

# Food insecurity: addressing a challenging social problem with supply chains and service ecosystems

Food  
insecurity,  
supply chains  
and ecosystems

Sebastián Javier García-Dastugue  
*Department of Marketing and Logistics, Florida International University,  
Miami, Florida, USA*

Rogelio García-Contreras  
*Strategy, Entrepreneurship and Venture Innovation Department,  
University of Arkansas, Fayetteville, Arkansas, USA*

Kimberly Stauss and Thomas Milford  
*School of Social Work, University of Arkansas, Fayetteville, Arkansas, USA, and*  
Rudolf Leuschner  
*Department of Supply Chain Management, Rutgers University,  
New Brunswick, New Jersey, USA*

Received 16 March 2023  
Revised 20 August 2023  
18 December 2023  
20 February 2024  
Accepted 25 February 2024

## Abstract

**Purpose** – Extant literature in supply chain management tends to address a portion of the product flow to make food accessible to clients in need. The authors present a broader view of food insecurity and present nuances relevant to appreciate the complexities of dealing with this social problem.

**Design/methodology/approach** – The authors conducted an inductive study to reveal the deep meaning of the context as managers of nonprofit organizations (NPO) define and address food insecurity. The focus was on a delimited geographic area for capturing interactions among NPOs which have not been described previously.

**Findings** – This study describes the role of supply chains collaborating in unexpected ways in the not-for-profit context, leading to interesting insights for the conceptual development of service ecosystems. This is relevant because the solution for the food insecure stems from the orchestration of assistance provided by the many supply chains for social assistance.

**Research limitations/implications** – The authors introduce two concepts: customer sharing and customer release. Customer sharing enables these supply chains behave like an ecosystem with no focal organization. Customer release is the opposite to customer retention, when the food insecure stops needing assistance.

**Social implications** – The authors describe the use of customer-centric measures of success such improved health measured. The solution to food insecurity for an individual is likely to be the result of the orchestration of assistance provided by several supply chains.

**Originality/value** – The authors started asking who the client is and how the NPOs define food insecurity, leading to discussing contrasts between food access and utilization, between hunger relief and nourishment, between assistance and solution of the problem, and between supply chains and ecosystems.

**Keywords** Societal problems, Food insecurity, Customer sharing, Customer release, Service ecosystems, Nonprofit organizations

**Paper type** Research paper

## Introduction

Food insecurity is the “. . . lack of access, at times, to enough food for an active, healthy life for all household members and limited or uncertain availability of nutritionally adequate foods” (Carle and Rosenberg, 2018, para. 2). In 2019, the 76 low-to-middle income nations were home



---

to 19.3% of the 3.8 billion food insecure people (Meade, 2019). While the proportion has decreased, at least 446 million in these low-to-middle-income nations are food insecure (Thome *et al.*, 2019). Also, large numbers of food-insecure people struggle in developed nations; for example, in the United States, one in ten households experienced some level of food insecurity (Coleman-Jensen *et al.*, 2020). While COVID-19 has intensified the problem (Blackmon *et al.*, 2021), food insecurity preexisted and is likely to continue (Durisin, 2022), “As the cost of nearly everything surges, more Americans are turning to food banks to eat” (Gibson, 2022, para. 1). Food insecurity persists; for example, in the United States, it ranged between 10.5% and 11.9% since the 2000s, except for a spike above 14% in 2008, to decline back to the 10% level in 2019 (USDA-Economic Research Service, 2021). While food insecurity is a worldwide challenge, it shows idiosyncratic territorially bound characteristics (Berrone *et al.*, 2016; Brenner, 1998).

Extant supply chain management (SCM) literature in food insecurity tends to focus on food distribution and redistribution (Ataseven *et al.*, 2018). The food banking model implies distributing food through partners – food pantries, schools and shelters – (Ataseven *et al.*, 2020; Blackmon *et al.*, 2021; Feeding America, 2021). The study of food insecurity beyond food distribution is scant; less is known about what happens facing the client. Thus, there is an opportunity to further our understanding of nuances that are relevant to designing and managing supply chains (SC) for dealing with food insecurity, particularly with a focus on the end-customer or client (individual or head of the household in need).

Our motivation is to better understand food insecurity from a SCM point of view by exploring how different nonprofit organizations (NPO) define the problem and design their SC to respond. We asked the following: *Who is the client and how is customer value defined? What do NPOs do to deliver that customer value to the client?* We conducted a systematic inductive qualitative study. Following prior work (O'Connor *et al.*, 2003; Sanders and Wagner, 2011; Wowak *et al.*, 2016), and to account for the interdisciplinary nature of food insecurity (Pohl, 2011; Sanders *et al.*, 2019) we adopted these research ideals: (1) use a multidisciplinary team (Sanders and Wagner, 2011) because it “. . . has greater potential for the development of more complete solutions to contemporary SCM problems” (Sanders *et al.*, 2016, p. 108); (2) design the study to transcend organizational boundaries of the focal NPO; and (3) adopt a broad view of SCM to include product flow, processes, and SC design (Mentzer *et al.*, 2001; Wowak *et al.*, 2016).

Our study provides a two-way bridge between SCM and the management of NPOs in the context of food insecurity. First, it contributes to the dialogue from a SCM view of food insecurity by showing that it is a complex problem for SCM and that, at an aggregate level, requires a holistic solution in addition to distributing food. Second, we provide SC implications beyond the product-flow-centric view. Dealing with food insecurity requires service components that can only be described by adopting a service-centered logic of the social problem (Vargo and Lusch, 2004). Third, our data showed a level of interaction across NPOs unexpected in the for-profit context based on resource-sharing. Most interestingly, unlike current literature (Kapoor, 2018; Ketchen *et al.*, 2014), customer-sharing reflected a *pure* service ecosystem where there is not a focal organization (Stolze *et al.*, 2016; Tansakul *et al.*, 2023).

### Literature review

This study is focused on the NPOs dealing with food insecurity by integrating SCs; we review the literature around three major themes: defining food insecurity, providing food access and new SC designs beyond food access.

---

### *Defining food insecurity*

Food *security* is defined as access “to safe and nutritious food and water adequate to sustain an active and healthy life with dignity” (FAO, 1996). Given that food *security* is unobservable (Barrett and Lentz, 2016), the antonym, food *insecurity*, is frequently used and is defined as “. . . lack of access, at all times, to enough food for an active, healthy life” (Raskind *et al.*, 2019, p. 476). Food insecurity might result in individuals experiencing “disrupted eating patterns and reduced food intake” (Coleman-Jensen *et al.*, 2020, p. 25) which risks affecting the individuals’ active and healthy life with dignity.

