected costs in order to produce 10 tons of compost per year at Midori Farm. The projected costs necessary for any composting system can be found in the Implementation Costs and Maintenance Costs tables. Additionally, the costs associated with choosing vermicomposting or aerated static pile composting can be found below as well.

<table>
<thead>
<tr>
<th>Implementation Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compost</td>
<td>10 tons/year</td>
</tr>
<tr>
<td>Waste</td>
<td>25000 kg / year</td>
</tr>
<tr>
<td>Households</td>
<td>31</td>
</tr>
<tr>
<td>Number of 1.3 gallon buckets</td>
<td>1 per household</td>
</tr>
<tr>
<td>Cost of 1 bucket</td>
<td>¥2,595</td>
</tr>
<tr>
<td>Total cost for buckets</td>
<td>¥80,470</td>
</tr>
<tr>
<td>Size of big container to transport waste to Midori Farm</td>
<td>40.3 gallons</td>
</tr>
<tr>
<td>Cost of 40 gallon container</td>
<td>¥4,965</td>
</tr>
<tr>
<td>Total cost</td>
<td>¥88,030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volunteer cost</td>
<td>¥5,643/week</td>
</tr>
<tr>
<td>Number of volunteers</td>
<td>2</td>
</tr>
<tr>
<td>Time of labor</td>
<td>9 months / 36 weeks</td>
</tr>
<tr>
<td>Total cost per year</td>
<td>¥406,300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>First year (implementation + maintenance)</td>
<td>¥494,330</td>
</tr>
<tr>
<td>Other years (maintenance only)</td>
<td>¥406,300</td>
</tr>
</tbody>
</table>

---

7 All costs in this table were converted from USD to JPY and rounded up if necessary to account for uncertainties.
### The Kyoto Composting Project

<table>
<thead>
<tr>
<th>Additional costs for Vermicomposting</th>
<th>Total cost added</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worm to waste ratio</td>
<td>1:1</td>
</tr>
<tr>
<td>0.5 kg of worms</td>
<td>500 worms</td>
</tr>
<tr>
<td>Worms needed for 25,000 kg of waste</td>
<td>25,000 kg of worms = 25,000,000 worms</td>
</tr>
<tr>
<td>Worms for one day</td>
<td>68,494</td>
</tr>
<tr>
<td>Buckets (5,000 worms per bucket)</td>
<td>14</td>
</tr>
<tr>
<td>Cost of 1 worm bucket</td>
<td>¥9,588</td>
</tr>
<tr>
<td>Total cost</td>
<td>¥134,232</td>
</tr>
</tbody>
</table>

### Additional costs for Aerated Static Pile Composting

<table>
<thead>
<tr>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of windrows</td>
</tr>
<tr>
<td>Length of windrow</td>
</tr>
<tr>
<td>PVC pipe cost</td>
</tr>
<tr>
<td>Outdoor extension cord length</td>
</tr>
<tr>
<td>Outdoor extension cord cost</td>
</tr>
<tr>
<td>Compressor cost</td>
</tr>
<tr>
<td>Total cost</td>
</tr>
</tbody>
</table>
Appendix E: Option Evaluation for Composting at Midori Farm

The following table details the potential options for each requirement involved when implementing a composting system at Midori Farm, as well as the justifications as to why a given option was selected. The recommended options are colored in light green.

<table>
<thead>
<tr>
<th>Options</th>
<th>Justifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processing location</strong></td>
<td></td>
</tr>
<tr>
<td>Midori Farm</td>
<td>Plot of land already exists and belongs to Midori Farm, and is easily accessible for our sponsor.</td>
</tr>
<tr>
<td><strong>Composting technique</strong></td>
<td></td>
</tr>
<tr>
<td>Windrow composting</td>
<td>Windrow composting is the least expensive option, and it allows for maintenance to be performed quite easily. However, windrow composting is less efficient than other techniques.</td>
</tr>
<tr>
<td>Vermicomposting</td>
<td>Vermicomposting is the most costly option of the listed techniques due to the high cost of a large amount of worms. Vermicomposting would also require worms to be sorted out once compost is produced.</td>
</tr>
<tr>
<td>Aerated static pile composting</td>
<td>Aerated static piles would be the most technologically demanding, and require effort to build the system. System also requires electricity to supply air to the piles.</td>
</tr>
<tr>
<td><strong>Storage of leaves</strong></td>
<td></td>
</tr>
<tr>
<td>Wooden container</td>
<td>Wooden containers are commonly used to store leaves in composting systems, however the amount of leaves required would need a large container to be stored.</td>
</tr>
<tr>
<td>Tarp covering</td>
<td>Covering the leaf pile with a tarp is the best option if the leaves needed to be kept dry, but it will not allow for the compost to start happening.</td>
</tr>
<tr>
<td>Pile of leaves</td>
<td>Keeping the leaves in a simple pile will result in the leaves beginning the composting process on their own. This method also requires no other investments.</td>
</tr>
</tbody>
</table>
### Origin of greens

