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Relational and Logistical Dimensions of Agricultural Food Recovery: Evidence from California Growers and Recovery Organizations

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Abstract: Efforts to recover on-farm food losses by emergency food organizations or businesses serving secondary markets have been promoted as a “win–win” solution to both food waste and hunger. We examined what it will take to realize this potential, drawing on interviews with 35 fresh produce growers and 15 representatives from food recovery organizations in California. By taking grower constraints seriously and identifying key dynamics in their relationships with food recovery partners, we provide a textured account of the relevant logistical and relational challenges and promising solutions. Our research makes three specific contributions: (1) providing a straightforward conceptual rubric to clarify when food recovery partnerships are likely to be more or less difficult to achieve; (2) highlighting key relational strategies or approaches that make success more likely, even if logistical barriers appear daunting; and (3) emphasizing the dynamic, developmental, and context-specific nature of recovery partnerships, such that “what works” will necessarily change over time and across different settings. Based on our analysis, successful partnerships require investments of time and attention that are in short supply, but necessary to establish and sustain recovery relationships. The path forward appears less rosy than presumed by those who focus on statistics suggesting a large recovery potential, but also more promising than presumed by those who see the structural challenges (both economic/logistical and social/relational) as inherently insurmountable.

Keywords: food loss; food waste; food recovery; farmers; food banks; secondary markets

1. Introduction

The United Nations Food and Agricultural Organization (FAO) estimates that 20 percent of fruits and vegetables produced in North America and Europe are lost at the site of production [1]; other estimates range as high as 40 percent [2–4]. On-farm food losses carry substantial economic and environmental costs, including lost profits from cosmetically unmarketable produce and wasted agricultural inputs [5]. Many solutions have been proposed to address this problem, including recovering fresh produce for human consumption, relaxing quality standards, encouraging consumer demand for imperfect produce, processing imperfect produce into value-added products, stabilizing agricultural markets, and creating energy from food waste via anaerobic digestion. Among these options, food recovery often receives special attention for its potential to simultaneously address both the environmental costs of food losses and the nutritional demands of low-income consumers [6–8].

Food recovery can be defined as the redistribution of surplus or cosmetically imperfect food to people who want or need it [7–10]. Examples include donating surplus food to emergency food organizations, gleaning unharvested produce on farms, and marketing or processing “ugly” produce. These recovery efforts often involve sizable economic and logistical challenges, both for growers and the organizations that redistribute surplus food. Financial and other barriers include transporting and storing recovered food, labor availability and cost, access and timing, and the perishability of food products [11–15]. These logistical challenges vary regionally and across crop types [11,16].

To date, only a few studies have explored how stakeholders’ social relations facilitate or impede efforts to overcome food recovery challenges or have sought out the perspectives of growers [11,17–20]. Our study aims to help fill these gaps in the literature by investigating the relational dynamics among fresh produce growers and recovery organizations in California. More specifically, our study seeks to understand the dynamic interplay between the economic/logistical constraints of food recovery and the relational dimensions of recovery partnerships, examining the extent to which relational strategies may help address the material challenges. Our investigation is therefore oriented around the following research questions: (1) What are the material and social barriers to agricultural food recovery in California? (2) How, and to what extent, do stakeholders employ relational strategies to address their various material challenges? (3) How are recovery partnerships established and maintained over time?

California is a compelling site for research on agricultural food recovery due to its global dominance and diversity in agricultural production, as well as its leadership in environmental policy. For example, in 2016, California passed Senate Bill (SB) 1383, which set the goal of reducing statewide disposal of organic waste by 75% and recovering 20 of edible disposed food for human consumption by 2025 (compared to 2014 levels). Our study seeks to inform these efforts, drawing insight from on-the-ground experiences.

2. Literature Review

Following the FAO’s distinction, we define food losses as reductions in edible food mass occurring at the production or processing stages of the supply chain, as opposed to “food waste”, which occurs at later stages [1]. We view “losses” as a more appropriate term than “waste” for agricultural crops that are left on the farm for two additional reasons. First, previous research has shown that on-farm food losses are often tilled back into the soil or diverted to animal feed, and thus serve a productive use, as opposed to food that is “wasted” via diversion to landfill [17]. Second, growers understandably resist the term “food waste” on the basis that it implies greater preventative power than they have in the context of a globalized, concentrated food system [17,18].

Previous research has identified two critical drivers of on-farm food losses: agricultural market dynamics and buyers’ cosmetic standards [17,18,21–23]. First, losses take place when supply exceeds demand in the market and when prices fall below the cost of harvest [19,24]. Second, growers respond to buyers’ strict quality standards by leaving damaged crops unharvested and culling cosmetically inferior products after harvest [1,21]. Quality specifications vary across buyers and are also unevenly enforced according to shifting market conditions; buyers are known to relax quality standards when the supply is limited and impose stricter standards during periods of oversupply [17,25]. Thus, on-farm food losses are driven primarily by growers’ attempts to manage uncertainty and minimize financial risks in a context involving numerous external constraints [17,26]. Estimates of on-farm losses vary due to methodological inconsistencies [27,28], but generally range between 20%–40% [1,2].

As food loss and waste (FLW) has attracted growing attention among policymakers and academics, food recovery has emerged as one partial yet popular solution. Food recovery has often been framed as a “win–win” for its potential to simultaneously address both food loss and hunger [7–10,29,30]. Food banks that obtain donated or low-cost produce from farms can increase the variety and nutritional value of their offerings [31,32]; therefore, in recent years many U.S. food banks have established gleaning or gardening programs and actively developed recovery partnerships with local growers [15,33,34]. However, it should also be noted that food recovery has also been critiqued for its

failure to challenge a charitable food model that has been extensively criticized on both nutritional and ethical grounds [31,35–40].

