Project Nurture

The Digital, Data Driven Food Bank

Ali Almadan | Mani Nagappan | Poorna Chandrika Maddisetty | Rick Chakra | Snigdha Bose

Introduction and Problem Statement

Key social elements that were once considered common to all have become increasingly hard to reach by a growing number of people. This tear within the social fabric of our community has become too large to ignore as it has a significant impact on the conditions in which people live, grow, and learn. It may not be immediately apparent, but we are surrounded by people who are struggling for food, education, healthcare, housing, and employment.

These conditions have grown to become large barriers to entry for social mobility within our community, and if not corrected now, whole generations may be at risk of poverty. These conditions are not mutually exclusive - they are systemically embedded within our society, compounding the magnitude of their impact on the community. The majority of people in need struggle to meet most of these conditions, and one project cannot realistically solve for everything across employment, housing, healthcare, education, and hunger. Therefore, the key question to answer when trying to have a significant impact on social good is where to start.

From our research, we believe that targeting hunger is an actionable first-step to improving the social-mobility of our community and the lives of its members. Our team views the issue of hunger as an optimization problem that we can solve for by embedding digital technologies into key areas of the existing supply chain infrastructure and food distribution network. We do not need to change how we distribute food, we just need to improve the efficiency and visibility of the process - we call this Project Nurture.

Users, Stakeholders, and the Existing Process of Food Donations

The initial phase of Project Nurture was focused on needfinding. Our team understood the high-level need around hunger across our community, but we had to develop a detailed understanding of who our users and stakeholders were, and how the existing system facilitated the movement of food from suppliers to the hands of those in need. In addition to identifying the users and their goals, a key element in this phase of the project was identifying the pain-points, errors, and shortcuts they encountered within the existing process - elements we could leverage in our solution design.

During this phase of the project, we focused on the two core guiding principles of data collection: first, identifying our key stakeholders and second, understanding their needs through analysis of their behaviors, tools, and alternative solutions. To identify the right needfinding participants, we first performed a high-level evaluation of the existing system to understand the main parties and their interactions. From this evaluation, four main groups of stakeholders

emerged - the suppliers, the food bank, the agencies, and the community. Out of these four groups, the critical path of the process flowed through the food bank. Therefore, we decided to focus on Second Harvest Food Bank, our community's largest food bank, as well as its upstream suppliers and downstream recipients.

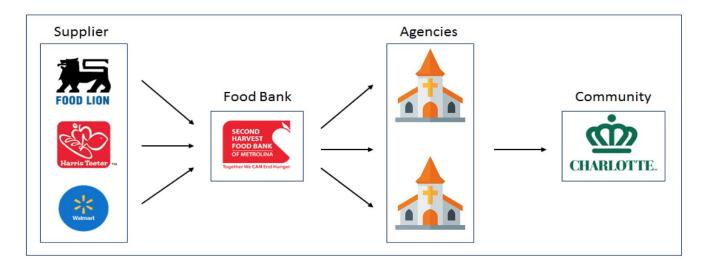


Figure 1 - Process flow of food donations from supplier, through the food bank, and into the community.

Needfinding at the Food Bank

Given the central role it plays in the overall process, we started our needfinding activities with Second Harvest Food Bank. Three researchers from our team scheduled an interview and observation session with our first user, the manager at Second Harvest Food Bank. Going into the interview, we had prepared a list of questions to ask during our contextual inquiry activity to help guide us towards an understand of their goals, processes, and pain-points. Similar to an ethnographic approach, we embedded ourselves into the manager's environment to get a first hand experience of the day-to-day operations of the food bank - instead of just leading the manager through our list of questions, we cooperated to develop our understanding of this specific user and their environment by using a semi-structured interview technique. We let the food bank manager lead use through a tour of the facility and we asked questions around specific observations along the way.