Addressing food insecurity may seem straightforward, if the problem is lack of access to food, the solution is providing access to food. However, several paradoxes depict how challenging this social issue is (Richards *et al.*, 2021). The overarching one is that even though global food production is sufficient to feed the entire population of the world, a significant number of people lack access to the necessary food products (FAO, 2011). Second, the wealth of an economy does not guarantee the ability to provide access to food for everybody (Irani and Sharif, 2018). A third paradox is that even though many individuals lack access to the necessary *nourishment* to maintain an active and healthy life, food waste is substantial (Moates *et al.*, 2016). The fourth is that lack of access to food is associated with obesity (Dhurandhar, 2016; Muzigaba *et al.*, 2016). This indicates that access to *food* and access to *nourishment* are two distinct problems; that is, one can have access to food and still be unhealthy or undernourished. Ultimately, it should be noted that social problems related to food are varied and complex (Ataseven *et al.*, 2020; Long and Wood, 1995; Wills, 2017).

The causes of food insecurity are varied, complex to determine, and probably impossible to articulate an agreed-upon comprehensive list (Godfray and Robinson, 2015; Irani and Sharif, 2018). First, food insecurity can happen in any geography and in any economy (Araújo *et al.*, 2018; Borch and Kjærnes, 2016; Hanson and Connor, 2014; Irani and Sharif, 2018). Second, unlike disaster relief, there is no beginning and end; that is, food insecurity is chronic (Cason, 1999; McDevitt, 2018; Wills, 2017). Social workers explain that a food insecure individual “does not know where the next meal is coming from.” The condition of food insecurity precedes the state of hunger (Cason, 1999, p. 49). Lack of access to food happens because excess food is not where it is needed when it is needed (Bals and Tate, 2018; Barrett, 2010; Long and Wood, 1995).

### *Providing food access*

In the United States, Feeding America is the largest network of food banks (Ataseven *et al.*, 2020) with 200 food banks across the country (Feeding America, 2021). Downstream, they operate through partner agencies such as food pantries, kitchens, schools and shelters (Ataseven *et al.*, 2020; Blackmon *et al.*, 2021) who deliver and, thus, have a relationship with the client. When compared to a contemporary SC of a business, this structure resembles a traditional, long-distribution channel with suppliers (producers/manufacturers), distributors (e.g. Feeding America), wholesalers (food banks), retailers (food pantries) and end-customer (clients). While not all food banks in the United States are partners of a network, the food banking/food pantry model is the most frequent. The food banking model attracted most research attention in SCM. Blackmon *et al.* (2021) focused on the operation of a food bank (box preparation). Some use food banks, though, their focus resembled that of an operational study in any [for-profit] context. Solak *et al.* (2014) studied a location-routing problem in the context of food distribution at food banks. Similarly, Biswal *et al.* (2018) studied RFID adoption to improve warehouse operations in a food bank.

SCM studies about food insecurity, either in the context of food banks or not, primarily focus on product flow operations. This is reflected on the performance measures used; they predominantly are process-centric in contrast to customer-centric measures. Ataseven *et al.* (2020)

---

use the amount of food distributed per food insecure individual; Blackmon *et al.* (2021) use the number of cases delivered from the food bank to food pantries; Davis *et al.* (2016) center on forecast accuracy of prediction of food donations. In sum, in SCM, research dealing with food insecurity focuses on food access to the food insecure, and tends to focus on the operational aspects of managing the product flow.

### *Beyond food access: new supply chain designs*

Some believe that dealing with or solving the chronic aspect of food insecurity requires more than providing food access. Specifically, it requires “[. . .] long-lasting, systemic solutions involving additional programs such as child nutrition, nutrition education, and job training for the unemployed” (Mendoza-Abarca and Gras, 2019, p. 988). This underscores the difference between access to food and to nutrition, and is relevant because there is a strong bidirectional causal relationship between poverty and malnutrition (Lentz and Barrett, 2013). Likely, this systemic solution called for by Mendoza-Abarca and Grass (2019) will require SCs to deal with issues beyond managing the product flow (distribution of boxes of foods). Annossi *et al.* (2021) highlight the re-conceptualization of SC designs to leverage the use of digital technologies to prevent food waste. Sundgren (2020) found new actors adopting new roles in closed-loop food SCs. Along the same lines, Ciulli *et al.* contend “circularity brokers” (2020, p. 299) are needed to connect waste generators and receivers. In sum, dealing with the social problem of food insecurity likely requires a more complex solution that transcends providing access to food. For example, Wills, supporting the “criticism of the dominant food bank model” (2017, p. 62), calls for the development of social enterprises *that complement existing efforts*. Our literature review shows that little is known about what happens at the customer interface. Also, while, strictly speaking, the definition of food insecurity is based on *nourishment*, in our field, studies tend to overlook the distinction between *food* and *nourishment* (e.g. Martins *et al.*, 2019).

### **Methodology**

We used inductive research based on qualitative data to examine food insecurity from the point of view of SCM. This required a detailed examination of the data using the language and mindset of NPO managers to reveal the deep meaning of the context as they define and address food insecurity (Kirchoff *et al.*, 2016; Lincoln and Guba, 1985). We approached the data without pre-determined models and used interpretation and inductive association. This methodology is suitable for exploring questions “involving inter-firm integration/collaboration/relationship issues”; that is, “questions involving complex social interaction within and between firms that can benefit from a deeper understanding of underlying concepts and their interrelationships” (Mello and Flint, 2009). We followed the tenets of systematic inductive research to guide our procedures (Gioia *et al.*, 2013; Quarshie and Leuschner, 2020; Villena and Gioia, 2018). In addition, we interactively reviewed literature, and collected and analyzed data (Glaser *et al.*, 2013; Glaser and Strauss, 2017; Kirchoff *et al.*, 2016). Data collection, coding and analysis happened jointly (Cohen *et al.*, 1969; Holton, 2010). At each iterations, using theoretical sampling, we decided what data to collect next (Cohen *et al.*, 1969; Corbin and Strauss, 1990).

### *Context and sample*

The context for this study is four counties in Northwest Arkansas. The US state of Arkansas, the fifth highest food insecure population (17.3%) and the second highest population for children (23.1%) (“Map the Meal Gap. Food Insecurity in the United States”, 2020). All four had food insecurity rates higher than the national average of 11.5% in 2018: Benton (11.6%),

Carroll (13.8%), Madison (15.7%) and Washington (14.4%) (Carle and Rosenberg, 2018). Initially, we planned to identify NPOs with novel SC designs in any geography. However, after interviewing the first two organizations, it emerged that “competing” NPOs interacted in unanticipated ways. For this reason, and consistent with studies in this domain (Sundgren, 2020) and the constructivist research tradition, we adapted the data collection strategy to focus on a limited geographic area. This approach has the benefit of understanding a concept deeply, without introducing additional noise in the data, at the expense of broader generalizability.