Recovering on-farm food losses via secondary markets or donations to emergency food organizations can involve substantial financial and logistical challenges [13,41–44]. Financial viability is a fundamental challenge for all recovery models, given that recovered produce is donated or priced lower than retail-grade but involves the same harvest costs and logistical constraints [5]. Logistical challenges for growers involve securing and training labor to harvest and sort multiple grades; transporting, storing, and packing recovered food; and accessing secondary markets [11–15]. Highly perishable crops are especially difficult to recover [11]. Recovery organizations must also secure adequate infrastructure and labor for sorting and distributing recovered food, a task that can be especially challenging for resource-strapped emergency food organizations [31,37,38,40,45,46].

Although the financial and logistical dimensions of food recovery are well-documented, less is known about the relational dimensions of recovery. Understanding how stakeholders' social relations intersect with the logistical dimensions of food recovery is crucial for identifying the social contexts in which recovery is most likely to succeed and the type of relational work needed to overcome obstacles. Indeed, previous research suggests that social trust and communication are critical for engaging growers in other kinds of programs and activities [47,48]. The research described in this paper therefore explores the relational dynamics of agricultural food recovery in California, drawing on qualitative interviews with growers and recovery organizations.

3. Data and Methods

We conducted 50 semi-structured interviews with growers, emergency food organizations, and businesses serving secondary markets. Data collection proceeded in two phases. In the first phase, we interviewed 35 growers to understand their perception of the drivers and solutions for food loss. The sample included roughly equal numbers of growers of three important crops with different production methods (row versus tree crops) and perishability profiles: leafy greens (fresh), tomatoes (fresh and processed), and peaches (fresh and processed). In the second phase, we explored the other side of the food recovery relationship, interviewing eight staff from emergency food organizations (mostly food banks) and seven from businesses serving secondary markets. The latter group included businesses specializing in produce sales and distribution, grocery delivery services, food service, and food processing. We sampled charitable food organizations and private businesses in roughly equal numbers to understand how the dynamics of agricultural food recovery unfold in different sectors. Table 1 summarizes the characteristics of the study sample.

Respondents were recruited through contacts at the University of California Cooperative Extension (UCCE), the California Food Waste Roundtable, and the authors' own networks. We employed a "snowball" sampling strategy to identify additional interviewees. All interviews were conducted by the second author either in person or by phone, and generally lasted between 30 and 90 min. With one exception, face-to-face interviews were recorded and professionally transcribed. Phone interviews were not recorded since the interviewer was able to take detailed notes at a computer during the conversation. Grower interviews occurred between June and October 2017; those with recovery organizations occurred between December 2018 and April 2019. Prior to data collection, the study protocols were approved by the university institutional review board. All respondents provided consent to be interviewed and were assured that their responses would remain confidential.

We used semi-structured interviews to investigate participants' experiences and perspectives on food recovery. Semi-structured interviews are well-suited for exploratory research about complex social processes since they facilitate data collection around predetermined themes while allowing participants to introduce unanticipated topics and freely express their views in ways that generate detailed, rich data for analysis [49–51]. The growers in our sample were asked open-ended questions about the causes, consequences, and total volume of food losses on their farms; prior experiences with food recovery programs; and perceptions about the main barriers and opportunities for increasing

food recovery. Respondents from food recovery organizations were asked open-ended questions about the nature and size of their programs, relationships with growers, and perceptions about the main barriers and opportunities for increasing food recovery.

Table 1. Descriptive characteristics of the interview sample (n = 50).

	n	%
Growers	35	70.0%
Respondent role		
Farmer/owner	25	71.4%
Production manager	7	20.0%
Sales	3	8.6%
Crop		
Leafy greens	8	22.9%
Peaches	11	31.4%
Tomatoes	9	25.7%
Multiple crops	7	20.0%
Farm acreage		
0–99 acres	5	15.2%
100–499 acres	2	6.1%
500–999 acres	4	12.1%
1000–4999 acres	9	27.3%
5000+ acres	13	39.4%
Emergency food	8	16.0%
Respondent role		
Executive director	2	25.0%
Food sourcing/procurement	6	75.0%
Organization type		
Food bank	6	75.0%
Food kitchen	1	12.5%
Hunger relief	1	12.5%
Private businesses	7	14.0%
Respondent role		
CEO/Co-founder	4	57.1%
Food sourcing/procurement	2	28.6%
Sustainability manager	1	14.3%
Organization type		
Grocery delivery	3	42.9%
Produce sales/distribution	2	28.6%
Processing	1	14.3%
Food service	1	14.3%
Total	50	100%

Interview transcripts and notes were analyzed using an inductive and iterative process. After reading through the transcripts and developing an initial coding scheme, the transcripts were coded in Dedoose version 8.3.10 [52]. We then organized the interview excerpts by code, identifying emerging themes through an iterative group process of writing and discussing analytic memos [53,54]. We also generated data matrices to organize our comparisons, develop generalizations about the data, and verify our conclusions [55].

Respondents' stories reveal that even the more successful partnerships vary substantially in the scale and frequency of food recovered. For example, we interviewed one grower who makes weekly donations to a local food bank after distributing Community Supported Agriculture (CSA) boxes, whereas other growers reported donating food only on rare occasions when all alternative markets failed. Some food banks distribute truckloads of fresh produce each week; others describe

small programs with a handful of growers. Arguably, even small wins are important, yet at the same time it is important not to overstate how much food is actually being recovered. Although elsewhere we have attempted to quantify the net environmental benefits of various food recovery scenarios (Spang et al. 2019), here we limit our focus to qualitatively characterizing key recovery challenges and opportunities. Our findings, summarized in the next section, reveal underlying dynamics that must be better understood if progress is to occur.