This also included an observation session of how they stock and manage inventory. We were extremely surprised at the lack of structure and organization at the food bank. As we discussed with the food bank manager, she explained how most of the work was done by various groups of volunteers and inventory was managed primarily on spreadsheets through a manual process. She explained that for them to know what they have in stock, they have to walk through their inventory and record any updates or changes on paper. It was immediately evident that inventory management would be a key area of improvement (Figure 2).



Figure 2 - (left) Old boxes mixed in with current inventory. (right) Volunteer taking inventory to be stocked. Multiple crates of food stacked on the left side of the image.

The manual process of receiving new donations, categorizing them into the appropriate bins, and storing them across various shelves was not designed to provide efficiency and tracking capabilities for the food bank; rather, this is the best they could do given their limited resources.

We were also able to observe our second type of user, the volunteers, during the inventory sorting process. We interviewed a participant with extensive food bank volunteer experience at a later date to better understand the details around the volunteering process. From our observation and interview sessions, we learned that these volunteers usually come in groups and are given a quick training session by an experienced individual before they start the inventory sorting process. This training covers the basics of how to sort various types of food and the requirements for discarding food items that do not meet safety standards. After training, the volunteers are stationed at different sorting tables, where they transfer food from the large boxes containing the items donated by the supplier to labeled crates containing similar food types (Figure 3). At this stage, anything that is not safe to distribute, either based on expiration date or packaging quality, is thrown away. This consists of a manual check performed by the volunteers for each food item. Due to the manual and relatively unstructured nature of this process, this was another area identified to as potential point of improvement.



Figure 3 - (*left*) Volunteers sort items at the various sorting tables. Unopened pallets of non-perishable items from the suppliers are stacked on the shelves - they are brought down for the volunteers to sort (*right*) Items stored in large crates after the sorting and grouping process performed by the volunteers.

According to Second Harvest Food Bank's annual report, these volunteers contribute over 162K hours and provide \$3.5 million in labor cost savings, thus a critical component in the process and a key user to understand.

After observing the unpackaging and sorting operations at the food bank, we transitioned to understanding how they source food from their various suppliers. The food bank manager provided us with a master spreadsheet that outlines the suppliers, agencies and routes utilized by the food bank (sample data in Exhibit A). She explained that the food bank sends 12 trucks every day to pick up donated inventory from local suppliers like Food Lion, Harris Teeter, and Walmart. The trucks are driven by our third key user group, the food bank's drivers. They are given a specific route to follow on a daily basis, and at their pick-up sites, the drivers have to estimate how much food they are receiving and do a rough count for inventory tracking purposes. They currently do not have an inventory scanning system to accurately track how much food they are receiving. Instead, the drivers write down on paper where they picked up the food and provide a count of the number of pallets. They are also tasked to estimate the total number of pounds of donated items they are receiving - another unstructured process that may be biased or skewed based on the driver.

If one driver calls in sick, then only 11 drivers are in service to pick up their routes. Based on the priority routes, each driver is reshuffled and stretched to meet the delivery needs. The food bank

does not have as system to track drivers, so scenarios like this often introduce confusion and chaos into the process. Similar to the other data gathering activities, we continued to build on to our mental models of how the system worked while identifying high priority areas for improvement.



Figure 4 - Second Harvest Food Bank truck (sourced from SHFB website)

During the needfinding process and to understand the capabilities of the information technology department at Second Harvest Food Bank, we were also able to interview their IT manager. The IT manager was able to give insight on what the food bank needs from a technological perspective. He also provided us with details regarding the infrastructure they have, such as hardware/virtual servers and operating systems, that can be used for Nurture. In addition, he mentioned some important features in Nurture that are essential for them such as donating money and tracking pickups/deliveries. During this interview and all the other interview, we asked the interviewees an open question: How do you think an app would help you do what you're doing? We found this simple question very effective in needfinding as we get them engage in the brainstorming process. "The idea is to have one central location for everything we do with all the fluff cut out. My experience is that people have no idea what it is that we do and have to offer or how they can help us. This app would simplify the user experience and allow all aspects of donating, volunteering, attending events, etc to be done on one pane of glass," the IT manager mentioned in his interview with the team.