Our sample included food banking and all organizations that designed and implemented a SC solution different than the food banking model. In this geography, there were another 154 active organizations focused on food insecurity. These organizations were not included because they were the distribution channel of the food banking model: 101 are food pantries, and 47 organizations providing free meals (soup kitchens or meal delivery services). From the remaining six, four were community gardens, one delivered groceries (not at scale), and one recovered and re-distributed food products that otherwise would go to waste. Table 1 shows there were 14 interviewees representing 10 organizations. While the sample might seem low, it is above other studies in a similar research context (e.g. Sundgren, 2020).

The research study began in 2019 by reviewing publicly available supporting material and having initial contact with potential participants. Interviews happened between April and October 2020. All interviewees were conducted via videoconference and lasted between 75 and 120 min. While all NPOs were experiencing the impacts of COVID-19, all interviewees were specifically asked to focus on their experiences before the pandemic. Before each interview, we collected and studied secondary information from each organization, including publicly available material, reports and presentations used by NPO management previously, and interviews available in trade magazines and social media. Most of these organizations were small; thus, we had access to the founding or top management team. On the flip side, the printed material (usually available in qualitative research on large corporations) was limited. At least two researchers participated in each interview. Interviews were recorded and transcribed, and notes were taken. Coding started after the first interview and team debriefing meetings were held regularly. There were four main researchers and two graduate assistants.

Interviewee	Organization	SC role	Size	Employees	Founded
1	A (*)	Focal	Large	34	1988
2	B	Focal	Small	2	2012
3					
4	C	Focal	Small	5	2017
5	D	Focal	Small	3	2011
6	E	Focal	Small	3	2020
7	F (*)	Supporting	Large	16	1965
8	G	Supporting	Large	37	1988
9					
10	H	Supporting	Small	14	2016
11					
12					
13	I	Focal	Small	14	2009
14	J	Supporting	Independent/Activist		

**Note(s):** (\*) Organization with national presence

Interviewees and organizations are listed in the chronological order the interviews took place

**Source(s):** Authors' own work

**Table 1.**  
Interviewees and  
participating  
organizations

---

Through a constructivist lens, researchers encouraged interviewees to reflect on their experiences as leaders and ascribe meaning to the structure, purpose, and strategies implemented. An interview guide was developed around five dimensions: (1) customer value creation (Bals and Tate, 2018), (2) relationships internal (Ataseven *et al.*, 2018; Kahn and Mentzer, 1998), (3) relationships external (Ataseven *et al.*, 2018; Gulati, 1998; Lambert *et al.*, 1999), (4) execution (Patel *et al.*, 2013) and (5) performance measurement (Randall *et al.*, 2015). The interview guide is shown as [Appendix A in Supplemental Online Material](#). The interview guide served to maintain consistency across all interviewees. Having interviewed all NPOs directly involved in integrating a SC to deal with food insecurity in the geography, we reached saturation.

### *Data analysis*

The initial step was a first-order analysis (Gioia *et al.*, 2013) coding of the interview transcripts. Three team members independently read and coded transcripts; one used manual coding, two used Atlas.ti Version 8. The researcher conducting the manual analysis read each transcript twice searching for reoccurring themes. The other two researchers did so, too, and used software features to identify reoccurring themes. Strauss and Corbin (1994) suggest comparing each new narrative to prior interviews. Researchers reviewed the results and discussed discrepancies. The second step was to formulate second-order themes (Gioia *et al.*, 2013), which are “researcher-induced concepts cast at a more abstract level” (Wowak *et al.*, 2016). We developed coding networks (Atlas.ti) rooted in the interview guide (see [Appendix A in online supplemental material](#)) to identify relationships among codes and second-order themes emerged. Second-order themes were grouped in third-order aggregate dimensions (Gehman *et al.*, 2018; Quarshie and Leuschner, 2020). The outcome of this process is the data structure in [Figure 1](#). Aiming to balance between how much data to show and our interpretation of these data (Pratt, 2009) and following established practices in our field (Quarshie and Leuschner, 2020), proof quotes supporting each first-order concept in the data structure are provided as [Online Supplemental Material Table S1](#).

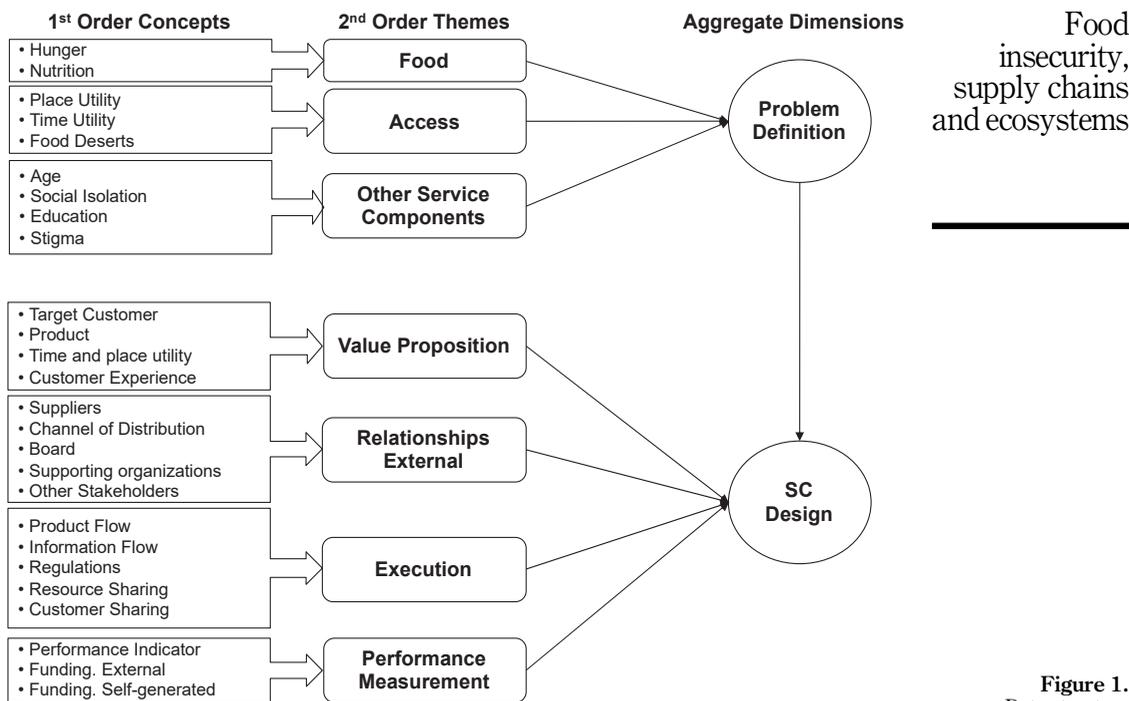
During the analysis, we returned to the literature on management, operations management, SCM, social work and supply networks. Sundgren (2020) underscores the value of focusing on a limited geographic area to study food insecurity; this is a specific example of the value of going back to the literature during analysis. Most interviewees had limited *formal* SCM expertise; however, we relied on accepted terminology in the SCM field to describe findings.