4. Results and Discussion

The challenges to agricultural food recovery described by respondents can be classified along two dimensions: (1) economic/logistical and (2) social/relational (see Figure 1). While the former dimension is consistent with previous research findings [11–15], the latter has received less attention. Further, our analysis suggests that it is the interplay of these two dimensions that is critical to understanding the opportunities and challenges for food recovery in particular circumstances. Some recovery opportunities fail because stakeholders lack mutual trust or shared goals, whereas in other cases, determined relational work reveals shared interests and sparks logistical solutions.

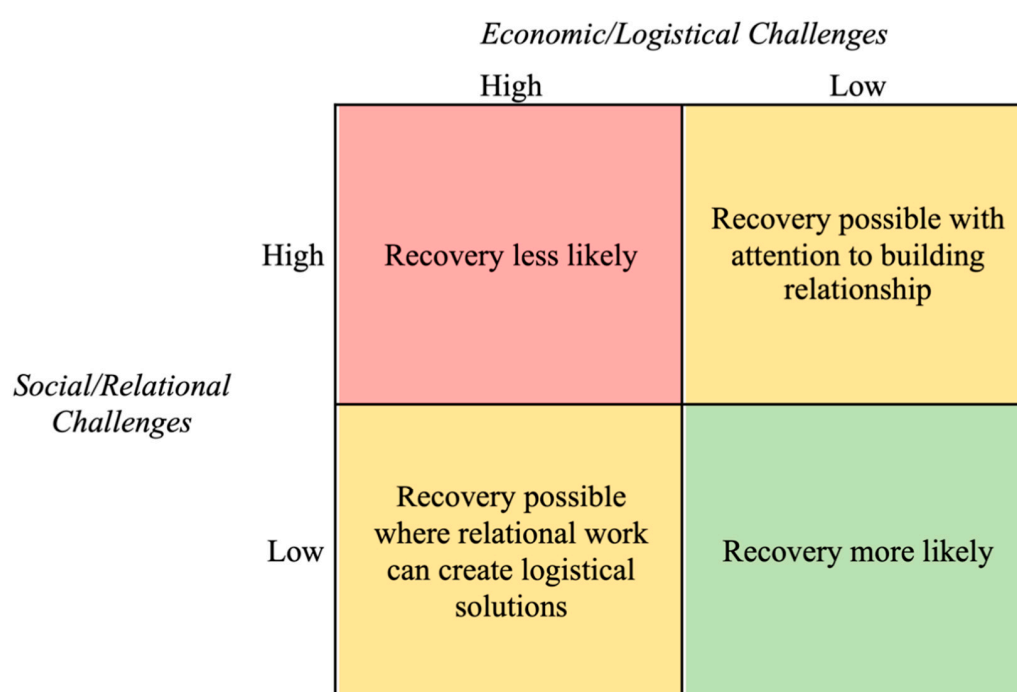


Figure 1. Typology of likelihood of agricultural food recovery in different contexts.

To assess the overall likelihood of successful agricultural food recovery in different contexts, one might use a matrix such as that displayed in Figure 1. Figure 1 displays the intersection of two dimensions of agricultural food recovery that emerged from the interviews: economic/logistical challenges and social/relational challenges. The likelihood of success diminishes when stakeholders encounter significant challenges within either the logistical/economic or social/relational domain, and the least likely scenarios are when both types of challenges are significant. However, our data suggest that neither logistical nor relational challenges are necessarily static. Instead, they can shift to reflect changes in stakeholders' social relationships and/or logistical constraints.

The following sections summarize the key data we collected from respondents. We begin with their emphasis on the need for a nuanced and detailed account of logistical variables that are context-specific and often unpredictable. We then discuss relational work at somewhat greater length, noting its role in deepening existing partnerships or overcoming logistical or other challenges. As their dynamics

are somewhat different from one another, we present the relational work evidence in two temporally distinct phases: (1) establishing a recovery partnership and (2) sustaining the partnership over time.

4.1. Logistical Challenges: Highly Specific and Variable

Our evidence is generally consistent with prior research finding that the logistical systems to support food recovery vary widely by farm, recovery outlet, and food product [11,15,37,38,45,46,56–58]. As one food bank employee explained, “There’s not any one magic, silver bullet way to get all food waste. The way that you’re going to get carrots is different than the way you’re going to get Asian greens or something like that. So, I think that’s the challenge.” Food recovery organizations are just as diverse as the products they seek. More than one respondent commented, “if you’ve seen one food bank, you’ve seen one food bank,” emphasizing the case-specific nature of recovery partnerships.

Although the logistical systems for food recovery are organization- and product-specific, respondents described common challenges around (1) scale, (2) labor, (3) infrastructure, and (4) financial viability. Here, we briefly summarize the interview data to give an indication of how respondents perceive and respond to these challenges.

Scale is one important factor that determines both the model and feasibility of recovery. Some recovery systems are better suited for a smaller scale, for example, food banks sending volunteers to collect unsold product at the local farmers market. At the other end of the spectrum are food banks and food loss companies that operate in truckloads of produce; they have sufficient volume to realize economies of scale and thus can invest in logistical supports. For private sector recovery organizations, the specificity of recovery models can be a business opportunity if they find and exploit a logistical niche to coordinate exchanges between growers and buyers. However, this same logistical specificity can be a barrier for growers and food banks who possess fewer resources and less time to navigate the details.

Labor challenges for growers include availability, scheduling, and the need to retrain staff on quality specifications. Growers distinguished between the labor requirements for recovering field versus shed-packed produce, with the former presenting greater logistical challenges. Although most food recovery in our study relied on growers’ harvest crews, some emergency food organizations arranged volunteer labor to glean fields after harvest; in this case, the volunteers’ unpredictable schedules and lack of harvest experience sometimes threatened the viability of recovery. For example, a tomato grower explained: “We have not had good experiences [with gleaning]. You know, people just don’t show up when they say they’re going to, and you’ve got liability, you’ve got people in your fields who don’t know what’s going on.”

