

Tackling Food Insecurity Through Technology

2024



Team members:

1. Freshta wali
2. faiz rahim rahimi
3. farhad yaqoobi
4. Floran furmoly
5. bassir esmatyar

**Contents:**

[**1.** **Literature Review** 2](#_Toc186368147)

[**1.1 Introduction:** 2](#_Toc186368148)

[**2.** **Preparing Data Research**  5](#_Toc186368149)

[**2.1 Introduction:**  5](#_Toc186368150)

[**2.2 Organization:**  5](#_Toc186368151)

[**2.3 Data Description:** 5](#_Toc186368152)

[**2.5 Conclusion:** 6](#_Toc186368153)

[**2.6 Potential Challenges and Solutions:** 6](#_Toc186368154)

[**2.7 Long-term Vision:** 6](#_Toc186368155)

[**3.** **Preparing Your Technology Review** 6](#_Toc186368156)

[**3.1 Introduction:** 6](#_Toc186368157)

[**3.2 Technology Overview** 7](#_Toc186368158)

[**3.4 Relevance to Our Project:** 7](#_Toc186368159)

[**3.5 Sustainability Consideration:** 8](#_Toc186368160)

[**3.6 Conclusion:**  8](#_Toc186368161)

[**4. Reference list:** 8](#_Toc186368162)

# **Literature Review**

## **1.1 Introduction:**

Food waste occurs when food that is intended to be consumed is either thrown away, spoiled, or not used for various reasons. Food waste is a critical issue that society is facing, and it has been considered a priority issue on the world agenda. According to the United Nations (UN) [1] a one-third of food, which is approximately 1.3 billion tons and according to this source [2] over 931 million metric tons of food reportedly wasted each year. On the other hand, millions of people are struggling to get enough food to survive. According to WHO, the numbers of people affected by hunger have been consecutively growing: 3.1 billion people could not afford a healthy diet in 2020. The same happened in 2021 when 29.3% of the global population faced severe food insecurity. It is also predicted that in 2030, up to 670 million people will face food insecurity [3].

Food wastage not only decreases the availability of food, it also reduces the resources needed to produce food for future generations. The Economist Intelligence Unit mentions that Indonesia is a country with the second largest producer of food waste after Saudi Arabia, one person Indonesia annually produces 300 kg of food waste. While in Saudi Arabia, one man produces 427kg [3].

Over the past years, there has been growing interest in the development of novel solutions that could tackle food waste as a critical issue with substantial economic, social, and environmental impacts. This challenge needs innovative solutions to reduce food wastage and to ensure that the surplus available food reaches needy people. However, several studies and projects have focused on the design and implementation of such food-sharing platforms like Olio, Too Good To Go, Total Ctrl Home, etc., in linking individuals, communities, and organizations through reduced food waste and attainment of food sustainability. These apps/ platforms, while possessing similar features, slightly modified, allow individuals, restaurants, and other organizations to share surplus food. It also allows the user to post information about food availability, quantity, location, and pickup time, contact details, etc. Users in need of food can then search for options available in their area and arrange for pick-up.

Hong et al. [4] conducted a systematic literature review of scholarly articles on the topic of mobile applications and food waste. They identified 37 articles written by authors mostly from 25 developed countries. Italian scholars - 23 authors, published 9 articles, followed by France with 5, the UK with 5, Norway with 5, the Netherlands with 4, and the USA with 4. By continent, the authors are divided into 80 Europeans and 34 Asians. Only one article is from South American scholars, and none from Africa or Oceania. The first relevant paper was published in 2017, and only five were published in the first three years. In 2020, nine articles were published, an increase of three in 2021, and two in 2022. 86% (32 out of 37) of the articles were published in the last three years. The paper screened 59 active mobile apps and 12 prototypes enabling food waste reduction, considering innovation management, platform relationships and performance, and acceptance of platforms. The following are some of them:

Morilla et al. [5], on the other hand, developed a web application called Foodernity in the Philippines. As stated, food insecurity remains a critical issue in low-income areas, heightened by crises like the COVID-19, to which this solution aims to improve food access and reduce waste.