### **Findings**

Each NPO defined food insecurity uniquely, which in turn guided their work, resulting in each organization having a SC that reflected their conceptualization of food insecurity. Even the discussion about who the client was (recipient of the value created), was not unanimous. Some surmised the clients were the individuals or households that experience food insecurity, while others argued that the client was the community at large as an indirect recipient of the benefits associated with working on reducing food insecurity. For this study, we chose to define the client as a food-insecure individual who requires assistance for herself/himself or for the household. This was chosen because statistics on the issue frequently count at the individual level. The description of the findings followed the data structure shown in [Figure 1](#), organized in the two aggregate dimensions that emerged from the data: (1) problem definition and (2) SC design (Ketchen *et al.*, 2014; Pathak *et al.*, 2014; Stolze *et al.*, 2016; Tansakul *et al.*, 2023).

#### *Aggregate dimension 1: problem definition*

Three themes emerged to describe problem definition: (1) *Food*, (2) *Access* and (3) *Other Service Components*. Understanding the way these organizations view food insecurity enables a deeper



Source(s): Authors' own work

Figure 1. Data structure

understanding of the associated SC complexities. *Food* involves two concepts that pose distinct challenges: (1) hunger and (2) nutrition. The basic response to ameliorate *hunger* is to provide food. Some perceived food insecurity as a hunger problem, others, consistent with FAO's definition, perceived it as a nutrition deficit. This contrast has substantial implications for the customer and the SC. Shelf-stable foods ameliorate hunger while easing operational complexity. But most shelf-stable foods are of lower overall nutritional value (nutrients as they relate to, for example, carbohydrates, fats, sodium and sugars). Of the organizations interviewed, some explicitly described the main problem as lack of *nutritious* food, even when food (though less nutritious) in general can be reasonably available.

*Access* includes three concepts. The first two concepts, *Place Utility* and *Time Utility*, from a SCM point of view are connected. Regarding *Place Utility*, some clients are home-bound; thus, they do not have the means to go to a food pantry (part of the food banking distribution channel). Concerning *Time Utility*, many food pantries are open during hours when volunteers are available to provide their services, but inconvenient for working clients. For a business, this could be an easy fix based on a revenue-minus-cost. For NPOs relying on volunteers, personnel operating a food pantry are often retired or have limited availability. As shared by one interviewee, "... most of them are all volunteers, and the volunteer base [here], as well as the rest of the world, is aging out and there is not the next age of volunteers coming through." Additionally, operating hours are important because, as one interviewee asserted, "[i]n most cases, the food pantry client is working at least one job, perhaps two."

The last concept of *Access* is *Food Deserts*, which, to our interviewees, refers to geographic areas where providing access to food is challenging for an NPO. Frequently, food deserts imply minimal access to grocery stores and/or that availability of *healthy food* to the customer

---

is limited (Walker *et al.*, 2010). In this study, because of a combination of lower population density, longer distance to the NPOs' locations, and a lack of food pantries (frequently associated with houses of worship), there are some geographic areas where it is more difficult to provide accessible food.

The third theme was *Other Service Components*. From our findings, this theme included several factors that added depth to the understanding of the complexity of food insecurity. Within this theme, the challenges that frequently emerged were *Age*, *Social Isolation*, *Education* and *Stigma*. The first are connected; however, social isolation can relate to other – sometimes more challenging – issues to manage such as chronic illnesses or mental health. Age and isolation resulted in additional complexity to access.

*Education* was manifested in two ways. One was the challenge faced by everyone. This includes knowing what to eat and being aware of the health implications of eating processed foods – usually with higher contents of carbohydrates, fats, sodium and sugar (Gearhardt and Hebebrand, 2021). Participants reflected there was a need to educate clients on the fresh produce available and how to cook these items. One interviewee described:

We realized there were different items that people were unfamiliar with, like maybe eggplant or bok-choy. So, we started coming up with recipes with pictures so that you could see that looks delicious even though they've never used it. We made sure all of our recipes were simple, still tasty, and very affordable to make.

The second education challenge was how to access programs such as SNAP (the Supplemental Nutrition Assistant Program run by the USDA). NPOs frequently assisted individuals in navigating the systems to access to available governmental programs.

*Stigma* was the last concept in *Other Service Components*. Two distinct aspects of stigma emerged. The first included the feelings from the client. This refers to the human tendency to not seek help which might be the result of fears and cultural judgments. Understanding stigma is relevant to dealing with the challenges of *Time and Place Utility*. Also, stigma was related to fundraising and donors. It is important to keep in mind that these organizations do not receive revenue from clients but fund their operations via donations and grants. Stigma ranged from being unaware of the problem of food insecurity to the belief that food-insecure individuals were abusing the system (see Table S1 in Supplemental Online Material).

#### *Aggregate dimension 2: SC design*

SC Design describes the SC NPOs designed to deal with food insecurity. Our purpose for this study was to further our understanding of food insecurity from the SCM point of view. Thus, the aggregate dimension *SC Design* reflects the structure of the interview guide: (1) *Value Creation*, (2) *Relationships External*, (3) *Execution* and (4) *Performance Measurement*. The fifth dimension, relationships internal, did not result in rich data. We believe that the fact that the participating organizations were small, in terms of the number of individuals working full-time, internal coordination was done informally.

The first theme, *Value Proposition* included (1) Target Customer, (2) Product, (3) Time and Place Utility and (4) Customer Experience. The food insecure individual or household was present in all discussions about for whom the NPO creates value. Defining who the target customer was could be accompanied by a greater level of specificity which represented a market segment or a target market. For example, some NPOs target the elderly food insecure individual while others define their target customer as “everybody.” One NPO manager replied, “You know, that’s the \$64,000 question in our business”; another said, “so, that’s a multilayered answer.” Regarding the *Product* that was distributed, the physical product was a standard bundle of food (shelf-stable, fresh produce and frozen protein). To this, a manager stated: “you want to give them food that they won’t necessarily have to cook like cucumbers or peppers or tomatoes or fruits.”