Needfinding at the Suppliers

Using the information we learned through the needfinding activities with the food bank, we moved upstream to its suppliers to learn more about the role they play and the needs they have within the integrated donation process. In this phase of needfinding, we decided to target the two main suppliers, Food Lion and Harris Teeter, to better understand the goals, actions, and

responsibilities for the parties at the head of the distribution network. We had initially prepared a questionnaire (Exhibit B) with 10 questions ranging from the types of food/non-food donated and number of donations made per month, to the inefficiencies and pain-points in the existing process from the supplier's perspective. We quickly realized that sending the questionnaire through the online communication channels provided by the suppliers would not provide the quality of results we desired. Thus, we utilized a triangulation approach and sent different members of our team to take the questionnaire to the suppliers' stores and use it to guide their structured and semi-structured interview approaches with the store managers. These interviews were conducted at the Harris Teeter and Food Lion locations within University areas. Both major suppliers provided similar responses and insights into their role within the distribution network.

They prepare daily donation packages to be picked up by the Second Harvest Food Bank truck in the morning. The structure and process they follow is extremely simple and mostly automated. Their corporate office does the up-front coordination with the food bank and determines the specific details around donation frequency and types of items. The individual grocery stores then rely on their Enterprise Resource Planning (ERP) system to identify which items should be donated and which items should be thrown away based on the best-by/sell-by date. This selection process runs on a daily automated cycle. At the end of the day during clean-up and restocking, the employees transfer the inventory identified as "donate" to the donation crate and throw away any inventory marked as "dispose". There are rules built into their inventory system that dictate what the grocery store can and cannot donate. The managers we interviewed indicate that this is a very structured and time efficient process on their end - adding no extra work for them, as they have to evaluate inventory on a daily basis either way. They also mentioned that they cannot think of any technological solution to improve the process on their end.



Figure 5 - Crates of donated food items prepared by the suppliers for pickup by the food bank

Needfinding at the Agencies

To close the loop on the end-to-end process, we contacted the downstream agencies on the master list provided by the food bank manager. We wanted to get a better understanding of how the donated food was being moved out of the food bank and into the agencies responsible for distributing it to people in need. One of our interviews was with Central Church off of Union Road in Gastonia. They indicated that they usually source donated food from the food bank on a weekly basis. They do not know the specifics of the food they are receiving, but it is usually the general grocery store items like canned goods, non-perishables, water bottles, and frozen goods. They do not have an accurate metric to measure the type of foods received, instead they also go by weight. They have volunteers on their end that separate the food into family sized boxes to be further distributed. An interesting fact we learned about them is that they have a cut off of 90 families per week, and work to meet that number. This environmental constraint is not unique to them, as most churches have their own constraints due to staffing and time limitations.

We also learned that they receive specific requests and conduct community events. Therefore, they would benefit from being able to send requests upstream to the food bank for specific types and counts of items. This is another indication that improving the visibility and communication processes within the donation network would positively impact the overall effectiveness of the distribution of donated food.

Additional Data Gathering Techniques

We also incorporated additional data gathering techniques to complement our needfinding activities with the key stakeholders. These techniques included studying the existing documentation produced by the food bank and researching similar ERP systems utilized in inventory management. In terms of existing documentation, we were able to analyze Second Harvest Food Bank's Annual Report to get a better understanding of their activities and how they measure success. This documentation gave us insight into their key performance indicators, as it highlighted what they care about and how they evaluate their performance.

Our team also analyzed the existing landscape of inventory management systems to educate ourselves in the way for-profit companies manage their inventory with the accuracy they require to operate their businesses. The major players in the ERP space are companies like Oracle and Microsoft. They specialize in the deployment of large scale applications to support inventory management, but this software is extremely costly and complex to implement and operate. This is not something that could realistically be used by a non-profit food bank due to cost and technological constraints. On the other end of the application spectrum, a couple of applications exist to manage a small stock of specific items, but are more suitable for a small business rather than the food bank.