<table>
<thead>
<tr>
<th>Origin of greens</th>
<th>Kyoto Farmers’ Market customers</th>
<th>Midori Farm’s Teikei customers</th>
<th>Restaurants and hotel kitchens</th>
<th>Supermarkets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The customers of the Kyoto Farmers’ Market are known to have organic waste each week. The Farmers Market would also provide a location for our sponsor to receive organic waste from all contributors.</td>
<td>Midori Farm already has a well-established relationship with its teikei customers, and these customers would likely be the easiest to contact and communicate with regarding the system.</td>
<td>Restaurants and hotel kitchens have a large amount of organic waste to contribute. However, the green waste could possibly be mixed in with other unwanted substances like oils, which may be harmful to the soil.</td>
<td>Supermarkets in the area may contribute any unsold vegetables and other green waste to the composting system, and may also be able to deliver waste to Midori Farm using their trucks. However, communication with larger companies may prove to be difficult.</td>
</tr>
</tbody>
</table>

### Origin of browns

<table>
<thead>
<tr>
<th>Origin of browns</th>
<th>Kyoto City leaf program</th>
<th>Forest Green Park Memories Resort</th>
<th>Takashima city leaf program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Currently, no significant amount of available information exists regarding the Kyoto City leaf program online. Learning more about whether or not this is a feasible option may require a point of contact within the program.</td>
<td>Initial connections have already been built with the hotel staff of the resort, and can be easily contacted at <a href="mailto:h-kubo@gp-kutsuki.com">h-kubo@gp-kutsuki.com</a>. Hotel manager has already expressed that the resort collects large quantities of leaves and is unsure what to do with them.</td>
<td>Similar to Kyoto City leaf program, little information can be obtained about the program without a point of contact, and communication may be difficult. However, receiving leaves from Takashima rather than Kyoto would limit transportation time and cost.</td>
</tr>
</tbody>
</table>

### Green waste containers

| Green waste containers | 1.3 gallon buckets | 1.3 gallon buckets are the only reasonable option for green waste containers, as they would be most suitable to the amount of green waste one household may produce each week. |
5 gallon buckets

5 gallon buckets would be able to hold much more waste, however would likely take up too much space for transportation after being filled with waste.

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Truck rental</th>
<th>Renting a truck would allow large quantities of waste to be transported to the farm each trip. However, the cost of the truck rentals would likely become substantial over time.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponsor’s car</td>
<td></td>
<td>Although our sponsor’s car is a family vehicle, it should be large enough to bring a good amount of the green waste to Midori Farm each week. Also, as our sponsor makes trips to the farm every Monday, Wednesday, and Friday, it would be convenient as he is already planning to travel to the farm on those days.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labor</th>
<th>Midori Farm volunteers</th>
<th>Midori Farm’s volunteers are the best option for performing the maintenance and labor for the compost pile, as the volunteers reside at Midori Farm at all times.</th>
</tr>
</thead>
</table>
A Beginners’ Guide to Composting

The world is currently facing a food crisis, and Japan is no different. 14% of the waste produced in Kyoto is food waste, with approximately 17.1% of the food being completely untouched, and 62% of food being discarded even before its expiry date (Sakai, 2018). As Japan already imports the majority of its food, incinerating so much food waste is both an environmental issue, and an issue for the future of fresh produce in Japan. In order to combat this, composting has grown in popularity in recent years as a great way to reuse food waste for a good purpose.

What is composting?

Composting refers to the natural process in which microorganisms, such as bacteria and fungi, decompose organic matter (“Composting Process”, n.d.). This process creates a compost that is rich in nutrients, commonly used as a soil conditioner and fertilizer to improve soil structure, attract beneficial organisms, and keep the soil fertile for longer periods of time (“Composting Process”, n.d.), which is highly advantageous for organic farmers.

What goes into a compost pile?

In order for organic matter to decompose efficiently, a proper ratio of carbon and nitrogen is necessary. This ratio is achieved through a balance of carbon-rich material, called browns, and nitrogen-rich material, called greens (“Composting Materials”, 2017). For most purposes, the greens will be mostly made up of kitchen waste, while the browns mostly consist of dead leaves.