---

In response to the 2nd order theme *Access* (part of Aggregate Dimension #1), *Time and Place Utility* was connected to *Value Proposition*. For instance, NPOs use food pantries or design alternative methods for direct delivery (direct-to-consumer in business). Everyone mentioned that, for strategy development, NPOs consider how their value proposition will complement that of existing NPOs.

Interestingly, the last concept was *Customer Experience*. Some sought to create an experience in addition to delivering food. For example, social isolation is a problem for some populations such as the elderly. After receiving assistance from one of the NPSs, they showed interest in becoming a volunteer, either coordinating activities or acting as an impromptu volunteer. Also, mobile food pantries created a socializing experience as the vehicle tended to remove the stigma felt by clients. When the goal of the NPO is to raise awareness about nutrition, the focus became creating an educational experience.

*Relationships External* included five first-order concepts. The first two were *Suppliers* and *Channels of Distribution*. The most distinct characteristic of management of these relationships were reported by most interviewees as the presence of an aspirational component that drives SC partners. For example, farmers know the value of eating healthier foods and put extra effort to make produce available rather than disposing of the produce because they do not want to waste their production (see quotes in [Online Supplemental Material Table S1](#)).

Additionally, literature underscores the importance of having a *Board* for guidance and networking ([Lecy et al., 2012](#)). Interviewees did describe the importance of active board with technical, strategic, and relationship development skills. Other *Supporting Organizations* with which the NPOs interacted include government agencies at the city or state level and the chamber of commerce. Successful social innovation initiatives usually involve such cross-sector collaborations ([Von Jacobi and Chiappero-Martinetti, 2017](#)). Thus, while these organizations were labeled as *supporting*, they frequently provided pivotal influence on how the problem of food insecurity was defined and how the SC was designed. Interviewees reported while there was a stigma surrounding food insecurity, increasingly *Other Organizations*, such as companies and governmental agencies, got involved. For example, Kraft Heinz committed a donation to Feed America during the COVID-19 outbreak ([Mullen and Galia, 2020](#)). One interviewee specifically described the challenge of coordination across governmental agencies:

... for example, let's just stick with the National School Lunch Program [...] the complexity in understanding all the rules and regulations ... I mean, this is a career in and of itself.

*Execution* of flows was the third theme. As expected from a product-based SC, the first two concepts that emerged were *Product Flow* and *Information Flow*. Interviewees recognized the value of information visibility. As in the previous literature (e.g. [Ataseven et al., 2020](#); [Blackmon et al., 2021](#); [Martins et al., 2019](#); [Ssenoga et al., 2019](#); [Thapa Karki et al., 2021](#)), inventory management, order fulfillment and demand management were concepts that emerged from the data. Regulations, traditionally, become liability barriers for companies to donate; for example, food that was near the use-by day. For this reason, *Regulations* emerged as a first-order concept. Interviewees agreed that the right regulations often facilitated the availability of foods to redistribute.

The last two first-order concepts in *Execution* were *Resource Sharing* and *Customer Sharing* as they showed how NPOs collaborated as an ecosystem. *Resource sharing* refers to inventory (food) available that needs to be allocated. It also refers to assets needed to store, transform or distribute available food. In the for-profit context, this is like Walmart and Amazon sharing a warehouse or Procter and Gamble and Colgate-Palmolive sharing manufacturing capacity. Noteworthy, resource sharing is used to serve customers as NPOs value more the ecosystem as a whole being able to respond than who does it. In the for-profit

---

context, this is referred to as co-opetition, competing and collaborating at the same time (Pathak *et al.*, 2014). For these interview participants, this was their norm, and there was no indication that the NPOs competed. However, like Ashley and Faulk (2010), they do compete for grants and donations.

*Customer Sharing* also emerged as another novel concept. Frequently, clients experienced challenges not handled by the NPO such as housing or work skills. For this reason, NPOs collaborated with other NPOs to provide the client the necessary bundle of assistance. This resembles the concept of supply ecosystems (Pathak *et al.*, 2014) or service ecosystems (Stolze *et al.*, 2016). Beyond this sharing among non-competitors, an NPO might *share a customer with a competitor*. In for-profit contexts, customer retention is central to obtain repeat business. In our context, the aspirational goal of assisting the food insecure was so prevalent that customer sharing became a resource to fulfill the mission of the NPO.

In the last theme, *Performance Measurement*, three concepts emerged. Previous research used product-flow-centric measures, such as pounds of food delivered (e.g. Blackmon *et al.*, 2021), rather than customer-centric measures. Almost all NPOs reported using operational indicators including pounds of food delivered, number of volunteers involved or number of visits. One NPO used people-centered indicators. Given their focus on nutrition, managers were using health-related metrics, such as weight loss or lab tests, to measure value provided.

*Performance Measurement* also includes *Financial Indicators*. The contrast between for-profit and not-for-profit management emerged here. When addressing financial performance indicators, most of the interviewees also addressed funding. *External* and *Self-Generated* funding emerged. *External funding* included donations and grants; these sources were not without limitations or costs. Donors often impose how funds can be spent (Rossouw, 2006). Grants also require substantial administration and reporting. For example, one NPO who focused on managing fresh produce described how during winter – low season – they handle administrative tasks including reporting. Because of these burdens, many NPOs sought to self-generate a revenue stream to decouple from other sources of funding. One interviewee asserted: “we’re really just trying to make a revenue stream so that we aren’t so dependent on grants and the rat race that that is.” Subsequently, measuring social impact is complex, multilayered and context-specific (Von Jacobi and Chiappero-Martinetti, 2017).

## Discussion

Our purpose for this study was to investigate how different nonprofit organizations (NPOs) addressed the social problem of food insecurity. Specifically, we inquired how customer value was defined, and what NPOs do to deliver said value. SCM literature tends to focus on the distribution and re-distribution of food to clients to address the problem. The literature review underscored the need to consider additional SC approaches to address food insecurity; other scholars have identified the need for new SC roles (Ciulli *et al.*, 2020; Sundgren, 2020), the need for additional connectedness among NPOs (Annosi *et al.*, 2021), and the need for developing complementary solutions (Wills, 2017). Initially, we had the intuition NPOs collaborated. We found a mesh of independent SCs that, from the point of view of the client (the recipient of assistance), behaved like a service ecosystem. Vargo and Lusch proposed service-centered dominant logic and asserted that “new perspectives have emerged that have a revised logic focused on intangible resources, the cocreation of value, and relationships” (2004, p. 1). Additionally, service ecosystems received increased attention (Adner and Kapoor, 2010; Ketchen *et al.*, 2014; Stolze *et al.*, 2016). In fact, Stolze *et al.* concluded “[i]ntegrating S-D Logic and service ecosystems thinking will provide a unique approach to integrating marketing and SC thought into a singular focus on shopper experiences within the service provision of the networked members of the ecosystem” (2016, p. 194).