Infrastructure development is another common challenge, as recovery often requires specialized harvesting processes and equipment, packaging, transportation, and refrigerated storage. It can be hard to justify the investment in these, given the inherent unpredictability as to the volume, availability, quality, and timing of recoverable food. As a secondary option for growers when they fail to line up primary buyers, the supply of recoverable food is not known until it is nearer the end of its shelf life. As one tomato grower explained, it is difficult to design systems to absorb high volumes of losses on short notice:

How do you have a marketing plan for something you don’t even know you’re going to have? And you don’t know when it’s going to appear. And how are you going to get your ten people on that assembly line, all of a sudden, when they call you that once every other year, or twice, when you get a load rejected?

Growers’ top priority is producing retail-grade produce. Harvesting and packing multiple quality grades usually involves separate processes and schedules, and growers are wary of investing in activities that interrupt production of the number one product. For example, harvesting off-grade produce might mean that harvest equipment or packaging must be reconfigured for a differently sized product or that labor crews must be retrained to sort for a new quality standard. Moreover, steps must be taken to ensure that the recovered product remains separate from the number one product or

growers risk rejection from buyers. A respondent from a private foodservice company shared an example of when the desire to protect retail grade spinach led a grower to turn down the company's offer to pay full price for off-grade produce:

The way they harvest it is like a lawnmower. They go across and it just clips and collects the spinach, and when that happens a lot of smaller spinach sprouts get their tips cut off. We said, "Well, there is so much spinach that's still in the field after that first harvest, if you let it grow a little bit longer it will be just the size that we would use. We'll pay the same price we would pay for our existing spinach that we buy from you now." It was still not preferable or financially viable: The extra effort of having this sort of funky field that does things differently was a big ask for them. And they would have to do a specific run of that spinach because it has to be separated out.

Another grower described how even slight modifications to the harvesting system could impact his productivity to the extent of making it unviable:

We can harvest loads of tomatoes in 15 minutes. If I had to have something alongside there that was capturing the green ones; and it took me, instead of 15 minutes, 20 minutes to pick a load; I don't think it would be worth doing it. Plus, you'd have more machinery running alongside the harvester, which adds to worker safety and lots of issues like that.

Volatility also impacts infrastructure planning on the receiving end of a recovery partnership. A food bank respondent explained: Do they build capacity to handle the highest volume season, knowing that for most of the year it will go unused? Or do they build less infrastructure and thus limit their ability to absorb donations during peak season? Another food bank employee described their food sourcing this way: "It's pretty much as volatile as it gets as far as consistency and reliability goes. It's pretty crazy trying to balance it. We always talk about it as 'riding the wave'."

The final challenge is financial viability, which is difficult for all the reasons we have just discussed. Due to the fact that food recovery often involves the same costs and logistical requirements as traditional food supply chains, but with lower (or no) anticipated profits, the financial viability of any recovery model is tenuous [5]. The specificity and variability that characterize recovery logistics make it difficult for the overall costs to pencil out for all parties. As one grower explained, "it's a cost to us to try to go in and harvest it, and then transport it somewhere, on top of our growing costs—especially if we're doing it for free. Cost-wise it's not sustainable for us to always be doing that."

Providing financial compensation to growers is one way to help offset the challenges of labor and infrastructure. Private businesses serving secondary markets build payments to growers into their business models, but the price for seconds relative to the price for retail-grade products varies. Many food banks and nonprofit recovery organizations also provide modest compensation to growers, often in the form of a "pick and pack out" (PPO) fee that covers the costs of harvest and transportation. Larger food banks with greater financial resources contract with growers to ensure a steady supply of fresh produce for clients.

We learned that financial compensation can generate gains for growers beyond the immediate cash value. For example, an employee of a large food bank network explained that by paying growers more quickly than the large corporate retailers, for example within 7–14 days instead of up to 90 days, they can improve growers cash flow: "We pay rapidly to be a part of their cash flow model, not just their profit model. It keeps people working. These days with shortages of people all of the time, that's a big deal." Another food bank found a different way to enhance the grower's bottom line by providing a "transportation solution"; when he picks up donations from the farm, he offers to drop off additional pallets of product at a nearby grocery store. In that way, he can offer growers value, rather than making it a one-way imperative: "farmers should donate because they have excess produce."

The economic calculations of growers can shift in response to external constraints such as market dynamics and regulatory policies, suggesting that structural changes might be able to tip the scales toward increased food recovery [17]. However, they can also shift in response to certain kinds of relational work at the local level, a possibility we analyze in the next section.

4.2. Relational Work: Learning from Success and Failure

The nature of problem-solving relationships between recovery outlets and growers can either limit or spur the recovery of food from farms. When taken on in a spirit of open curiosity, active listening, and solution-focused learning, this kind of relational work can be an exciting path of discovery leading to beneficial outcomes. Our interviewees provided insightful data based on cases of successful partnerships and also on failures. One overall finding is that recovery partnerships require investments of time and attention that are often in short supply but are necessary if potential benefits are to be perceived and realized. There is a kind of catch-22 feature to this relational work: without clear reasons to think a partnership will work, there is little incentive to invest time and attention, yet only with this investment can shared interests be discovered and pursued. Thus, we have chosen to separate our discussion of relational work into two stages: (1) establishing the partnership and (2) sustaining and strengthening the partnership. The former includes data related to how partners move past initial reluctance; the latter focuses on what it takes to maintain relationships over time.

