Mangez, Partagez.

Eat, Share.

Introducing...

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0 Abstract and Vision

Project Abstract

Foodlib' is our proposed system for reducing food waste by consumers in Paris. Each year, almost 4.8 million tons of food waste is generated by consumers across France: a massive amount, especially considering that there are needy people who struggle to afford or obtain food. We propose that a system of refrigerators and pantries be created across Paris into which consumers can put food which they know they will not use but which has not spoiled. Membership for both donors and recipients of the food will be just €1 a year (as a minimum), using a card or a smartphone app to unlock the station for food to be donated or taken. The food will be checked for hygiene, and transferred to a different compartment for use; spoiled food will be composted. People can then take the checked food freely at any time. The project will be rolled out across four key phases, with modifications made based on observations and feedback during the pilot phase. The project's effectiveness will be assessed by the number of users putting in and taking out food, and the amount of food redistributed or composted.

Foodlib': A Vision

You probably have food in your home that you know you won't eat. Right now, you'd probably throw it out - there's no alternative. Imagine, though, that there's a solution to dealing with that extra food, preventing its waste - and helping others with it. You put the food in your bag, and on your commute, pass by a Foodlib' station conveniently located outside a shop next to the Metro entrance- a place where food gets exchanged, for free. You tap your membership card, put your food into the "Food In" refrigerator and pantry, and label it. Then you go on your way knowing you've helped someone, and the environment too, with just a minute of your time. Later, the food is checked for hygiene by an inspector, who moves the food to the "Food Out" compartments. Someone else in the cooperative- a student, maybe, a hurried businessman, or a single parent- checks out the Foodlib' station on his way home, and sees the food you donated: he smiles and takes it for dinner tonight. This is Foodlib': a cooperative costing just €1 per year for membership, linking those with food they don't need, with those who want it.

1

The Issue: Background and Context

The United Nations' Sustainable Development Goals

The United Nations' Sustainable Development Goals[1] are the aims of the international community on how the world should be improved by 2030, to make the planet more peaceful and prosperous for all. Foodlib', in reducing food wastage in Paris, is a small part of this larger effort: fighting food wastage helps to make cities and human settlements more sustainable, and to ensure sustainable consumption and production patterns.

We also hope to help reduce inequality and eliminate hunger, by letting people of all incomes and social strata participate in our Foodlib' food-sharing community for a minimal cost.

Food Waste: A Global Issue

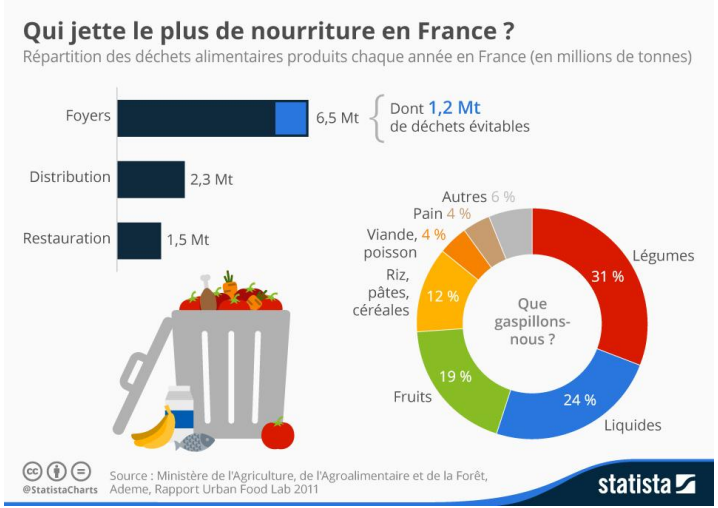
Food waste is an issue across the world. These sobering statistics show the vast amount of waste that we produce:

- Almost a third of the food produced for human consumption across the world is wasted. Each year, that's roughly 1.3 billion tonnes of food [2].
- Each year, US$990 billion is poured down the drain: the cost of food waste across the world [3].
- Each year, food wastage produces 3.3 billion tonnes of greenhouse gases (in CO_2 equivalent) [3].
- In the European Union, 53% of food waste is produced by households and consumers [4].
- From Europe alone, the food currently wasted each year could feed 200 million people [2].

It's clear that we have to act.

What About France?

France generates 7.1 million tons of food waste annually as of 2010 (with an increase in 2011 as seen in the diagram to the right), of which 11% is attributable to supermarkets, and 15% to restaurants. By far the most significant source of wastage is consumer waste: consumers throw away a massive 67% of all food waste in France [5]. This being the case, the French government aims to reduce food waste: earlier in 2016, it passed a law to force supermarkets occupying above 400m^2 of space to donate food that is about to expire to charities rather than disposing of the food in the trash or deliberately destroying the food to deter foragers [6].



Landfills: Where our wasted food goes, hidden from our eyes, to rot and produce methane and carbon dioxide.

How Food Waste Is Generated By Consumers

Typically, consumer food waste happens when purchased food is kept at home beyond its expiry date and sits unused by the consumer; most consumers do not take action to give it to somebody that will actually eat it. A similar process happens with food left at home when a person goes on holiday or away for some time. The problems with the current food consumption chain which cause this wastage of food are many: first, the connection between consumers and places when food can be collected is usually not clear for people- where should the consumer go to donate the food?

Secondly, even if the consumer knows where to go, it is often inconvenient for the average consumer to go to these charity donation points to deposit soon-to-expire food that they cannot use. Finally, it is common to donate canned or other preserved foods to charities for redistribution to the needy, but there are no common methods to quickly and easily donate other kinds of food to those who will need it- take, for example, a bottle of milk that will expire soon, and needs to be redistributed quickly to avoid wastage.