Problem Activities and Analysis

There is clearly an unmet need to improve how food moves from the suppliers to the hands of those in need. Based on our needfinding results, this need lies in the way the food bank manages their inventory within the constraints of their environment. After our initial needfinding activities, we synthesized our observations and learnings into a set of critical issues we could solve for to improve our targeted users' experiences and better align with their user goals. These critical issues revolved around the food bank's ability to efficiently source, manage, and distribute food, as well as its ability to manage its people and ensure they have what they need to be effective. We began to group these issues and potential resolutions into functional and non-functional requirements, as well as data and environmental requirements, allowing the high level problems to emerge from the patterns. The three main problem activities that emerged were within inventory management, inventory sourcing, and volunteer management.

Inventory Management

Since the food bank sits at the heart of the distribution network, their limited resources and highly manual processes created a bottleneck in the overall process. Compared to its upstream suppliers, the food bank has a primitive system to manage their inventory. While the suppliers relied on data-driven decisions and inventory tracking and flagging functionality within their ERP system to select and facilitate the donation of items, the food bank relied on estimations and manual record keeping to track the inventory they were sourcing. For example, when sourcing a box of donated potatoes, the food bank usually estimates the weight of the box and records it under a general category, like vegetables. This error-prone and time-consuming method of tracking inventory not only impacted the sourcing and stocking of donated items, it had downstream impacts as well. Without data around the type, volume, and movement of inventory, the day-to-day operations of the food bank were not optimized to ensure speed of service and tracking of goods. Therefore the food bank consistently struggled to maintain a detailed understanding of existing inventory, inventory needs, agency distributions, and payments for distributed material. This lack of data also impacted the food bank's ability to easily quantify their needs and services during weekly evaluation meetings and the development of funding requests. Access to granular data on their operations would give the food bank an advantage when submitting funding requests, as they would be able to quantify their impact on the community in a way most non-profits cannot.

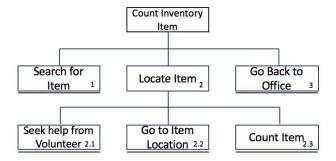
To better understand this specific problem and tie it back to our users, the following persona of a typical food bank manager was created from our needfinding activities:

Photo	Name & Title	Demographics	Goals & Tasks	Environment
	Helen Brown ——— Program Manager	- 51 years old - Married - Mother of two - MS in Public Administration from UNCC	- Manages day-to-day operation - Communicates with suppliers and agencies - schedule trucks to come in	- mostly office environment - on the phone or in meetings - warehouse operation - always surrounded by people

In addition, the following scenario demonstrates a typical problem Helen has to resolve at the food bank:

It's 3:00 pm and a group of volunteers have just finished their shift. Helen is sitting at her desk when she receives a phone call from the Men's Shelter asking if the food bank has any bread. She must put the call on hold and walk out into the warehouse to verify the supply of bread. She cannot find the crate of bread in its usual area, as it must have been moved during the day's operations. She has to quickly track down a senior volunteer to help her locate the crate of bread, only to find that they have just a few packages left. She has to let the Men's Shelter know that they only have a couple of packages left, but they should be getting a supply within the next few days. She hangs up the phone, frustrated that she wasn't able to identify the lack of critical inventory earlier.

Task Analysis:



Inventory Sourcing

The process of collecting donations is the first touch that the food bank has on the donated material. The problem that exists in this phase of the process is the initial and most critical of problems, as the food bank must quickly and accurately collect food within an environment dictated by the supplier constraints.