4.2.1. Establishing Recovery Partnerships

As in any relationship, there must be some initial reason to connect and to join fortunes. At the same time, certain assumptions or misunderstandings about the other party can create reluctance or barriers. In this section, we first discuss what respondents told us got in the way of building a relationship, including both practical constraints and the role of cultural or ideological differences. We then lift up three promising strategies that respondents used to overcome those issues: (1) crafting initial approaches and messages carefully, (2) drawing on a common identity or history, and (3) focusing on each party's interests to identify potential mutual benefits.

Practical and Cultural Impediments to Building a Relationship

Establishing relationships with growers can be a major challenge for recovery organizations. Initially, it can be difficult even to identify or reach growers, given that they are busy people with unpredictable schedules. Moreover, the harvest season is often their most hectic time of year, and this is precisely when food recovery must occur. Our respondents who succeeded noted that persistence is key, since growers may ignore or delay responses to unknown callers.

Further, some growers are reluctant to engage due to previous experiences. As one grower reported, they can find themselves dealing with well-intentioned people who are naïve about the realities of farming and overly optimistic about recovery potential:

We have people come through from all over the world and they go, "Wow, why are you throwing this away or why are you throwing that away?" We're like, "We wish the hell we weren't." And they're going, "We're going to figure this out." And we go, "Okay, get back to us, yeah."

Having already spent their careers attempting to minimize losses to increase profits, growers resent any implication that they don't care about waste and are irritated when the issue is framed in ways that put them at moral fault. Several described negative encounters with recovery outlets who had made them feel like they were being lectured or shamed. For example, one grower expressed frustration with food bank staff who criticize farmers for wasting food rather than taking proactive steps to recover it:

There was a video of all the tomatoes being dumped last year – some local news report – and they had someone from a food bank complaining. Saying "What a waste, they should never throw this stuff away." He was shaming, but you've got to build relationships instead of sitting there saying just "tsk, tsk, tsk."

Another grower explained:

I have a bit of an issue with this idea of food loss. I have been in the leafy greens business forever. I have done a ton of tours. They go out there and go, "Oh my god, I can't believe there is so much waste!"

And I'm going, "Waste? What are you talking about? We just got the maximum yield here!" So, we are worlds apart. People don't understand that the outer leaves are the old, cruddy leaves, and that what they are eating is the younger, good stuff. You wouldn't go out into a tomato field and see all of those vines and go, "oh, what a waste!" It's not waste. It's what we needed to grow the vegetable!

It is important to recognize the diversity of views among growers. Many growers appreciate an economic emphasis from recovery outlets, and some even dismiss the humanitarian mission of food banks as simply promoting dependence. Conversely, other growers welcome an ideological emphasis and enjoy supporting charitable work in their communities. One even rejected the very idea of being paid for food donations: "No, I don't want the food bank to pay me for product . . . that's not the idea. They don't have that kind of money—I mean, not if they're trying to provide meals for people who need them."

Clearly, recovery outlets need to know with whom they are dealing and tailor messages accordingly. The examples cited above demonstrate that, independent of logistical barriers and constraints, the challenge of establishing relationships with growers can itself short-circuit potential recovery partnerships. The next section discusses a variety of strategies that interviewees described that had helped them get relationships off on a better footing.

Crafting Initial Approaches and Messages Carefully

We learned of three strategies that respondents from recovery organizations associated with success in engaging farmers: (1) face-to-face meetings, (2) altering semantics in their initial pitch, and (3) selectively emphasizing material benefits or ideological concerns, depending on the perspective of the particular grower. While none might apply in every case, they provide options for consideration for those looking to begin a recovery partnership.

A food bank representative stated:

At the beginning, it was very hard to get anybody to take us seriously because farmers are so used to being promised the world and then nothing coming back or being taken advantage of. What I found is I could not do it over the telephone or email. What I needed to do was actually go sit down with them, because the inspiration comes through. They hear that I know what I'm talking about and then if there's enough time and personal contact we can drop deeper and deeper until they recognize that we really have something to offer them.

Recovery outlets that succeed learn to shift their pitch to deemphasize "waste." For example, one respondent from a private recovery outlet said, "I think people also bristle when you tell them about waste. They feel a little bit like, 'Oh, are you telling me I'm doing a bad job?'" This respondent instead learned to frame potential exchanges with growers as "trying to do something that's mutually beneficial." Similarly, a food bank respondent noted: "We need to be careful when we're using the term 'food waste' because we primarily work with farmers. And so we talk about 'farm-level food loss.' It's semantics, but it's important."

In initial conversations with growers, recovery outlets differed in the extent to which they emphasized the material or ideological motivations for partnering around recovery. Some felt that the key to securing donors was helping growers understand the food bank's mission: "When I go and talk to a donor, I can say, 'Here are the people we're serving,' dispelling myths and general misconceptions about what food banks do, explaining why we're different, explaining what we can do." Others found greater success by emphasizing the material benefits of food recovery in addressing growers' needs:

I was getting these appointments to speak in front of boards, and folks really expected to listen politely and pat me on the head and send me on my way. Generally, the audience is a bunch of farmers on their phones. But my pitch is, I'm not here to tell you people are hungry, or to tell you how to do your business, but I'm here to say that there is a way to donate your excess and increase your prosperity at the same time. We want to be integral to your business model. And then you watch the phones go down, and people pay attention.

Respondents from private food loss companies also emphasized material benefits in their pitch to growers, noting that their message resonates differently depending on the scale of the farm: “My first point to everybody is: if you don’t have a problem that can be solved or helped by us, then you don’t need us and I’ll just move on.”

Drawing on a Common Identity or History

Several stories of successful partnerships came from people at recovery organizations, who described how the fact that they grew up in the same town, worked together in the past, and/or had a shared history in the industry created opportunities to connect with growers. For example, one respondent from a food bank described how their industry experience gave them a distinct advantage: “My situation’s a little bit unique. I, before this, worked on three different organic farms in the community. I met a lot of other farmers from working at the farmers’ market and being immersed in that community.”