Food waste isn't considered a problem because, for the most part, it isn't considered at all. It's easy to ignore because it's both common and customary … I have yet to meet somebody who is pro-food waste, but many aren't convinced that it's important.

Jonathan Bloom

Journalist and Author of "American Wasteland: How America Throws Away Nearly Half of Its Food (and What We Can Do About It) [7]

Foodlib': Our Goals

We see a need to improve the process of dealing with unwanted food. One potential way of doing this is using refrigerators and pantries to collect food from consumers, and allowing this food to be taken by others: both those in need, and those who simply want a diversity of food.

We decided to focus on creating a system to reduce food waste, by redistributing food which is about to expire from those who have it, to those who want food: meeting our goals of reducing food waste, and helping the poor and disadvantaged by reducing hunger while doing it. Reducing food waste also helps to make the city of Paris more environmentally sustainable. It also tackles climate change, by reducing the carbon dioxide emissions generated from incineration of food waste disposed of in trash cans.

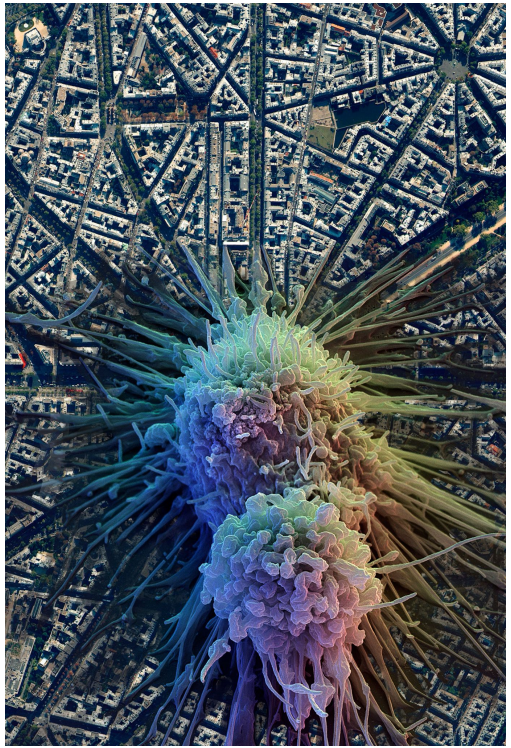
- **R**educe food waste
- **E**nvironment sustainability
- **R**educe hunger

2

Foodlib's Biology

The Biology Of The City

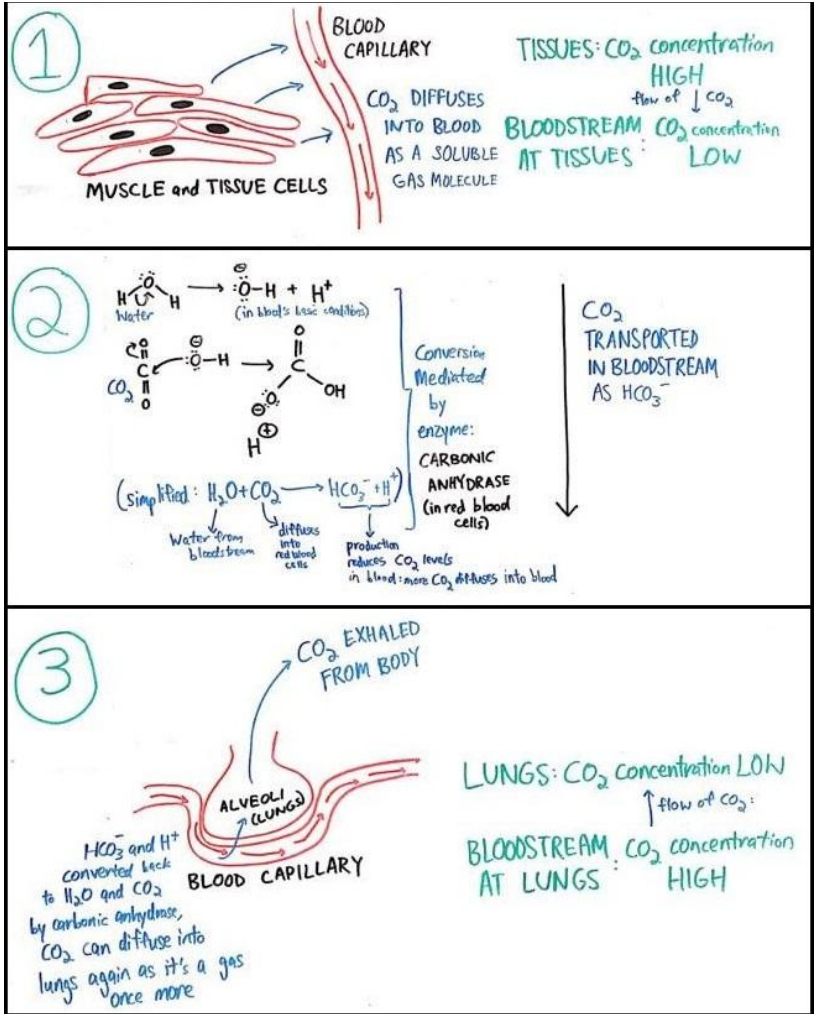
Cities mirror biological organisms in many ways: they can be born, grow, evolve, and die. Both organisms and cities have to deal with transportation as a critical part of their infrastructures, to survive. Organisms, for example, have to move their waste carbon dioxide (CO_2) out of the body. This carbon dioxide is produced in the cells by respiration, and must be transported to the lungs for exhalation into the atmosphere- where plants can then take in the CO_2 and generate energy using it, which can then be used as energy when the plant is eaten by another organism. Similarly, cities must deal with their waste, typically by transporting out of the city, or to a place where the waste can be repurposed; repurposed waste (like recycled paper) must then be transported back to a place in the city where it can be useful.