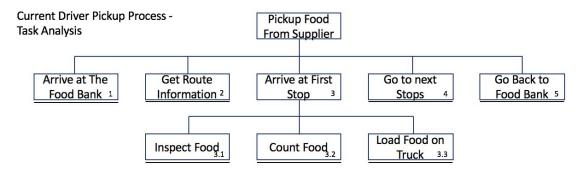
Based on our needfinding activities, the following persona of a driver was created:

Photo	Name & Title	Demographics	Goals & Tasks	Environment
	Kevin O'Neill Delivery Driver	- 40 years old - Married - No children - Some community college experience	- operate daily routes - quickly load trucks at supplier sites - measure inventory - content with pace and expectations	- on the road over 8 hours/day in the truck - lifting and moving of heavy objects - time constraints - enjoys his time at home to unwind and watch TV

The following scenario demonstrates a typical early morning route for Kevin:

Kevin arrives at the food bank at 6:15 am. He walks into the warehouse and picks up the paper with his route details for that day. Food Lion is his first stop and he arrives at 7:15 am. He backs the truck against the loading dock and walks into the loading area. He inspects the supplier's donated items and manually documents the quantity and type of the donated food items. He know he doesn't have to be accurate, as speed is more important that detailed records, so he quickly documents his best guess at the inventory and loads them into the truck. Within 10 minutes, he has the truck loaded with two crates of food items and is off to his next stop. After he completes his 4th stop and last stop then he routes to the Food Bank. Once he reaches the Food Bank then he unloades the two crates. Afterwards he goes home.

The following task analysis outlines the activities performed by the driver while picking up food from the suppliers:



Volunteer Management

The lack of inventory and activity data also impacts the way the food bank manages their volunteers. Although they have general forecasting methods based on years of operation, the food bank is mostly in a reactive state towards the volunteers. They do not have the data required to proactively predict how many volunteers are needed during a given weekend and do not have the technology in place to know the number of volunteers that will actually show up on a given weekend, since not all registered volunteers show up. Similar to the inventory management

process, the volunteer sign-in and training process is all manually performed at the day of the event. Furthermore, the volunteer process is relatively unstructured and prone to error and inefficiencies as their decisions around food quality are based on their judgement. But, the most critical inefficiency here is that this is the food bank's second touch on the donated items, and they still have not been able to accurately track their inventory.

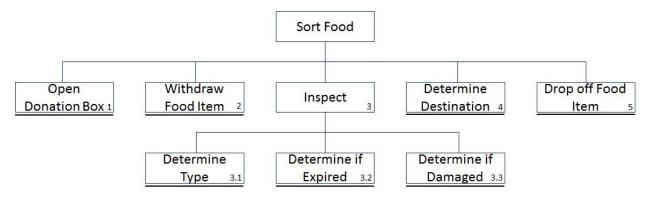
Based on our observation and interview, we created the following persona of volunteer:

Photo	Name & Title	Demographics	Goals & Tasks	Environment
VOLUNTEER	James Richardson Volunteer	- 27 years old - Single - IT Analyst - BS in Computer Science from ECU - Works at Bank of America	- focused on a year-long IT transformation - up for promotion, wants to show the value he can bring - wants to give back to the community, especially with coworkers	- spends over 8 hours a day in his cubicle, most in solitary - lives downtown, loves the social environment

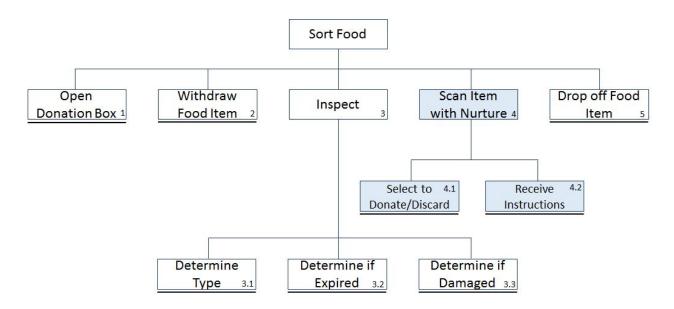
The following scenario describes James' first experience at the food bank:

James is going with a group of nine people from work to volunteer for the first time at Second Harvest Food Bank on the Friday after Thanksgiving. They arrive at 9:00 am and proceed to fill out the sign-in sheet and get name tags. Since it's the day after Thanksgiving, many trucks are scheduled and have already arrived. They join two other groups for a 15-minute food safety orientation. Training consist of how to determine if an item is donatable or must be discarded, as well as how to sort and place the food in their target crates. James starts the sorting process, still feeling unsure about what goes where and questioning his ability to determine if an item must be discarded. In addition, he feels the structure of the warehouse is confusing, since they do not have aisle numbers nor descriptions. So, he reaches out to Helen and she explains each aisle to him. For the next three hours he does his best to quickly sort the food, then washes his hands, takes a group picture, and heads out.