How is a compost pile maintained?

Several factors need to be maintained to keep a compost pile decomposing efficiently, including proper aeration, moisture, and temperature regulation. If these factors are not regulated properly, either the decomposition rate will become too slow, or the quality of the compost itself could be damaged (“Parameters Affecting...”, n.d.).

How is a compost pile kept healthy?

1. Water the compost pile occasionally, but make sure not to soak the pile. If it has rained recently, don’t worry about watering again!
2. Every so often, turning the compost pile will add enough oxygen to keep the process efficient.
3. Make sure the pile is always covered when the pile is not being watered or turned.
4. Although any organic waste can technically be composted, avoid putting things like meats and dairy into the compost. Meat and dairy products may attract insects and rodents to the pile.
# Appendix G: Waste Contributors

The following is a list of organizations and contacts compiled over the course of our team’s time in Kyoto that could potentially serve as waste contributors. This list includes organizations that could be a source of green or brown waste.

<table>
<thead>
<tr>
<th>Organization/Name</th>
<th>Description</th>
<th>Type of Waste</th>
<th>Contact Person</th>
<th>Contact Information</th>
<th>Benefits for Midori Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takashima City Leaf Program</td>
<td>Takashima City gives leaves to farmers for them to use as fertilizer.</td>
<td>Brown Waste</td>
<td>Kubo-san</td>
<td><a href="mailto:h-kubo@gp-kutsuki.com">h-kubo@gp-kutsuki.com</a></td>
<td>Source of brown waste that is free and easy to get involved with due to the location of the farm.</td>
</tr>
<tr>
<td>Do You Kyoto?</td>
<td>Organization that supports any environmentally conscientious initiatives in the Kyoto area.</td>
<td>Brown Waste</td>
<td>-</td>
<td><a href="mailto:info@doyou-kyoto.com">info@doyou-kyoto.com</a></td>
<td>Opportunity to participate in the leaf distribution program in Kyoto city.</td>
</tr>
<tr>
<td>Mesa Kitano Food Shop (メッサ北野)</td>
<td>A relatively small supermarket near Yokai Soho.</td>
<td>Green Waste</td>
<td>075-464-2850,</td>
<td><a href="http://www.mesakitano.com/1211/access.html">http://www.mesakitano.com/1211/access.html</a></td>
<td>A supermarket that might be willing to give free green waste to a composting system, especially one in Kyoto. It has been observed that they put out their green waste everyday at around 7:00 pm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organization/Name</th>
<th>Description</th>
<th>Type of Waste</th>
<th>Contact Person</th>
<th>Contact Information</th>
<th>Benefits for Midori Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yokomine San</strong></td>
<td>Organic egg farmer in the Osaka area. Interested in supplying chicken manure as green waste.</td>
<td><strong>Green Waste</strong></td>
<td><strong>Yokomine-san</strong></td>
<td>090-8756-0302</td>
<td>An organic Chicken farmer who is willing to give away his chicken manure for composting purposes.</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>------------------</td>
<td>-----------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>JA Facilities</strong></td>
<td>The Japanese Agricultural organization contains a significant amount of aid towards farmers. Midori Farm should investigate the extent and possibilities of JA further to determine feasibility in a composting system.</td>
<td>-</td>
<td>-</td>
<td><a href="https://kyo-ja.com/contact/">https://kyo-ja.com/contact/</a>, <a href="http://rice.kt.zennoh.or.jp/html/support_plant/support_plant_tyuou.html#support">http://rice.kt.zennoh.or.jp/html/support_plant/support_plant_tyuou.html#support</a></td>
<td>JA has numerous collection points and composting facilities in and around Kyoto. Through contact, it might be possible to obtain waste. These facilities handle anything from rice to yard trimmings.</td>
</tr>
<tr>
<td><strong>Kyoto University</strong></td>
<td>Kyoto University has a composting system that handles 20% of the leaves from the campus to produce 4-5 metric tons of compost.</td>
<td>Brown waste</td>
<td>Misuzu Asari</td>
<td><a href="mailto:mezase530@gmail.com">mezase530@gmail.com</a></td>
<td>If a collaboration between Midori Farm and Kyoto University is not possible, it might still be feasible to gain access to Kyoto University's leaves.</td>
</tr>
<tr>
<td><strong>Fushimi Create</strong></td>
<td>An environmental garbage collection company</td>
<td>Brown Waste</td>
<td>-</td>
<td><a href="mailto:info@fushimi-create.co.jp">info@fushimi-create.co.jp</a>, 075-922-3251</td>
<td>This company handles the waste of numerous large industries through composting and other methods of recycling. This company is environmentally driven to improve the waste management in Japan. Midori Farm should consider contacting them to determine sources of waste.</td>
</tr>
</tbody>
</table>
Appendix H: Collaborators

The following is a list of organizations and contacts compiled over the course of our team’s time in Kyoto that could potentially serve as collaborators of this system.