Carbonic Anhydrase And Carbon Dioxide

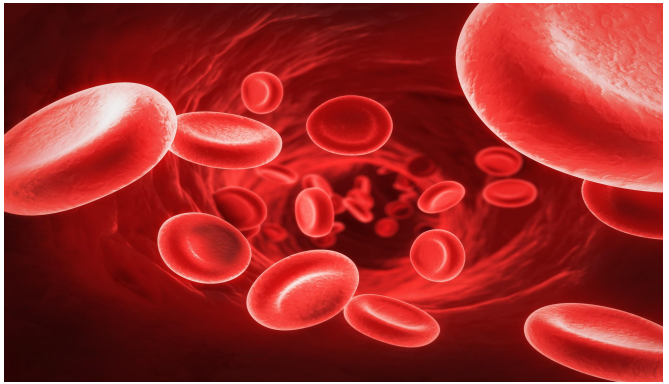
In the body, carbon dioxide build-up can affect blood conditions and cause poisoning. Therefore, the body needs an efficient way to move carbon dioxide rapidly and with high throughput from the cells to the lungs, using the bloodstream. Carbon dioxide is a gaseous molecule, and diffuses freely into the blood and into the red blood cells [8]. Diffusion takes place because there is more CO_2 in the tissues than the blood, so CO_2 moves down this gradient; however, dissolving CO_2 in the blood is not sufficient for removing CO_2 from the body. Thus, the red blood cells contain an enzyme called carbonic anhydrase [8], which reacts CO_2 with water to form two ions called HCO_3^- and H^+, allowing more CO_2 to diffuse down the concentration gradient into the blood to be converted (since there is now less CO_2 in the blood due to its conversion). When the blood reaches the lungs, the reverse reaction occurs, producing CO_2 which can then diffuse into the lungs for removal from the body.

How Carbon Dioxide Moves In The Body: From Tissues To Lungs



Foodlib': Carbonic Anhydrase For Paris's Food Waste

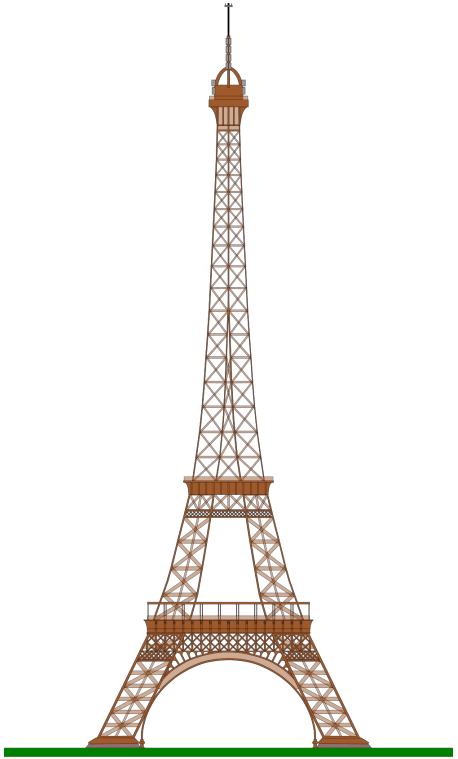
Given our goal of efficiently moving food waste from consumers with excess food, who have a high food concentration (like the CO_2 in the tissues), to people who want food, who have a low food concentration (like the CO_2 in the lungs), Foodlib' shares many similarities with carbonic anhydrase. Both are mechanisms for making the transport of the unwanted compound much more efficient and effective. Our role is to facilitate the movement of food that would otherwise be wasted by consumers (who have low food demand), to those who can use it; similarly, carbonic anhydrase facilitates the movement of carbon dioxide out of the body and into the lungs, from which the carbon dioxide can enter the atmosphere and become useful (through its usage by plants).



3 Foodlib's Audience

Who Is This For?

Foodlib's audience, broadly speaking, is the citizenry of Paris. More specifically, Foodlib' aims to connect Parisian consumers, and the food waste generated by each of us living in Paris, with those Parisians who want food- whether they are the less well-off, such as refugees or single parents; students; or just people who would like more diversity in their diet. As Foodlib' expands across the city, it can also begin to expand into nearby Parisian suburbs. Given that consumers currently have no option but to throw away food that they have kept for too long or which they no longer wish to eat, our system will make it convenient for consumers to dispose of this food in a way that is eco-friendly and helps other Parisians, through reducing food waste, and helping to compost food that cannot be passed on to others. The less well-off will directly benefit from getting free food to be eaten, without the stigma some people associate with asking charities for help: we hope that everyone will be comfortable using Foodlib', and without any stigmas associated with it- it's not just for the poor.



Homelessness In Paris

It is a well known fact that Paris has many people who are homeless, and who need help: however, Foodlib', while completely open to them, is not targeted directly at helping the homeless. According to Louis-Xavier Leca [9], founder of the Parisian social startup *Le Carillon*, which works with restaurants and enterprises in Paris's 11th Arrondissement to offer services to the homeless, homeless people in France generally are not in need of food: they receive donations from passersby and charities regularly, and in fact often waste food because they have too much and have no place to store it. That being the case, we decided not to focus on the homeless as recipients of the food: instead, we wanted to focus on all other demographics that can use the help offered by Foodlib' - for example, those who find buying produce in bulk to be too expensive, or those who just want to add some diversity to their diet and can stop by the refrigerator to find that: in other words, anyone who simply wants food.