Yasith Chandula et al. [6] developed a web application called Food for All, which connects donors and recipients, something that is in shortage in Sri Lanka. This system addresses the need by connecting individuals with surplus resources to those in need, provides a platform to share information about food requirements, and enables organizations to raise funds for related projects. Admin verification ensures trust and prevents fraud.

Naik et al. [3], inspired by food wastage and safety concerns, created Foodlink, a system to connect NGOs and hotels. FoodLink makes use of technology in developing an easy-to-use platform with, for example, the K-Nearest Neighbors (KNN) algorithm. This platform matches surplus food from hotels with the best-fitted NGOs so that food is provided to the needy efficiently and as quickly as possible. FoodLink considers the shelf life of donated food to minimize waste, thereby ensuring food safety. This paper not only meets the current food delivery need but also will contribute to long-term food security.

DOĞAN et al. [7] studied the role of mobile applications that developed to prevent food waste. For this, they developed a research model based on relevant literature and tested it on 439 people that they accessed through social media. From the findings, it was found that people concerned about sustainability are found to be concerned about food waste and transform their attitude into sustainable purchase behavior on mobile applications selling food available with the purpose of preventing waste. This behavior is mediated by attitude towards mobile applications.

Frascascia et al. [8] carried out a survey on 283 Italian consumers about their willingness to use the apps. It shows that perceived usefulness and perceived ease of use positively affect the willingness to use mobile apps against food waste while perceived risks by potential users negatively influence such willingness. However, none of three consumer-related factors has been proved significant. The results of this paper offer managerial implications to the developers; related to how to advertise the app, how to improve the functionality, in order to raise consumers' willingness to use it.

Besides, Delft University of Technology has analyzed the efficiency of these platforms. Food sharing via such platforms has a good potential to reduce up to 40 percent food wastage, while there could be social and environmental added advantages too, it was reported [9]. Such food waste apps bear considerable potential for reducing various environmental and climate damages while being considered as an effective approach toward improving resource distribution.

As conclusion, the literature review shows that several developed countries have developed different web and mobile applications to share extra food with people in need as a way to reduce food waste. However, there is no practical web-based or mobile application currently available for Afghanistan-a country bearing a severe food security crisis due to long-term conflict, poverty, natural disasters, and low agricultural production. According to the most recent reports by the World Food Program and the World Bank, 12.4 million out of Afghanistan's 44.5 million population suffer from acute food insecurity, with 1 in 4 Afghans unsure where their next meal will come from [10], [11]. To address this gap, we have chosen to develop, as our capstone project, a web-based app that could play a vital role in connecting surplus food suppliers, like individuals, restaurants, wedding halls, NGOs, charitable organizations, and catering services, to donate unsold or excess food to individuals and families in dire need of food assistance within Afghanistan.

# **Preparing Data Research**

## **2.1 Introduction:**

We do realize that data research is important in our project, most specifically in the realization of patterns in food distribution and volunteer involvement. Because of the nature of this particular project, core data will be generated dynamically, through organizations signing up to provide food, and people registering their need for aid; hence no dataset pre-existed. The research questions we seek to answer revolve around how best to understand the flow of resources, identifying gaps in food distribution, and monitoring over time the impact of volunteer efforts. We thus need to conduct a deep exploratory analysis of this evolving dataset so that we make the system responsive to the real-world demands and adaptive to it.

## **2.2 Organization:**

Since we do not have a dataset yet, our data analysis will have a logical structure while data is being collected. We will categorize the data by the two major users: organizations providing food and people registering their needs. We will also be collecting data on volunteers who are ready to help. Thematic data organization and analysis will be developed in the following sequence: user registration, food offered, and tracking of volunteers, need types (e.g., urgent, moderate), location, and contact information.