Thus, we frame our discussion from the service-centered dominant logic lens. Table 2 provides a description of the dimensions used by Vargo and Lusch (2004, p. 7) to distinguish the good-centered dominant logic (GD) and the service-centered dominant logic (SD) and serves to guide our discussion. We want to stress that, based on our study, the two dominant logics coexist and, more importantly, complement each other in novel ways. For this reason, Table 2 includes an additional dimension to address SC design and service ecosystems. As additional online material, Table S2 shows the proof quotes provided in Table S1 reorganized in the goods- and service-centered dominant logics.

### *Unit of Exchange*

Food insecurity is based on three pillars: availability, access and utilization of food (Barrett and Lentz, 2016) which present a hierarchical relationship (Webb et al., 2006). For a food item to serve as adequate nourishment, it must be utilized; for this to happen, it has to be accessible to the food insecure; and, for that to happen, food has to be available. Availability represents the supply side (Barrett and Lentz, 2016). Statements such as “[e]nough food is produced today to feed everyone on the planet, but hunger is on the rise in some parts of the world, and having 821 million people ‘chronically undernourished’” (UN, 2019, para. 1) speak about availability, and tacitly overlooks access and utilization. It is important to underscore that the availability of food (the supply side) seems to be considered less of a challenge than providing access (the demand side) to the food insecurity problem. In the words of one interviewee: “. . . we feel like we have access to all the product necessary to serve the public, but I think it’s a distribution . . . the term the last mile comes in to play a lot and I think that’s where we’re short, [ . . . ] we are not getting it into the hands of the people.”

Thus, the distinction between access (product) and utilization (the service rendered by the product-in-use) remains to be discussed, and it fits well to reflect on the two dominant logics.

	Goods-centered dominant logic	Service-centered dominant logic
Unit of exchange	<i>People exchange for goods</i>	<i>People exchange to acquire knowledge and skills, or services</i>
Role of goods	Food items <i>Change in form, place, time and possession</i> Access	Nutrition, experience <i>Goods are intermediate “products” used as appliance in value creation-processes</i> Utilization
Role of customer	<i>The customer is the recipient of goods</i> Recipient of food items	<i>The customer is a coproducer</i> Applied knowledge (food choices, recipes) Develops community (reduce stigma and loneliness)
Determination of value	<i>Value is determined by the producer</i> Access to a standardized bundle of food items	<i>Value is based on “value in use”</i> Food choices, cooking healthy
NPO-client interaction	<i>Transactional exchanges</i> Transactions	<i>Relational exchanges and coproduction</i> Relational: customization, customer release
Supply chain design	Management of flows: product and information	Ecosystem: collaboration, and resource and customer sharing

**Note(s):** In *italics*, the original definition of the dimension. In non-italic, the summary of how the discussion fits with the goods- and service-centered dominant logics of food insecurity

The original table includes an additional row, namely source of economic growth

**Source(s):** Based on Vargo and Lusch (2004), Table 2, p. 7

**Table 2.**  
Goods- and service-centered dominant logics of food insecurity

These quotes exemplify the focus of both logics (all quotes also are part of the data structure shown in [Figure 1](#) and are provided as [Table S1](#) available as [supplementary online material](#)).

GD: food items

Our goal, our vision, is that by the year 2025 – and we have an estimate of how many pounds of food that is – everybody who is food insecure in the area will have reasonable access to that food.

SD: nutrition

What we started hearing is that not only was there hunger that's being faced, but within that there was a lack of nutritional value.

### *Role of Goods*

The role of goods is important in both logics ([Lusch, 2011](#)). Under GD, the focus is not only on the goods but on logistics services ([Vargo and Lusch, 2004](#)). Access is the output of logistics: time and place utility. For this reason, many assert that hunger happens because available food is not where it is needed when it is needed ([Bals and Tate, 2018](#); [Barrett, 2010](#); [Wood et al., 1995](#)). Under SD, goods are intermediate “products” used as appliance in value creation-processes. Thus, the focus turns to utilization, the third pillar on which food insecurity is based. These quotes reflect this distinction.

GD: access to food items

What we found along the way was that a huge barrier for people is transportation, it's mobility . . .

SD: utilization of food to improve nutrition

The ultimate goal is we want people to want to eat this [nutritious] food and incorporate it as an ongoing part of their diet.

NPOs using long distribution channels face the challenge that partner agencies are volunteers. Thus, it is not unusual for food pantries to operate on limited days and times. For example, one states: “Pantry Hours: Wednesday 9:00 a.m.–11:00 p.m. We serve all who come” ([FoodPantries.org, 2022](#), para. 1). Thus, NPOs, like businesses, seek to implement direct-to-consumer access with mobile pantries. The CEO of one NPO stated: “*Well, we don't have a lot of direct distribution to the client, that's where the dilemma comes in. There are about 65,000 food insecure people in the four-county area. We have 160 partner agencies [. . .] Now the caveat to that is that we do have 13 mobile pantry locations that we distribute ourselves.*”

### *Role of Customers*

Operating at the utilization level involves helping individuals improving eating habits. A longer distribution channel allows for reaching more clients ([Ataseven et al., 2020](#)). However, NPOs focused on utilization require customer intimacy, but they do so at the expense of scale. Accordingly, the role of customers in GD is to take part in the product flow as the output is access. In SD, the client becomes a coproducer by applying received knowledge and transforming the provided food items to fit specifically the client's health needs.

---

GD: recipient of goods

[ours is] a client-choice pantry where they [clients] actually walk through like a grocery store and say I want this, this, and this . . . Some of the others are not client-choice, they pre-bag and this is it, “Here’s your bag thanks very much” and this is what you’re going to get.

Food  
insecurity,  
supply chains  
and ecosystems

---

SD: the client is a coproducer

So, we are primarily focused on nutrition education with our partner organizations because often food insecure folks are more at higher risk for health issues and diet related health issues and often the food that food pantry isn’t always the most nutrient dense.

### *Determination of Value*

In GD, value is determined by the producer (Vargo and Lusch, 2004). Contrastingly, in SD, value is determined when using the product. Under GD, the approach is focused on maximum output and efficiency, including product standardization. In contrast, the determination of value under SD, customization and education to support food utilization (the third pillar of food insecurity) is part of the value proposition, which materializes once the client transforms that proposition into value-in-use.