4 Previous Approaches

Kochi, India

The idea of “community refrigerators” has already been implemented in several countries, helping us to understand how the systems could work, or the possible obstacles we might encounter. One example of this idea was implemented in a restaurant in Kochi, India; the owner installed a refrigerator in front of her establishment, into which she puts all the leftovers from her restaurant for the day [10]. This refrigerator is open to everyone, but helped the neediest people most.

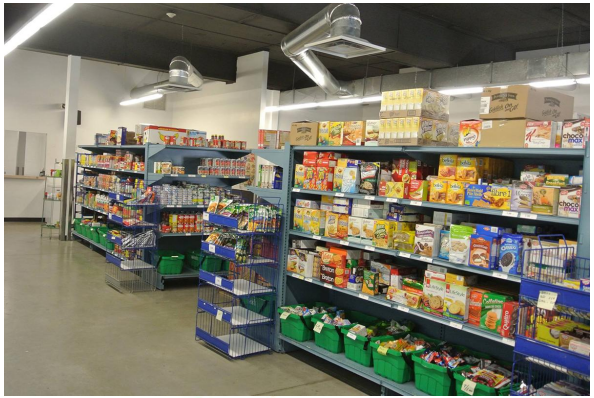
Galdakao, Basque Country

Another example of a community refrigerator was implemented in Galdakao in Basque Country [11], where people can put food that they won’t use, or that they cooked specially for others, into the refrigerator, so that homeless or needy people can have free food. One important aspect of the system in Galdakao was that there were rules on what food could be put into the refrigerator: no raw meat, fish or eggs could be put in, and all food donated needed to be tagged with the expiration date on it, or, if the food was cooked, with the date it was cooked.

What We've Learned From Others

These examples show us that our idea of reducing food waste by donating expiring food to those in need is viable: however, the ideas and laws implemented so far have tended to be small in scale, or focused on restaurants and supermarkets (such as the new French law mentioned above [6], which will be fully implemented by 2017). It also serves as a reminder that the safety of the food being donated has to checked for rigorously, to ensure that basic food safety and hygiene is not compromised: this is important for both public health and for trust in our proposed system, especially given that the food put in will reach its expiry date soon, by design.

Food Banks In Paris



In Paris, food banks already take donated food from the supermarkets and redistribute it through quality-control warehouses, to be passed on to charities which then redistribute the food to the needy and homeless [12]. The amount of food being processed by this system is set to rise as the new law mentioned above takes effect; food banks and charities are expanding their operations to avoid being overwhelmed. However, a different system is needed for consumers to donate soon-to-expire food: one that is convenient for consumers, to encourage them to donate of their own volition.

foodsharing In Germany And Austria

Foodsharing.de, a network of food-sharing refrigerators based in Germany and Austria, is the biggest and most similar system to that which we are proposing. Using a network of volunteers who save food from supermarket trash bins, and donors who donate their own expired food, the refrigerators are open to the community and anyone can take the food if they want to. Over 12,000 volunteers and 100,000 users have saved some 3 million kilograms of food since the program began in 2012 [13], proving the viability of the concept of giving food which would otherwise be wasted, to those who can use it. Besides using refrigerators and food storage space to transfer the food, people can also use the foodsharing.de website to inform others of food they want to donate, and to link up with those who wish to receive food.

Why We're Different

Both Foodlib' and *Foodsharing.de* are strengthened by the fact that they cater to all demographics – not just the needy as receivers, but all people as receivers, in order to avoid any stigma with taking food from the system. However, we differ from Foodsharing.de in our operating models and hygiene procedures. *Foodsharing.de* has recently come under fire for unhygienic practices, with Berlin authorities citing the refrigerators as a health hazard [14]. Foodlib' aims to be as hygienic as possible, by placing a hygiene check between the donated food items and their consumption, using trained inspectors; it also is fairly selective in what types of food are permissible and who can donate each kind of food (e.g. only restaurants and other certified producers of cooked food can donate cooked food). Foodlib' also has more tracking and monitoring of users and the food they put in, to prevent abuse and ensure quality of service, while preserving user privacy: our cooperative model helps build a sense of ownership and responsibility towards both the system and food waste.

5 Execution Plan

So What Exactly Is Foodlib'?

Foodlib' is a cooperative system: a community of members who together contribute a small amount of money each year to help reduce food waste, by donating food for others to use, as well as receiving food that others have donated. Centrally managed and run by the Foodlib' non-governmental organisation (NGO), this organisation will be staffed by full-time paid employees who oversee the cooperative's operations, legal responsibilities and management, from finances and implementation of Foodlib' and its planned expansion phases, to the food safety inspection system and liaising with partners, donors and the government. If Foodlib' is carbonic anhydrase, this NGO is the genetic code guiding its production and use.

How Do I Join?: Option I

The App/Website: Just download the app on your smartphone OR open the website, and use your credit card to pay a small fee of €1-5 for your membership for the year (it's your choice how much you want to give within this range!) If you want to donate more to support us, feel free to do so too. Fill in some more information (name, address, and date of birth), and then you're in! If you used the website, you'll be given a card with a QR code to print on paper and cut out to put in your wallet. Then, just go to the nearest Foodlib' station, scan your personal QR code from the app / printout on its scan reader, and the doors will unlock, letting you put in food or take it out from the station. Simple as that.