## **2.3 Data Description:**

At this stage, we do not have any dataset. The actual data will be generated once we launch the platform and several organizations, people in need, and volunteers start their registration. The data initially will be filled in manually and kept in a database, although it is expected to evolve with the inclusion of machine learning for optimization. This database will be structured such that it is easy to retrieve food and volunteer data by location and urgency, which is an important aspect for the success of our project. We value the protection of user privacy and data security. All personal data that will be collected from individuals, organizations, and volunteers will be anonymized upon analysis and stored in a secure way to avoid unauthorized access. Data usage will follow ethical standards with respect to transparency for trustworthiness among stakeholders.

**2.4** **Data Analysis and Insights:**

As we collect our data, we then review it for key trends like, food distribution patterns, volunteer participation, needs Assessment. We will summarize such insights using descriptive statistics and visualizations once we collect enough data. Initial findings will help us in enhancing the functionality of the platform and decision-making.

## **2.5 Conclusion:**

Since we don't have the data to begin with, the same will be created through interactions of the continuous users of the platform. Key takeaways from the research would come out while collecting continuous data regarding the food distribution, volunteer contribution, and requirements of people in general. This shall serve as the sole basis for honing the system to effectively work towards the food vulnerability issue of Afghanistan.

**2.6 Potential Challenges and Solutions:**

Despite the strength of our intended approach, some challenges may well arise, including limited internet connectivity in remote areas and/or reluctance to share personal information. We will try to overcome such limitations by providing options for offline registration, mobile-friendly interfaces, and community outreach programs aimed at building trust and awareness.

## **2.7 Long-term Vision:**

In the long run, this platform would be an integral part of tussles against food insecurity not only within Afghanistan but also within regions faced with similar challenges. Partnerships would lie with local organizations and global aid agencies, creating a model which would be scalable and replicable for any place in the world.

1. **Preparing Your Technology Review**

**3.1 Introduction:**

This part highlights the technologies that will be needed in the development of a web application to handle food insecurity in Afghanistan. Since the project has two points of focus, namely food redistribution and emergency aid, the technologies discussed will be supporting the connecting of food vendors with people in need, especially in disaster areas. It is in this application that the core technologies come into play. Indeed, it is emphasized to tackle SDG 2: Zero Hunger via reducing food wastage and offering equitably better distribution of the food.

**3.2 Technology Overview Purpose:**

The below technologies support a web application that can be used for food redistribution and coordination of volunteers under an Emergency Food Assistance Plan and more regular food assistance under a Local Food Redistribution Plan.

**3.3 Key Features:**

**CRUD Operations:** To manage food and user data.

**Real-time Food Tracking:** It displays the availability of food.

**Sign-up Volunteer:** Volunteers to help in case of emergencies.

**Integrating Maps:** finding vendors and observing the availability of food.

**User Authentication & Data Validation:** It is expected to be trusted and secure.  
Such food-sharing websites, such as "Foodernity" from the Philippines and "Food for All" from Sri Lanka, have been able to bridge the gap between donors and recipients to help solve or at least alleviate the problem of food insecurity through the use of sharing technologies, such as CRUD operations and SQL databases for real-time tracking.

**3.4 Relevance to Our Project:**

**3.4.1 SQL Data Management:** It provides scalable storage in SQL databases, meaning more room to store user and vendor information to scale up the growing circle of users without affecting performance.

**3.4.2 Future Development:** Integrating machine learning in this ever-evolving system will increase food demand prediction and resource allocation to optimize food distribution, further enhancing the effectiveness of the app during disasters and otherwise.  
Comparison and Evaluation:

**3.4.3 Python:** The best option for a backend language due to its scalability, friendliness, and flexibility; it also provides support to a wide variety of machine learning tools out of the box and is highly supported within the community. PHP is very popular, but Python is more scalable and flexible; hence, it's not exactly the best option when trying to future-proof an application.  
Cost & Affordability: An open-source framework like Python provides solutions in SQL at very minimal cost, without compromising any amount on performance and scalability.

**3.4 Measuring Success:**

The impact will be monitored in terms of key indicators such as the number of served people, reduction in food waste, and volunteer engagements. Regular reporting on such metrics would help in refining the platform and demonstrating its effectiveness in light of SDG 2: Zero Hunger.