GD: access to a standardized bundle of food items

. . . we’ll serve in a two-hour window between 250–300 families and give them a box of shelf-stable food, a bag of fresh produce, and a bag of frozen protein.

SD: food choices, cooking healthy

Someone could get access to food, . . . but maybe it wasn’t the food that they necessarily needed or not all of what they needed. We found that while a lot of the food is not something that they are familiar with, we will have recipe boxes . . .

### *NPO-Client Interaction*

Under GD, interactions are transactions; in each, a standard unit is the locus of the transaction. Under the SD logic, NPO-client interactions are customized to the client, who, in turn, is actively involved as a coproducer. In the quotes below, this contrast is shown between the recipient of a standardized transaction, the 30-to-40-pound box, and the level of customization implemented under SD to match client’s needs and preferences.

GD: transactions

We basically tell our end customer, each of the residents, we’re going to bring you a 30-to-40-pound box of perishable and non-perishable product. So, you’re going to get canned goods, you’re going to get spaghetti, beans. You’re going to get some level of produce and some kind of meat.

SD: relational, customization, customer release

Customization: She's from West Africa, Nigeria. She got tears in her eyes and said, 'this is the food of my homeland.' From then on, we exchanged phone numbers an any time I get some sweet potato vines I call her up and we meet somewhere in town, and I just go straight to her because I know that her and her family members are just going to love it and use it.

Customer release: . . . success for me would be not meeting the need but preventing the need in the first place. So, providing individuals with enough resources to get them out of the situation they are in. . . . I mean, I would like to think success would be not needing the services anymore . . .

Customer release differentiates the NPO and the for-profit contexts. While some food insecure individuals may be dependent on community resources, some clients could become food *secure* by their own means. In business, customer retention, repurchase intention and lifetime value of the customer are associated with success. Contrastingly, in the context of food insecurity, success is *customer release*, that is, helping individuals develop the necessary resources to stop needing community assistance.

### *Supply Chain Design*

Consistent with the contrast provided with the multiple dimensions described above, GD favors thinking about the management of flows in the SC. The management of both flows, products and information, emerges from the data. The next proof quotes represent well the relevance of the management of both flows.

GD: Management of flows in the SC

Product flow: We serve much like a wholesale grocer where we collect food, store food, and distribute it through our partner agencies.

I believe we have a logistics and distribution problem more than a procurement problem.

Information flow: . . . out of our partner agencies we have thirty-four that [. . .] subscribe to the software [. . .]. . . . You [the client] are logged into the system with your name, address, how many dependents, it builds a profile for you . . . , we can take and mine data, [. . .]. We can also identify if you're having to go to multiple locations. [. . .].

NPOs in this study achieved a degree of collaboration that leads to reflect on service ecosystems. Consistent with extant literature ([Mendoza-Abarca and Gras, 2019](#)), our data show that many food-insecure clients also experience other challenges such as housing- or job-related. For this reason, the level of collaboration across NPOs that provide complementary services is substantial.

SD: Ecosystem

Collaboration: We work very hard at collaborating with other [NPOs] . . . [Affordable-Housing-NPO] job is to build that house. But I recognize that if somebody has to have help to build a house, more than likely they are food insecure. So, when [a client] moves into her new house, I'll be there to stock her cabinets for the first time. [. . .] We're working with [NPO] trying to find a way that those students who are single parents don't have to worry about food.

Resource Sharing: No, I don't own any of those things. I mean, [COMPETING NPO] owns like fridges and freezers and they have a trailer. So, they have resources that I have access to.

Customer Sharing: On Wednesdays, we work with [this other NPO who works in food insecurity too], we've worked with them for 9 years now, and they actually distribute to [a couple of] places where [. . .] people are living on a fixed income and have very little access to food.

Given the lack of competition for customer revenue, NPOs in this context collaborating with competitors for the sake of responding to client's needs lead to sharing customers if needed.

When further inquired about this level of collaboration, an interviewee shared a vision of the level of interaction [and integration] of the multiple independent organizations that pool resources to deliver value to clients:

... we're kind of thinking about that as the four corners: a patient is connected within their [health care] provider and then referred to the nearest partner organization [NPO] that has access to the foods the patient will need [not just any food, but the one that meet the patient's nutritional needs], the order is fulfilled as a [an order for our NPO], at [another NPO], and then the order is kicked out to be picked up by either a volunteer or driver, or at scale I think probably [a ride-hailing service], [...] and then finally to the patient. I think with the patient that feedback loop is going to be really important.

NPOs achieved a degree of collaboration that leads to reflect on ecosystems. In this context, sharing clients and resources transforms the multiple independent SCs into a mesh of SCs which becomes an ecosystem with no central organization owning customer relationships. Conclusively, this study provides initial support to describe a duality of SCs and ecosystems. “[The] SC perspectives reflect the knowledge and operational capabilities through information coordination and collaboration across organizations throughout the service ecosystem” (Stolze *et al.*, 2016, p. 191). For the customer in our study, these knowledge and operational capabilities are combined in whatever manner necessary. At ground level, each organization manages a SC; at 10 thousand feet, the mesh of SCs forms the ecosystem.

A last consideration regarding ecosystems versus SCs is the point of view for the analysis. The management team of each NPO manages its own SC to serve its target clients. However, resources and customers are shared among NPOs. From the client's perspective approaching an NPO, the ecosystem responds by delivering the needed assistance. Whether that assistance is provided by the NPO initially contacted or any other is probably irrelevant to the client (*customer-sharing*). Whether the assistance is provided using the resources owned by the NPO initially contacted or owned by any other NPO is also irrelevant to the client (*resource sharing*).

### Implications for practice

This study underscores how differently NPOs approach food insecurity. This is important to highlight because in SCM, most studies are in the context of food banks (Ataseven *et al.*, 2020; Blackmon *et al.*, 2021; Martins *et al.*, 2019), and this might lead to the thought that this is the only way to address food insecurity. To achieve scale, the operation is simplified by, for example, standardizing the product and processes and by developing IT capabilities to connect with the partners and clients (Vargo and Lusch, 2008). Some NPOs adopt a service-centered view by developing a deep knowledge of the client to tailor their offering as needed. In practice, how food insecurity is defined and the approach to reach the client will dictate the design of the SC.