How Do I Join?: Option II

The Card: Alternatively, you can head down to the Foodlib' station, where you'll find a vending machine. Just enter your personal information on the inbuilt tablet screen, select how much you want to pay and/or donate for the year's membership (€1-5 fee, again), and pay with cash or coins: a card will be dispensed with your personal QR code which you can conveniently put in your wallet, and take out to scan on the reader to unlock the doors. When the membership expires, just get a new card and recycle the old one!

What Is A Foodlib' Station? (I)

Foodlib' stations, at their most basic, are a set-up of two stacked half-fridges and a pantry, which are locked except to members who scan their phone codes or tap their card to open the units. The upper half-fridge is for food to be donated: that's why it says "Food In", and has instructions on what food types are acceptable for donation and how to donate it (see next pages). The lower half-fridge is labelled "Food Out": it is for food to be taken by anyone who wants it, after inspectors check the food and transfer it from the "Food In" to the "Food Out" compartments. The pantry is for all non-perishable food, and similarly has an one section for donations and one section for people to take the food from: it, too, has guidelines on what food can be donated.

What Is A Foodlib' Station? (II)

The membership card also allows tracking of who puts food in or takes it out, while maintaining a low barrier to entry and usage of the system; it also allows Foodlib' to ban anyone who abuses the system, ensuring system resilience and security. Only those who have the membership QR code (on their card or phone) can open the doors of the refrigerators and pantry.

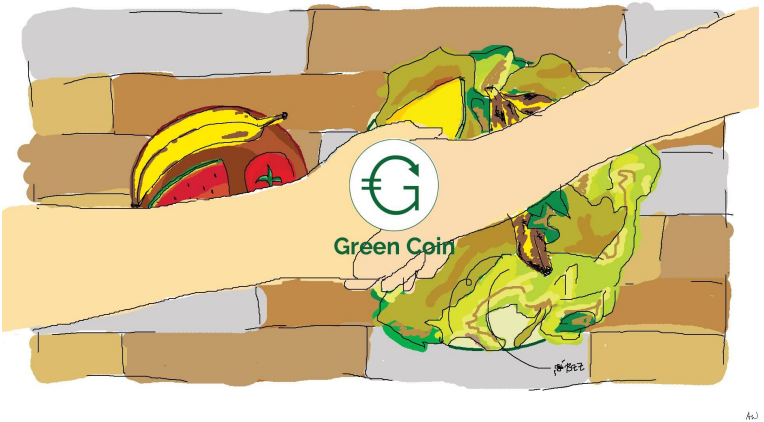
Additionally, each Foodlib' station, besides having the card readers, card dispenser, half-fridges and pantry, will also have several other key features: first, advertisement panels on the sides where there is space, to generate advertisement funding as well as explain the concept of Foodlib'. There will also be stickers and markers in the pantry and fridges' donation sections, that will allow people donating food to quickly write what the food they are donating is, and when it was donated. Trash and food waste bins will be placed a short distance away; safe anti-pest solutions will also be put in the pantry to prevent pests from entering and making the food unhygienic.

What Is A Foodlib' Station? (III)

Each shelter will also have various signs on the front and inside doors of the pantry and refrigerators, in line with a community-policing model, asking users to help compost or throw away clearly spoilt food if they see it, or to close the pantry/refrigerator if they see it left open. Additionally, the front doors of the refrigerators and pantry will feature buttons with smiley faces, which are connected to a digital counter: each user is requested to give the button a quick press if they put in food or take out food from the station and they're satisfied. Besides allowing data collection on satisfaction with the station, it also gives a psychological benefit that users are reminded that they are helping others, or have been helped by the others, leaving them to walk away happy.

Trash And Compost (I)

A short distance away from the set-up, a covered compost bin and a standard city trash bin will be placed. These will allow inspectors or users to place spoilt food into the compost bin: if users spot spoilt food inside the Food In compartment, they are encouraged to dispose of the food and its container in the compost and trash themselves. However, as Paris currently has no public composting system, we hope to use the Green Coin composting system proposed by Team 1 from our program: if their idea is implemented, then our volunteers can move the compost from the Foodlib' station to the Green Coin collection areas.



Trash And Compost (II)

Alternatively, the Foodlib' organisation will find local partners in each area near the Foodlib' station who make and use compost for their gardening and farming activities, to give the compostable material to them. Unfortunately, if both of these approaches are not workable, then the disposed food must be disposed of in the trash. Regardless, the trash and compost must be cleared daily for hygiene reasons.

Where Are Foodlib' Stations Located? (I)

We plan for Foodlib' stations, especially during the initial phases of implementation, to be located right outside shops which are next to the entrances of Metro stations: this would require us to find shopkeepers who are interested in supporting our cause, and who would be willing to provide electricity for the stations, as well as keep an eye on the stations to ensure its functionality and prevent anyone from tampering with the stations or other irresponsible actions and activities: if the stations are damaged or are not working, the shopkeepers will help to contact Foodlib' central management for repairs. The Foodlib' stations should be located outside the shop together with the other items that the shop places outside its interior, preferably under an awning for protection from the elements.