Where recovery organizations lack these personal ties, they can build bridges and trust with growers by strategically recruiting members of industry to join the organization. For example, one large network of food banks in California deliberately hires former members of the food industry to source fresh produce: “With farmers, the best way to develop a relationship is person-to-person. Our food sourcers are people from industry, they live in those communities, they already know everyone there It’s all about trusted partners.” Similarly, an interviewee who leads a private food recovery organization described how they purposefully recruited a partner with 10–15 years of experience in the industry to manage food sourcing.

It is important to emphasize that not all efforts to launch partnerships succeed, even when there is both a dedicated effort and some preexisting relational ties. For example, one respondent described the grower community as a “good ol’ boy network” that remained closed to her despite mutual connections:

We went around, and we passed out flyers. We went to different farms. We Googled some farmers. We actually reached a few on Facebook as well. So we tried to reach them through every avenue that we saw. Most of them we got through the farmer who is on our Board. He called them, and they told him yes. And then when I contacted them, it was kind of like, “Hey, I don’t have time for this.” It’s difficult. It is a type of a good ol’ boy network.

Focusing on Each Party’s Interests to Identify Potential Mutual Benefits

Shared interests can include both material goals, such as financial compensation, and ideological goals, such as addressing food insecurity in the community. Although the primary interests of various parties differ—growers and businesses serving secondary markets need to maximize financial returns in competitive agricultural markets, whereas emergency food organizations seek to provide low-income clients with an adequate supply of food—stakeholders can find creative ways to serve multiple interests simultaneously through food recovery partnerships. Not all benefits need to be immediate. For example, one grower anticipated a long-term economic benefit to food donation, explaining that “the poor may not always be poor,” and thus food bank recipients who are exposed to fresh produce might become paying customers once their circumstances improve.

Identifying shared interests requires both parties to understand each other’s worldviews and day-to-day operations sufficiently to recognize opportunities for mutual gain. This discovery is necessary but not sufficient, since the needed financial and logistical capacity might still be out of reach for one or both partners. It matters, for example, that some recovery outlets can offer growers close to full price for cosmetically imperfect produce, whereas others are unable to offer any compensation at all; some require growers to drop off donations, whereas others manage most of the logistics themselves.

Both growers and recovery organizations emphasized the need to clarify the quality specifications of recovered food. Recovery organizations often accept food with cosmetic imperfections that would be rejected by retailers, but the food must nevertheless be safe for human consumption and fresh enough to reach its destination before spoiling. Educating growers about quality standards and securing

their agreement is thus a fundamental task for recovery organizations, and miscommunication can be costly. For example, we interviewed a grower who complained about how the food bank is too “picky” about donated products, implying that the food bank should accept all donations regardless of quality or need. We also interviewed food bank personnel who became frustrated when growers donated poor-quality produce or tried to drop off donations without first checking if it was needed. Growers might get different answers from different recovery organizations, since their quality standards vary. For example, some are happy to accept donations with some degree of spoilage because they have the capacity to sort it.

The opportunities for learning and accommodation around practical concerns are not unidirectional, with growers always adapting to others’ requirements. Our interviews also suggest that when recovery organizations take time to learn from growers about their products and operations, they can find novel opportunities to recover more food. For example, one grower shared this story about the procurement manager for a local food bank visiting the farm:

[She] talked her way past our shipping department and got me and then said, “can I just walk through?” And then she pointed and just said, “where does this go, where does this go?” When I said this goes to goats, she said, “we’ll take it.” And that started the relationship of realizing what they could take. We didn’t know how much they could take Now we load sometimes five or six semi-trucks a week to them of product that we were just disking into the ground. . . . Some [peppers] make it past the initial sort and they get that little sticker for the grocery store applied to them, and the processor won’t take those. We didn’t have a place to go with them, so they would just go into a trash bin, or to like, a swap meet. [The food bank] is like, “can we have these? It saves us time and energy.

Mutual education is critical, since some solutions only come into view when the details are known. Because this food bank representative took the time to visit the farm and learn about the products that are ordinarily diverted to animal feed, she could identify opportunities that benefitted both parties. The grower also learned more about the particularities of the food bank, since he possessed edible produce that failed to meet retailers’ specifications but not those of the food bank.

4.2.2. Sustaining Recovery Partnerships

Once a recovery partnership has been established and stakeholders gain a working understanding of each other’s constraints, they confront the additional challenge of working through inevitable obstacles that emerge over time. Collaborative problem-solving involves nontrivial investments of time, money, and/or attention that are often in short supply but are necessary to achieve long-term benefits. Our interviews suggest that two key relational dynamics influence this stage of recovery partnerships: (1) communication to facilitate collaborative problem-solving and (2) offering each other flexibility within a consistent commitment to deliver on promises. When enough positive momentum is achieved, recovery partners adopt a long-term view, even accepting short-term losses in the interest of sustaining the partnership.

Communication to Facilitate Collaborative Problem-Solving

As in any relationship, ongoing communication and problem-solving increases the likelihood that a recovery partnership will succeed. For example, a respondent from a food recovery business described how they design and finance systems for harvesting and sorting imperfect produce:

Because of our scale, we’ve been able to develop programs with farms where they’re going out and doing a second harvest for a certain grade of field packed produce or setting up lines in their operations. It’s just proving to them that there is going to be just enough demand on our side to make that investment worth it. We often work with them to help them set those processes up because there’s the upfront cost, but then once they’ve trained those pickers, they’re able to see the returns over time.