<table>
<thead>
<tr>
<th>Organization/Name</th>
<th>Description</th>
<th>Contact Person</th>
<th>Contact Information</th>
<th>Benefits for Midori Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escola</td>
<td>Self-sustained community near Kyoto Station with a space for living, working and events. Very involved with Seika University.</td>
<td>Léo Porte</td>
<td><a href="mailto:leomer.porte@gmail.com">leomer.porte@gmail.com</a></td>
<td>Potential location to build a composting system in Kyoto or to form a community of interested individuals from Seika University.</td>
</tr>
<tr>
<td>Kyoto University Composting Program</td>
<td>Vermicomposting program that produces 5–6 metric tons of compost per year with the help of 20% of the fallen leaves at the University.</td>
<td>Misuzu Asari</td>
<td><a href="mailto:mezase530@gmail.com">mezase530@gmail.com</a></td>
<td>Potential opportunity to collaborate and build a larger composting system, in a larger piece of land such as Midori Farm.</td>
</tr>
<tr>
<td>Do You Kyoto?</td>
<td>Organization that supports any environmentally conscientious initiatives in the Kyoto area.</td>
<td>-</td>
<td><a href="mailto:info@doyou-kyoto.com">info@doyou-kyoto.com</a></td>
<td>Contact that would potentially be willing to collaborate if the idea of composting in Kyoto was presented.</td>
</tr>
</tbody>
</table>
# Appendix I: Compost Contributors

The following is a list of organizations and contacts compiled over the course of our team’s time in Kyoto that could potentially serve as compost contributors. This list includes organizations that either commercialize compost or give it out for free.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
<th>Contact Person</th>
<th>Contact Information</th>
<th>Benefits for Midori Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Hub &amp; Labo</strong></td>
<td>Innovative restaurant with a composting facility located in Ohara.</td>
<td>-</td>
<td><a href="https://www.facebook.com/foodhubandlabo/">https://www.facebook.com/foodhubandlabo/</a></td>
<td>Compost is commercialized and produced in large quantities that Midori Farm could benefit from. The facility is open to visitors, which could present an opportunity for Midori Farm to observe detailed examples on how to build a composting system.</td>
</tr>
<tr>
<td><strong>Kyoto City Zoo</strong></td>
<td>Zoo with a composting system in place from which farmers can obtain free compost.</td>
<td>Léo Porte</td>
<td><a href="mailto:leomer.porte@gmail.com">leomer.porte@gmail.com</a></td>
<td>Potential steady source of compost for Midori Farm, if involved in the program officially.</td>
</tr>
<tr>
<td><strong>Kyoto University Composting Program</strong></td>
<td>Vermicomposting program that produces 5–6 metric tons of compost per year with the help of 20% of the fallen leaves at the University.</td>
<td>Misuzu Asari</td>
<td><a href="mailto:mezase530@gmail.com">mezase530@gmail.com</a></td>
<td>Potential steady source of compost for Midori Farm. Also a good source of information and a learning opportunity for composting techniques.</td>
</tr>
<tr>
<td><strong>Forest Green Park Memories</strong></td>
<td>Resort in Kutsuki (30 minute drive from the farm) that makes compost with their food waste and sells it.</td>
<td>Kubo-San</td>
<td><a href="mailto:h-kubo@gp-kutsuki.com">h-kubo@gp-kutsuki.com</a></td>
<td>Potential source of either compost to purchase or leaves.</td>
</tr>
<tr>
<td><strong>Lake Biwa Composting System</strong></td>
<td>Shiga Prefecture Seaweed Water Grass Compost Distribution</td>
<td>-</td>
<td>[<a href="mailto:dk00@pref.shiga.lg.jp">dk00@pref.shiga.lg.jp</a>, 077-528-3463, <a href="http://www.pref.shiga.lg.jp/d/saisei/files/mizukusa/muryouhhaihu.html">http://www.pref.shiga.lg.jp/d/saisei/files/mizukusa/muryouhhaihu.html</a>](<a href="mailto:dk00@pref.shiga.lg.jp">mailto:dk00@pref.shiga.lg.jp</a>, 077-528-3463, <a href="http://www.pref.shiga.lg.jp/d/saisei/files/mizukusa/muryouhhaihu.html">http://www.pref.shiga.lg.jp/d/saisei/files/mizukusa/muryouhhaihu.html</a>)</td>
<td>A source of compost for Midori Farm that is relatively nearby. It consists of composted Lake Biwa grass.</td>
</tr>
<tr>
<td><strong>Nikko Shiga Composting System</strong></td>
<td>Large-scale composting system in Shiga where waste contributors receive compost after 2 months.</td>
<td>-</td>
<td><a href="https://pro.form-mailer.jp/fms/d6ab25107211">Form to get involved: https://pro.form-mailer.jp/fms/d6ab25107211</a></td>
<td>If more food waste than is processable is provided to Midori Farm, this system is an opportunity to give waste and eventually receive compost for free.</td>
</tr>
</tbody>
</table>
### The Kyoto Composting Project