Where Are Foodlib' Stations Located? (II)

As Foodlib' expands (in Implementation Phase III), we will find more shopkeepers to help host Foodlib' stations, for example in neighbourhoods and near outdoor markets, which are not directly next to the Metro stations. We may also explore working with religious associations, such as churches, as hosts for our stations, fulfilling the same role as the shopkeepers in preventing abuse and malicious acts such as vandalism from taking place at our Foodlib' stations: given the moral authority of churches and the regular presence of people at the church, as well as the convenient locations of churches in various neighbourhoods, the churches and other religious buildings across Paris might be ideal locations to host Foodlib' stations.

Where Are Foodlib' Stations Located? (III)

We chose to locate Foodlib' stations outside Paris Metro stations rather than outside Parisian supermarkets, given that there are many more supermarkets than Metro stations, and thus it is more cost-effective to locate Foodlib' stations at Metro stations since so many Parisians commute using the Metro: we can thus reach more people with less stations in the initial stages. Later, we might incorporate supermarkets as hosts when the stations expand to neighbourhoods, if they are interested.

Ultimately, our goal is to make it convenient for consumers to drop off their food at the Foodlib' stations: just as carbonic anhydrase comes to the tissues in the red blood cells to allow carbon dioxide to easily move out of the tissues, so too does Foodlib' come to consumers. We are an enzyme for the city: a facilitator of the process of transporting food from where there's too much, to where there's not enough, and that means making it convenient and easy for people to both donate and receive food, by bringing Foodlib' close to them.

What Food Can Be Donated?

Uncooked Food

Almost all uncooked food can be donated by anybody: non-perishables to the pantries, and perishables to the refrigerators. However, opened liquids, raw meats and raw fish cannot be donated.

Cooked Food:

Cooked food can only be donated by restaurants and other certified food providers which are licensed to provide cooked food to the public by the government. When donating leftover food they have, they must label it with the date cooked, date donated, and ingredients used.

How Does Foodlib' Food Get Inspected And Used?

Each day (or, as the system expands, every few hours) inspectors will come to the Foodlib' stations to check the food for hygiene. Unhygienic and spoilt food will be disposed of in the compost or trash bins. Food that is safe will be stamped by the inspectors with an approval stamp or sticker as well as the date of inspection, and moved to the "Food Out" compartments. Both the "Food In" and "Food Out" half-fridges and the pantry will be checked by inspectors. Other tasks done by the inspectors will include regular cleanings of the refrigerators and pantry, as well as replacing the anti-pest installations as needed. People will be able to take inspected and stamped food from the "Food Out" compartment of the refrigerators at any time, whenever they come to the fridge and see something they want through the transparent door of that half-fridge. They will, however, be reminded to check the food for hygiene themselves before consuming it.

Who Inspects The Donated Food?

We hope to work with two groups of people who can help us to implement Foodlib' through conducting the all-important role of food inspection. First, since cooking school students are already knowledgeable about food and how to tell if produce is safe or spoilt, making an arrangement with cooking schools for their students to help inspect food donated to Foodlib' in return for school credit would allow Foodlib' to run while also letting students serve in an easy way aligned to their skills.

Secondly, we hope to work with the government's Civic Service, using this large pool of volunteers who sign up to work for good causes. Given that this is a dedicated group of people who will work on such causes regularly, it would be easy and relatively low-cost to train the volunteers in food hygiene inspecting and then deploy them to inspect the food regularly.

In this way, we can produce a regular roster of inspectors and inspection timings, to make sure that the stations will be checked frequently and that Foodlib' is a hygienic system that can be trusted by all.

What's Foodlib's Financial Model?

Cost Category	How The Cost Is Met
Initial Costs	Donations, Crowdsourcing and Grants from private sources: private foundations and charities
Inspector Training Costs	City Hall
Maintenance Fees	Cooperative membership fees
Expansion Costs	Donations, Public/Private Financial Support from corporations and City Hall, Crowdsourcing, Cooperative membership fees, and Advertisements (placed on the stations)

Foodlib': Financial Estimates For Each Station's Cost

We aim to minimize the cost of Foodlib' stations by using off-the-shelf components as much as possible, as well as using reused components.