## **3.5 Sustainability Consideration:**

It shall therefore consider open-source technologies to facilitate sustainability and seek opportunities to solicit funding by forming various partnerships with humanitarian organizations so that cost-effective, scalable, uncompromising performance ensures growth.

**3.6 Conclusion:**

These discussed technologies therefore provide a very strong platform on which the issues of food security in Afghanistan could be pursued. The present work integrates data management, real-time tracking, and user-friendly interface and hence addresses SDG 2: Zero Hunger. Future development in machine learning and AI will further improve the prediction of food demand and optimization of resources, thereby making an effective difference to food security.

# **4. Reference list:**

[1] L. D. Zanetta *et al.*, “The use of food delivery apps during the COVID-19 pandemic in Brazil: The role of solidarity, perceived risk, and regional aspects,” *Food Research International*, vol. 149, p. 110671, Nov. 2021, doi: 10.1016/j.foodres.2021.110671.

[2] S. Rajendran and D. Rajeswari, “A Web-Based Platform to Reduce Food Wastage Through Women Organisation,” 2024, pp. 1–13. doi: 10.4018/979-8-3693-1435-7.ch001.

[3] C. Naik, M. Uplenchwar, S. Ingale, and S. Khatke, “Foodlink: Bridging the Gaps Between NGOs and Hotels,” 2024. Accessed: Dec. 28, 2024. [Online]. Available: https://www.ssgmce.ac.in/uploads/UG\_Projects/cse/202324/Project%20Report%20Gr.%20No.%2003\_2023-24.pdf

[4] J. Hong, A. Jaegler, and O. Gergaud, “Mobile applications to reduce food waste in supply chains: a systematic literature review,” *British Food Journal*, vol. 126, no. 2, pp. 509–530, Jan. 2024, doi: 10.1108/BFJ-09-2022-0742.

[5] J. A. R. Morilla, F. C. Bagsic, M. K. Dela Cruz, C. D. A. Patio, and E. R. Yabut, “Foodernity: A Mobile and Web Application for Food Sharing,” in *2021 1st International Conference in Information and Computing Research (iCORE)*, IEEE, Dec. 2021, pp. 90–95. doi: 10.1109/iCORE54267.2021.00035.

[6] Yasith Chandula, Akila Kavinda, Thushal Shaminda, Sachintha Gunaratne, D.I. De Silva, and Dulanji Cooray, “Food-For-All Web Application for Donation Management,” *International Journal of Engineering and Management Research*, vol. 12, no. 5, pp. 90–98, Oct. 2022, doi: 10.31033/ijemr.12.5.11.

[7] S. DOĞAN, U. PALA, and N. EKİCİ, “MOBILE APPLICATIONS AS A NEXT GENERATION SOLUTION TO PREVENT FOOD WASTE,” *Ege Akademik Bakis (Ege Academic Review)*, Oct. 2022, doi: 10.21121/eab.1181830.

[8] L. Fraccascia and A. Nastasi, “Mobile apps against food waste: Are consumers willing to use them? A survey research on Italian consumers,” *Resources, Conservation & Recycling Advances*, vol. 18, p. 200150, Oct. 2023, doi: 10.1016/j.rcradv.2023.200150.

[9] A. Coudard, E. Corbin, J. de Koning, A. Tukker, and J. M. Mogollón, “Global water and energy losses from consumer avoidable food waste,” *J Clean Prod*, vol. 326, p. 129342, Dec. 2021, doi: 10.1016/j.jclepro.2021.129342.

[10] WFP, “WFP Afghanistan Country Brief September 2024 ,” 2024. Accessed: Dec. 28, 2024. [Online]. Available: https://docs.wfp.org/api/documents/WFP-0000161755/download/?\_ga=2.221538909.450590725.1735382008-948851496.1735382008

[11] F. Hadad-Zervos and D. Umali-Deininger, “Building resilience to address Afghanistan’s food security crisis,” World Bank Blogs.