Below is a task analysis of the current food sorting process. For a given donation box, this process is looped starting at 2 for each new food item:



Below is a possible task analysis of the same task but using the scanning, logging, and informational features of Nurture. For a given donation box, this process is looped starting at 2 for each new food item:



While this task analysis is just a glimpse into a potential task that Nurture can dramatically improve, it demonstrates the data collection and informational benefits that can be introduced by positioning existing technologies within key areas of the process.

Design and Usability Goals

To develop our core design goals, we integrated the insights we built during data gathering and activity analysis with our key user groups. We wanted the design goals to accurately build upon the existing workflow and effectively transform it into something that is preferable in use and in functionality. In development of the design goals, we tried to maintain the core components of the system to facilitate a smooth user adoption phase, while targeting specific functionalities to redesign and improve.

Although this system has various users with different tasks, the high level goal for each user can be summarized as: quickly and accurately move the donated item to the next phase. Since the users within our system are in series with each other, the joining of their high level goals ultimately represent the movement of food from the supplier to the community. This system level goal ties back to our initial problem statement around how to optimize the movement of food from source to community, without changing the basic structure that is in place.

From the various needfinding activities we conducted, we came up with different activities the application should support (*Table 1*). The Second Harvest Food Bank doesn't currently have a an integrated system and does all inventory tracking and management activities manually. We are certain that the app with its suggested features, especially inventory management, will organize the process and save them both time and resources. The application will also provide the users with more accurate information and a history of records. Although many digital transformations have a steep curve of adoption, we believe the natural design, simplicity, and visibility within our application will make it much easier to adopt to. In addition, the application will be able to support the following key activities identified during our needfinding phase.

Inventory management and scanning	Payment tracking	Volunteer sign in/out and tracking	Start a food drive	Start a virtual food drive
Donate to a virtual food drive	Special event registration	Schedule retail pickup	Track delivery/pickup of product	Track mobile pantry
Agency reporting	Agency conference registration	Get notification on volunteer opportunities. Choose opportunities to get notified about	Get notification for when you have a scheduled pickup or delivery	Get a notification when you have a shopping appointment
Payment tracking	Drivers' tracking	Generate reports		

Table 1: Summary of activities supported by the Nurture

To be usable, the application should meet the usability goals. This means the application be efficient, engaging, error tolerant, and easy to learn. The users should be able to perform the tasks easily and quickly. In terms of user experience, the three key goals that this system should meet are Helpful, Simplifying, and Supporting. The experiences this system will aim to avoid are Overwhelming (Gulf of Execution), Uncertainty (Gulf of Evaluation), Time Wasting, and Hindering. The simplicity of this system will also ensure that the users do not make any critical

errors, and any errors that are made can be easily reversible. At the core, this application is a data aggregation and utilization tool, so the design must be simple to use for both scanning of inventory (data collection) and requesting of information (utilization). For example, the application will allow the users to scan the inventory items when they are being received/sent. This way, all the information come from the barcode and they do not have to enter them manually. They also can remove an item which was scanned by mistake in no time. Feedback will be a critical component within this process since the user's task requires precision and speed. Feedback will allow the user to quickly determine when an item is scanned, so they can move on to the next item without any confusion, or remove an item that was scanned in error. Once this information is in the food bank's system, the users will be able to experience a simplified approach to running their operations through data driven reporting and funding requests - this is in comparison to their existing manual process utilizing high level key performance indicators since granular data is lacking.

To make sure we measure the user's satisfaction and the usability goals are achieved, we should also have a feedback utility within the app, allowing the users to give information regarding the functionality of the system and if anything needs immediate attention to be fixed.