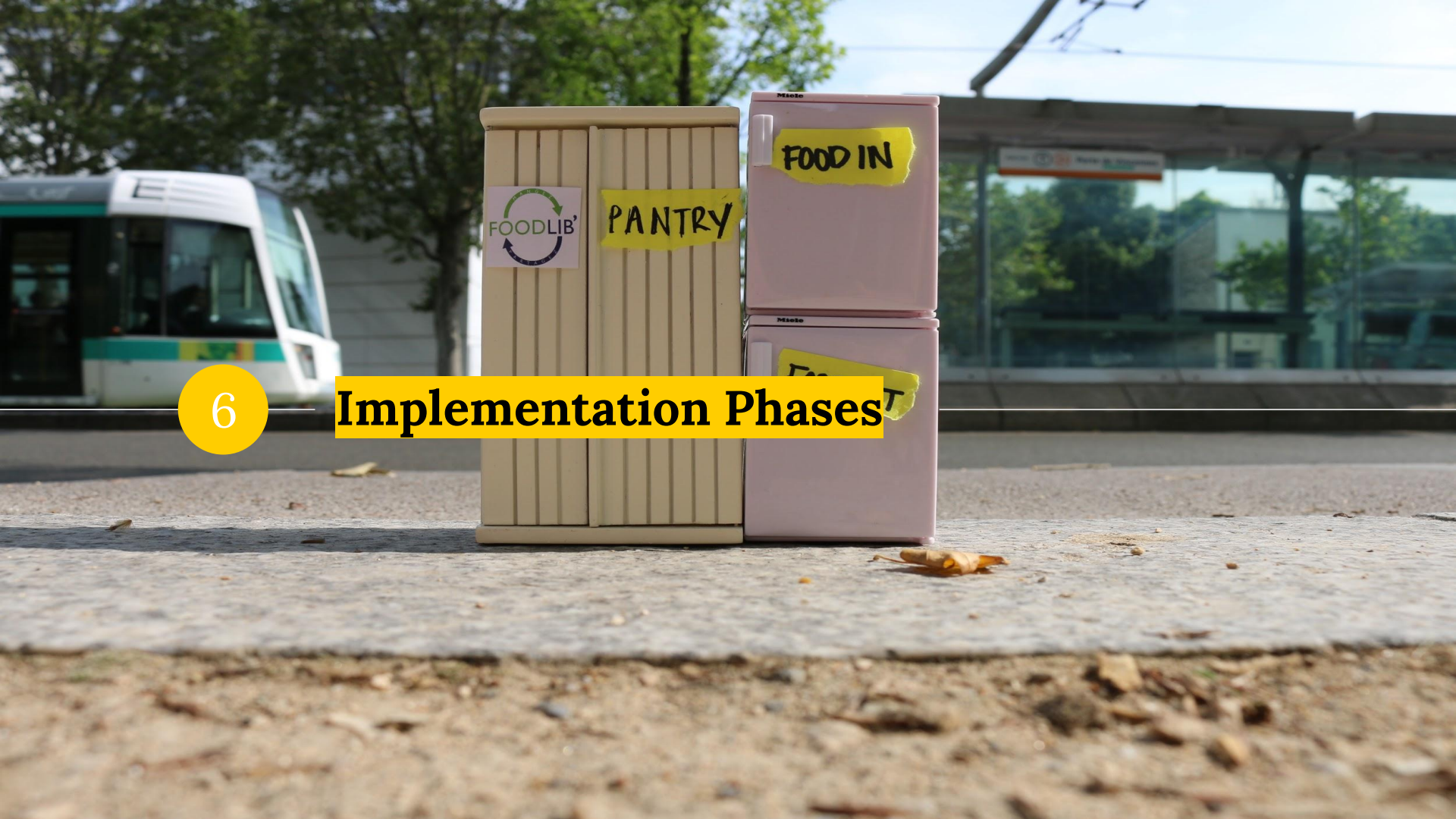
A range of potential costs has been given due to the variations inherent in using reused components, or choices between items of varying quality.

Component	Cost
Fridges (both)	100-150€
Pantry	50-100€
Tablet (includes QR code reader app)	50-100€
Card Dispenser	50€
Cards Supply	15-20€ / 500 cards
Installation Costs	100€
Total Estimated Cost For Each Foodlib' Station	375-520€

Foodlib's Organisational Model: City Hall + Publicity

We hope to work with the city of Paris's government to allow volunteers in the Service Civique (Civic Service) to be the inspectors for Foodlib', and cover the funding for the training of these volunteers in food hygiene.

Publicity is also critical to Foodlib's success, so the help of the government, media, private foundations and perhaps even the Paris Metro would help greatly in expanding public awareness of Foodlib', besides a Facebook and social media campaign, and the simple act of going out there and implementing Foodlib' for people to see as a successful project.



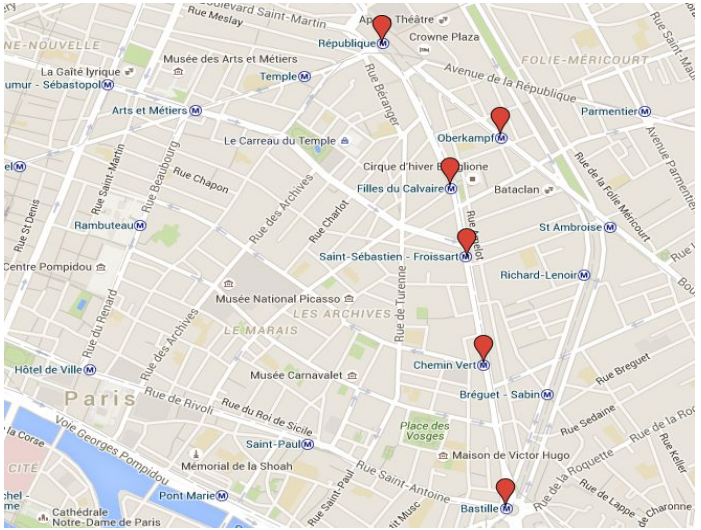
6 Implementation Phases

Implementation: Phase IA

The implementation of Foodlib' will take place across several key phases, starting with a pilot project in Phase I. Phase IA consists of the placement of stations in 6 Metro stations in the 11th arrondissement as shown. We chose the 11th arrondissement as it is also the site of a pilot project by a social project to help the homeless, Le Carillon[15], showing that residents in the area are interested in social causes. We also hope to work with Le Carillon to find initial volunteers as inspectors during Phase IA, and find shops willing to help the cause by hosting Foodlib' stations, since Le Carillon and its founder Louis-Xavier Leca have already expressed interest in helping us.

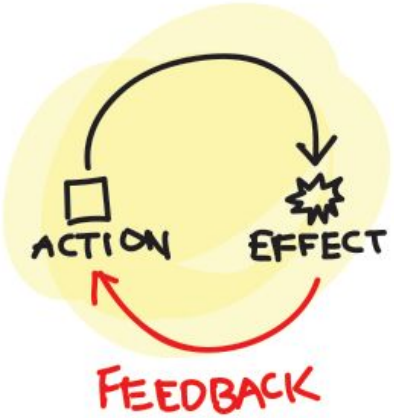
Phase IA would start with reduced inspector workload by having the stations open for donations and taking of food only on weekdays, and would be the beta-test for the system (and app).