A grower described working with a local food bank over time to improve logistical systems for recovering food:

I worked on the logistics. For instance, I sold the food bank a bunch of totes. I told them, “This the way to do this. Don’t do this in cartons.” Then we worked a deal with the cooler, where they donated the cooling, because I’m a partner in a cooler. It stays there for the week, and then they can efficiently send a six-pallet truck over, pick it up, and they don’t get inundated with, “Here comes two loads of product.” You know what’s coming, and they can do it in a system.

Some successful cases involve complex feats of coordination in order to make recovery pencil out. A peach grower shared a story in which a food aid organization approached a box manufacturer to get donated or low-cost boxes, a transportation company to move the fruit, and then another corporate partner to donate \$1 per box to subsidize the grower’s harvest costs. The grower explained, “once you get all these pieces together, you can suddenly provide a box of fruit to the food bank for nothing by piece-mealing out all the costs.” Note that this example would be difficult to replicate where time and/or professional networks are in short supply.

As already noted, a key challenge in coordinating a supply-driven system that can respond to volume fluctuations is knowing what is going to be available, when, and in what quantities. For food recovery businesses, this means modifying orders to accommodate surpluses or shortages. For food banks, this means knowing when a grower has something to donate. Equally important is clear and timely communication about the quality of the product, including the nature of any imperfections and the length of its shelf life. For example, one respondent from a food bank shared this description of their top donor:

So our number-one top donor is a local CSA farmer. He has twice-weekly pick-ups, so we go and glean whatever is left over the day after his pick-ups. So that works very well for us because it’s very predictable. He also is really communicative. If there for some reason is not a lot leftover, he will reach out and say, “Hey, there’s only one box of lettuce this week, and it might not be worth the resources that it would cost you guys to drive out here.”

Regular communication demonstrates respect for partners and enables them to make real-time adjustments, optimizing limited resources such as volunteer labor. A commitment to timely communication and collaborative problem-solving can therefore address both the relational and logistical challenges to food recovery.

Flexibility and Consistency

The success stories we heard often involved operational flexibility within a broader commitment to provide consistent, reliable service to partners. This means being willing and able to accommodate fluctuations in partners’ schedules, offerings, or needs, and then following through on commitments. This success is often hard won, especially given the volatility associated with agricultural markets. Indeed, food recovery exists in part because of that market volatility, but it means that the playing field is constantly shifting under the partners’ feet.

The private recovery companies we interviewed succeed when they build flexibility directly into their business model, for example by varying what they offer to customers. Food banks also vary their offerings to clients based on what they can receive in donations. However, both types of recovery outlets are limited in their ability to absorb the available supply of recoverable food. Without corresponding demand from customers or clients, recovery outlets risk exacerbating environmental costs by sending excess food to landfills, negating a key societal goal in promoting recovery. Balancing the multiple goals and needs in an ever-changing landscape is a difficult balancing act, and of course it doesn’t always work.

Respondents often emphasized the give-and-take that their partnerships require. Each party would accommodate the other’s needs, sometimes responding to urgent or inconvenient requests, with the knowledge that the roles would probably be reversed tomorrow. For example, a private food recovery organization occasionally asked growers to deliver a product early or send surplus products to another vendor; likewise, growers occasionally requested and received flexibility from

the organization. One grower also reinforced the importance of maintaining good relationships with buyers, who can build more flexibility into the system in cases of over- or undersupply:

When you develop relationships with customers, they will help you, you know. When you're short you don't just cut them out. You cut everybody back some. Or if you're long, you encourage them. "Hey, John, I really need you to take an extra pallet today," or, you know, "let's lower the price a little bit so you can work it out."

The volume and variety of donations that food banks receive varies constantly according to the season, current weather conditions, and market prices. Growers can offer food banks consistency by setting up recurring donations or providing advance warning about future donations. Meanwhile, recovery organizations can offer consistency to growers by sticking to a regular schedule or providing reliable labor. As one interviewee from an emergency food organization explained:

They're dealing 23 and a half hours a day with exceptions. They want a half-hour where they don't have to deal with an exception. . . . You're going to be here on Wednesday morning at nine to pick this product up, as opposed to, "Well I'll be there on Wednesday except maybe if some volunteer doesn't make it in," or whatever it is.... What are ways that I can bring value to the relationship?" It doesn't necessarily have to be money every time. It can be consistency.

Providing flexibility and consistency requires not just relational commitment but also logistical capacity. The ability to reliably offer volunteers, volumes, or prices requires a capacity that may not be available to many recovery organizations or all growers. For example, one small-scale grower explained that he cannot offer the consistent supply of seconds that a school foodservice would require:

I've gone around and around with foodservice people, and the schools, and they said, we're happy to buy your stuff, but you have to have consistency. You have to be able to supply us 52 weeks out of the year. You have to have it prepared, cleaned, ready to go, so that our food servers can take it out of a bag, pour it out, for the kids to take. And we want it competitively priced. And I said I can't do any of that. So, there we are, at the same stalemate for years.

By contrast, organizations with the logistical capacity for consistency can offer it as a signal of their value for others. For example, a larger-scale peach grower successfully donated or sold all his culls that year, creating a dependable system for juicers that made him an attractive partner:

When [the juicing company] take[s] the culls away from us, it simplifies their life if they have a minimum stop time. They go where they're going to get good service. Timely. And where there's enough volume to load their trucks. They don't want to be running around. Through the years, we've been able to adapt. When he shows up, boom, boom. So, it's not just the fruit they're coming for, they're also coming for the service.

Some growers are willing to accept short-term losses if they expect relationships with recovery organizations to yield net benefits over time. For example, one interviewee from a food bank explained that they source fresh produce both through donations and a smaller, paid program offering growers a "pick and pack out" (PPO) fee, and often growers in the region will begin donating products because they hope to be considered for the paid program in the future. Recovery organizations will also incur short-term losses in order to build longer-term relationships with growers, as in this food bank's response to a grower who delivered off-grade produce:

I might say, "This time let's move the trash for them, and then we'll educate them." If they're a new donor we'll educate them on what our guidelines are, invite them to take a tour of our warehouse, talk to them about it a little bit and then try again. Because that might be an opportunity for more in the future.