The incorporation of these design goals using existing technology can transform the way a non-profit food bank is operated - supply routes will be monitored, food items will be scanned, inventory will be managed to numbers, and the distribution of food downstream will be quick, accurate, and optimized to move as much food, as quickly as possible. This will take the guesswork and the unneeded manual processes out of the picture, allowing the volunteers to focus on making the largest impact during their volunteering activities, and giving the food bank manager the power to know what is in stock and what is needed at all times. In addition, this will raise the food bank's capabilities closer to the level of its suppliers, increasing the overall rate at which food is processed, while allowing the food bank to provide data driven details back to the supplier around how their food is making an impact to the community. This fulfills the supplier's goal of increasing their brand's presence within the community by making a measurable impact.

Sources:

Truck image - https://www.secondharvestmetrolina.org/about-us

SHFB Annual Report -

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https://www.secondharvestmetrolina.org/about-us/financials/annual-report

Tackling economic mobility in Charlotte-Mecklenburg

https://www.bizjournals.com/charlotte/news/2017/11/14/tackling-economic-mobility-in-charlotte.html

CHARTBOOK: SNAP and Hunger in North Carolina

http://www.ncjustice.org/?q=budget-and-tax/chartbook-snap-and-hunger-north-carolina

The Second Harvest Food Bank of Santa Clara - https://www.shfb.org/donate#food

Exhibit A:Second Harvest Food Bank Master Supplier/Agency list:

Store Number	Store Name	Address	City	Sta te	Zip Code	Phone Number
	Albert's Organics	11922 General Dr	Charlotte	NC	28273	
2	Aldi #2	10710 S Tryon St	Charlotte	NC	28273	704-588-6947
5	Aldi #5	555 W John St	Matthews	NC	28105	704-849-0283
6	Aldi #6	1560 W. Floyd Baker Blvd	Gaffney	SC	29341	864-489-6639
7	Aldi #7	1920 E Main St	Albemarl e	NC	28001	704-982-2088
9	Aldi #9	6402 W. Wilkinson Blvd	Belmont	NC	28012	704-825-1447

Route/Agency	Agency Name	Agency Email
4, South		
6		
5		
	Encounter Church	
737, 181AP, 133AP, 529AP,081AP,4 28AP: ON CALL	Montgomery County COA, Mt. Gilead	181: jimkiser@embarqmail.com , mrood@embarqmail.com; joann_jones71@yahoo.com 428AP: vada@embarqmail.com; secretary@mbanc.org

	SOCKS	lemmiea@aol.com			
Exabilit B:					
Link to the questionnaire: https://www.surveymonkey.com/r/QSWXT5C					
Below are the que	estions used in the Sur	vey.			
Please enter the cor Name: Location:					
2. Does this store currently donate food or non-food items to a local food bank, like 2nd Harvest Food Bank Metrolina? Y N					
 3. On average, how of a. > 4 shipments b. 4 shipments c. 2 shipments d. 1 shipment e. < 1 shipment 	iten are donations made to lo	ocal food banks per month?			
 4. What is the primary a. Vegetables/Frui b. Meats c. Dairy products d. Grains/Oats e. Frozen meals f. Other g. Food is not don 					
5. What is the primary a. Toiletries b. Medicine c. Clothes d. Furniture e. Pet products f. Other g. Non-food items	category of non-food donate	ed?			
6. Is the current donat activities? Manually managed System managed		or are systems used to track and manage the donation			

 $7.\,$ On a scale of 1 to 5, how time consuming is the process of donating items to the local food banks, with 1

being very little time required and 5 being very time consuming?

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- 8. On a scale of 1 to 5, how well do you understand how your donated items are being used in the community, with 1 being total clarity and 5 being no clarity?
- 9. Given the current donation process, what are the two most important elements that could be improve and why? (for ex: communication with food banks, paperwork/systems...etc)

Item 1:

Item 2:

10. Do you ever receive specific donation requests?

Y

Ν