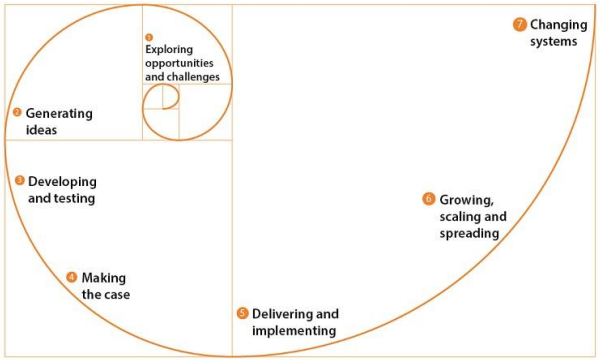
The stations would have links to the app and website for users to submit feedback for us to tweak or change the Foodlib' system as needed.



Implementation: Phase IB

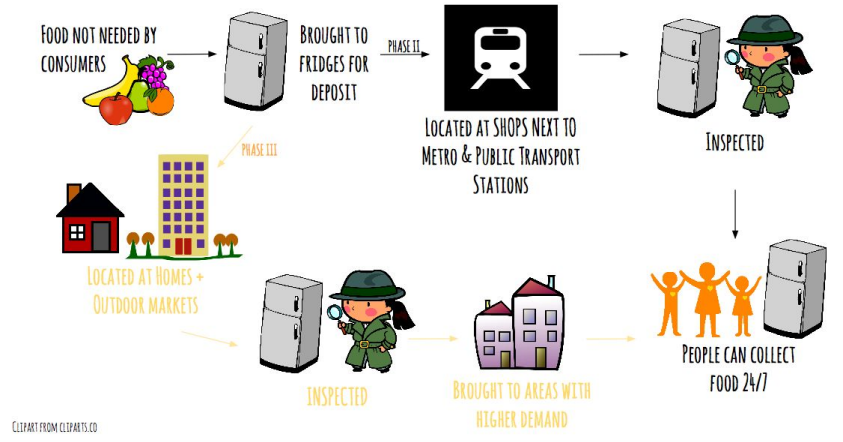
If Phase IA's pilot project succeeds, we hope to scale up the operations of the pilot project through a positive feedback loop, similar to what happens in biology when one stimulus causes a reaction which then reinforces the stimulus to cause the reaction to grow even stronger. In this case, the project working would help to build up publicity and awareness, attracting more members, and more funding, and enabling us to keep the stations open throughout each day and the week if we can show City Hall that our system works and they are interested in letting Civic Service volunteers work as Foodlib' inspectors. This positive feedback loop would then enable us to enter Phase II.





Implementation: Phase II And III

Phase II involves the expansion of Foodlib' stations to cover every Metro station across the Parisian metro network, allowing Parisians from all over the city to get involved in donating as well as using food. In Phase III, the Foodlib' stations would expand to neighbourhoods and outdoor markets, with even more members; the food might even be driven by inspectors to locations with greater numbers of those who want food, after inspection, for them to access the free food with the greatest possible convenience (see Assessment Plan for a discussion of this possibility). As these phases progress, Foodlib' may expand into nearby Parisian suburbs and their transport stops.



Implementation: Phase IV

The final stage of implementation is the most ambitious, requiring a large membership and financial base to invest in the increased cost. With Foodlib' scaled up and generating advertisement, membership and crowdsourcing revenue from across the city, it could look into investing in new technologies to ensure additional food safety, and implementing them in the stations. For example, food irradiation [16] and high-pressure food preservation [17] are technologies that hold promise for treatment of food to ensure food safety. The stations could also move to a more expensive dispenser-style model in which food is automatically sealed and treated upon insertion to the station, held until inspection, and then dispensed out vending-machine-style for users to take and eat.

7 Assessment Plan

Assessing Foodlib's Effectiveness

In order to assess how well our project is working, particularly in its pilot phase, we can use the following parameters:

- How many people join the Foodlib' cooperative, and how many inspectors help Foodlib' to operate;
- How much food is moving through the system;
- How much food the inspectors process can be used, and how much is unusable;
- How much food is composted; and
- How many people are satisfied with the Foodlib' system, using the buttons on each shelter and feedback.

The pilot project and phases of implementation will help inform us about the feasibility of Foodlib', and the feedback and observations from these will help us to resolve any unforeseen issues that may crop up. If abuse takes place (such as a person regularly emptying the station of items or vandalism), we can investigate the possibilities of appropriate fixes, such as paying more to integrate a weighing system into the station, that prevents users from taking more than a specified amount of food, or no longer having stations open 24/7 and instead asking station hosts to move the stations into shops overnight to be locked up.

Assessing Foodlib's Environmental Friendliness

Additionally, how much CO_2 is generated by the refrigerators will be tracked throughout each phase, and compared with the projected CO_2 emissions from the food waste which was reduced through Foodlib', to determine if the system ultimately reduces CO_2 output through reducing food waste, or if the extra emissions cancel out the benefits of saving food, and should be offset by, for example, powering Foodlib' stations with solar panels (despite the higher cost).

Similarly, in Phase III, CO_2 emissions from the vehicles used to move the food from areas of high food deposit to areas of high food demand by the needy should be tracked for the same purpose.

8

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