Other examples include food banks that occasionally accept donations of food they have in abundance if a grower is desperate to move the product quickly, or businesses serving secondary markets occasionally offering growers some flexibility on price or quality. In all the above ways, mutual accommodation greases the squeaking wheels of partnership.

5. Conclusions

By looking jointly at the perspectives and experiences of both growers and their partners in food recovery organizations, our research highlights what it will take to make recovery of on-farm food losses more successful. The path forward appears less rosy than presumed by those who view the statistics on recovery potential from a distance, but also more promising than presumed by those who see the structural challenges (both economic/logistical and social/relational) as inherently insurmountable. Instead, our work suggests that recovery work will be difficult, but possible in some scenarios. Its success will be largely dependent on the ability to build sustained relationships capable of addressing the economic costs and logistical challenges associated with recovery. Our research makes three specific contributions by: (1) providing a straightforward conceptual rubric that helps to identify when food recovery partnerships are likely to be more or less difficult to achieve; (2) highlighting key relational strategies or approaches that make success more likely, even if the logistical challenges are significant; and (3) emphasizing the dynamic, developmental, and context-specific nature of the work, such that “what works” will necessarily change over time and across different settings.

First, our data support a conceptual model of agricultural food recovery that focuses on the intersection of economic and logistical considerations with stakeholders’ social relations (Figure 1). When stakeholders encounter substantial challenges along both dimensions, the path to food recovery may prove exceedingly difficult. However, our interviews suggest that recovery becomes more achievable when stakeholders can address one or both dimensions through careful relational work. The fourfold typology is intended less as a static classification of recovery opportunities than as a tool for understanding how the drivers of food recovery are multidimensional and dynamic. Our data provide multiple examples of how relational work can ease economic and logistical barriers to food recovery. However, logistical and economic forces also constrain the efficacy of relational work, which requires organizational capacity and not simply personal commitment. Our rubric thus helps practitioners locate their own circumstances in terms of degree of difficulty while directing their attention, and that of other stakeholders, to the most significant variables impacting the potential for success.

Second, by examining the positive and negative cases of recovery efforts in the data, we have identified several relational strategies that successfully enabled stakeholders to overcome economic, logistical, and/or social challenges. Before successful partnerships were established, respondents reported that they worked to carefully craft their message, draw on common histories or identities, and focus on each party’s interests to identify possible mutual benefits. Once established, successful partnerships were maintained over time when partners communicated to support collaborative problem-solving and offered each other flexibility within a consistent long-term commitment. Thus, the findings from this research suggest that relational work is a critical dimension of agricultural food recovery that has often been overlooked. A key finding is that partners need to develop mutual understanding of one another’s short and longer-term interests. They must know enough about each other to be able to ascertain if they have something practical to offer one another. In the best-case scenarios—where logistical hurdles are minimal and the relationship is easily established—practical pathways forward are more likely to occur, but even in those cases, partners must be able to reliably deliver on promises while making inevitable adjustments as circumstances change. In more typical scenarios where barriers are higher, it can take some time and effort to discover partnership possibilities that may not be apparent at first.

Thus, those seeking to enter into food recovery partnerships should realize that it will take doing their homework and making the effort to gain information and perspective. Successful relational work often is rooted in a certain kind of humility that seeks to understand the viewpoint of the partner,

rather than leading with what is in one's own interest. By hiring the right people—such as those who have worked previously in the realm of the partner organization, or who simply excel at this kind of relational work—recovery organizations or growers can potentially lessen the time it might take to build working partnerships. Where this is not possible, the logistical complexity of food recovery means that participation is not a casual endeavor. Organizations pursuing this path should make sure to budget for the substantial commitments of time, attention, and resources required. Some of that time and effort is reflective time, to assess what strategies and approaches have been working and what have not, while adjusting future plans accordingly.

Finally, our interviews reinforce earlier research indicating that the costs of food recovery will vary significantly across different crops, community and regional contexts, and over time as market realities, regulations, or policies change [11,13,41–43]. As such, the work of recovery is inherently dynamic and developmental, evolving in response to complex and shifting variables, only some of which the players control. Fluctuations in agricultural markets, regulatory policies, tax incentives, the supply of agricultural labor, and retailer quality specifications are important external constraints on the viability of food recovery, independent of stakeholders' social relationships or personal views about the enterprise.

Our work has at least two key limitations. First, our relatively small sample of growers and recovery organizations in California may not capture important dynamics that are present in other geographic regions or organization types. Second, the sample of interviewees willing to be interviewed is likely biased toward perspectives that take food loss seriously and support food recovery efforts. Nevertheless, their commitment and experience allow us to derive insights that illustrate key factors influencing their recovery efforts. Our approach is to use the interview evidence to document a range of challenges and potential solutions as perceived by respondents, rather than to ascertain which is more important than others or to make broad claims about their generalizability.

Future research is necessary to better understand the overlapping influence of social and material forces on agricultural food recovery, especially in different crops and geographic contexts. We are grateful to the respondents who have shared their perspectives on this important work and hope our framework of interpretation will be useful in guiding practice and in generating working hypotheses about the conditions under which food recovery becomes more or less viable. For practitioners, our findings can be interpreted as a caution against the risks of ignoring relational dynamics when designing food recovery programs. Our research demonstrates not only that stakeholders' social relations can serve as an additional barrier to food recovery alongside the better-documented logistical and financial barriers, but also that certain kinds of relational work can be a promising strategy for addressing these constraints.

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