<table>
<thead>
<tr>
<th>Composting System</th>
<th>Description</th>
<th>Resources</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yodo Clean</td>
<td>Large Scale commercial composting system in the Kyoto area</td>
<td><a href="http://yodo-clean.co.jp/compost.html">http://yodo-clean.co.jp/compost.html</a></td>
<td>Commercial compost available to be purchased within the city.</td>
</tr>
<tr>
<td>JA Ohara Compost Center</td>
<td>A large-scale composting center in Ohara, Kyoto prefecture.</td>
<td><a href="https://kyo-ja.com/about/store/compo.html">https://kyo-ja.com/about/store/compo.html</a></td>
<td>JA is a large Japanese farming collective. Based on our research, Midori Farm should investigate what resources JA has. At the Ohara composting facility, compost can be purchased for around 4000 Y/ton. <a href="http://www.kyochiku.com/images/products/oharanoh.pdf">http://www.kyochiku.com/images/products/oharanoh.pdf</a></td>
</tr>
<tr>
<td>Kyoto City Composting System</td>
<td>A small-scale composting system put in place by the Kyoto City Government.</td>
<td><a href="http://www.city.kyoto.lg.jp/kankyo/page/0000134424.html">http://www.city.kyoto.lg.jp/kankyo/page/0000134424.html</a></td>
<td>This composting is very small scale, with only a handful of composting units distributed around the city. If Midori Farm is interested, the compost produced by these units should be pursued. Currently, we do not know where the compost goes once finished.</td>
</tr>
<tr>
<td>Econo Mori</td>
<td>A commercial processor of food waste, branded as &quot;Kansai's largest food waste recycling system&quot;</td>
<td><a href="http://www.economori.com/">http://www.economori.com/</a>, 075-953-6100</td>
<td>While this is a large commercial company, Midori Farm should determine whether Econo Mori can be of assistance to supply compost or food waste.</td>
</tr>
</tbody>
</table>
Appendix J: Map of Midori Farm in Japan

An enlarged version of the map of Midori Farm in Japan as displayed in Figure 1.2.
Appendix K: Map of Midori Farm

An enlarged version of the map of Midori Farm as displayed in Figure 1.2
## Glossary

### Project Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Example</th>
<th>Collaborator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner</td>
<td>Any entity or organization that is willing to participate and assist in the project as a collaborator or contributor.</td>
<td>Collaborator, Contributor</td>
<td>Local governments, Residential communities</td>
</tr>
<tr>
<td>Contributor</td>
<td>A partner that can supply organic materials to the Midori Farm Composting Program. A contributor can be further identified as a brown or green waste contributor.</td>
<td>Hotels, Schools, Parks</td>
<td>Kyoto City Government, Kyoto Farmer’s Market</td>
</tr>
<tr>
<td>Brown-waste Contributor</td>
<td>A specific contributor that will supply waste with a high Carbon to Nitrogen ratio such as leaves.</td>
<td>Parks, Coffee Roasters</td>
<td></td>
</tr>
<tr>
<td>Green-waste Contributor</td>
<td>A specific contributor that will supply organic waste with a low Carbon to Nitrogen ratio. An example of green waste is kitchen scraps.</td>
<td>Residents, Hotels</td>
<td>Local organic farms, Volunteers</td>
</tr>
<tr>
<td>Collaborator</td>
<td>A partner that will assist in the development or maintenance of the composting program due to their personal interest in the project’s benefits.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Execution Collaborator</td>
<td>A collaborator that will assist in the development, maintenance or logistics of the composting program.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing Collaborator</td>
<td>A collaborator that will assist in the processing of the organic waste for the composting program.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bibliography


Midori Farm. (n.d.). Retrieved from https://www.midorifarm.net/