Extant literature and our fieldwork show the contrast between “feeding the line” and “shortening the line” (Mendoza-Abarca and Gras, 2019). The former refers to providing food to food-insecure clients. Shortening the line references helping clients develop the necessary resources to diminish the need for assistance. While providing food items to the food insecure may assist to transit a rough moment, it seems there is agreement that to shorten the line, assistance from NPOs that work in other spaces than food insecurity is needed. Experiencing food insecurity seems to be a symptom of other challenges (Rosenberg *et al.*, 2018) and as such needs to be addressed holistically (Zivkovic, 2017). Thus, the coordination of efforts across NPOs both in food insecurity and others such as housing and job training seems to be central to “shortening the line.” Other scholars have identified the need to complement existing solution approaches, new SC roles and a higher degree of information sharing (Annosi *et al.*,

---

2021; Ciulli *et al.*, 2020; Sundgren, 2020; Wills, 2017). Thus, policymakers could consider mapping by geography a mesh of NPOs, and services provided.

### Implications for research

We address research implications from two viewpoints: the socioeconomic problem and SC research broadly. From the point of view of the problem, while existing literature in SCM tends to focus on a product-centric view, one in which at the center is the distribution or redistribution of food products, there are multiple SC approaches to addressing food insecurity. As an explorative study, we have described numerous nuances associated with food insecurity that have received scarce attention from the SCM standpoint. Food insecurity is not solved by providing food (feeding the line) but by providing clients other services to enable themselves to become food secure (shortening the line). While this idea is present in the literature (Mendoza-Abarca and Gras, 2019), we have provided depth to support the further study of what happens at the client interface and the need for complementary services.

Addressing SC research broadly, the number of studies focused on food banks indicate that much of the research efforts adopt a good-centered dominant logic (Ataseven *et al.*, 2018, 2020; Blackmon *et al.*, 2021; Davis *et al.*, 2016; Elmes *et al.*, 2016; Hasnain *et al.*, 2021; Martins *et al.*, 2019; Mendoza-Abarca and Gras, 2019; Solak *et al.*, 2014). While the food banking model is the one operating at the largest scale (reaching the largest number of food insecurity individuals and households), food banks act as distributors in a long distribution channel. Observing this discussion through the lens of the food availability-access-utilization hierarchy (Barrett and Lentz, 2016), utilization virtually remains unexplored in SCM. Future research could explore the customer interface by combining last-mile delivery, consumer behavior and customer well-being. Much of what happens at the customer interface in food insecurity is largely unexplored from the SCM point of view. Ultimately, we believe that a key concept is customer release, conceptually the opposite of customer retention. This is fundamental in our understanding of value and value proposition among socially oriented initiatives and social innovation strategies.

We observed a high level of interaction and adaptability among what would be described as competing organizations. This interaction resulted not only in sharing resources and information but, most interestingly, in sharing customers. Past research in ecosystems highlights the need for the supply ecosystem to adapt to the needs of the customer (Stolze *et al.*, 2016) and the value of resource orchestration and information sharing for the ecosystem as a whole to respond (Ketchen *et al.*, 2014). However, in the for-profit context, the importance of customer satisfaction and customer retention seems inevitable. In light of this competition, some members of the ecosystem might view their capabilities more positively than those of others (Ketchen *et al.*, 2014), leading to tension among the ecosystem members. Extant research in the business ecosystem usually includes a “focal firm” (Adner and Kapoor, 2010, p. 306), something that resembles a SC. The context of NPOs providing social assistance may provide the adequate context to study *pure* ecosystems, that is, an ecosystem without a central organization that owns the relationship with the end customer.

### Limitations

As with any study, limitations always exist. Food insecurity is a complex problem that unlikely will be solved. While our study sheds some light into understanding food insecurity from the SCM point of view, further research is needed. This study is based on a limited number of interviews, though, this number is above other studies in a similar research context (e.g. Sundgren, 2020). We were able to explore more deeply at the expense of generalization. It is possible that the research context we found can be described as a

---

phenomenon (Groenewald, 2004), but that does not make it less interesting, in fact, we argue that our detailed approach allow us for a deeper understanding of what it takes to generate impact or imagine solutions to complex problems.

## References

- Adner, R. and Kapoor, R. (2010), "Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations", *Strategic Management Journal*, Vol. 31, pp. 3-333, doi: [10.1002/smj.821](https://doi.org/10.1002/smj.821).
- Annosi, M.C., Brunetta, F., Bimbo, F. and Kostoula, M. (2021), "Digitalization within food supply chains to prevent food waste. Drivers, barriers and collaboration practices", *Industrial Marketing Management*, Vol. 93 January, pp. 208-220, doi: [10.1016/j.indmarman.2021.01.005](https://doi.org/10.1016/j.indmarman.2021.01.005).
- Araújo, M.L.D., Mendonça, R.D.D., Lopes Filho, J.D. and Lopes, A.C.S. (2018), "Association between food insecurity and food intake", *Nutrition*, Vol. 54, pp. 54-59, doi: [10.1016/j.nut.2018.02.023](https://doi.org/10.1016/j.nut.2018.02.023).
- Ashley, S. and Faulk, L. (2010), "Nonprofit competition in the grants marketplace: exploring the relationship between nonprofit financial ratios and grant amount", *Nonprofit Management and Leadership*, Vol. 21 No. 1, pp. 43-57, doi: [10.1002/nml.20011](https://doi.org/10.1002/nml.20011).
- Ataseven, C., Nair, A. and Ferguson, M. (2018), "An examination of the relationship between intellectual capital and supply chain integration in humanitarian aid organizations: a survey-based investigation of food banks", *Decision Sciences*, Vol. 49 No. 5, pp. 827-862, doi: [10.1111/deci.12300](https://doi.org/10.1111/deci.12300).
- Ataseven, C., Nair, A. and Ferguson, M. (2020), "The role of supply chain integration in strengthening the performance of not-for-profit organizations: evidence from the food banking industry", *Journal of Humanitarian Logistics and Supply Chain Management*, Vol. 10 No. 2, pp. 101-123, doi: [10.1108/JHLSCM-04-2019-0024](https://doi.org/10.1108/JHLSCM-04-2019-0024).
- Bals, L. and Tate, W.L. (2018), "Sustainable supply chain design in social businesses: advancing the theory of supply chain", *Journal of Business Logistics*, Vol. 39 No. 1, pp. 57-79, doi: [10.1111/jbl.12172](https://doi.org/10.1111/jbl.12172).
- Barrett, C.B. (2010), "Measuring food insecurity", *Science*, Vol. 327 No. 5967, pp. 825-828, doi: [10.1126/science.1182768](https://doi.org/10.1126/science.1182768).
- Barrett, C.B. and Lentz, E.C. (2016), "Hunger and food insecurity", in Brady, D. and Burton, L. (Eds), *The Oxford Handbook of the Social Science of Poverty*, Oxford University Press.
- Berrone, P., Gelabert, L., Massa-Saluzzo, F. and Rousseau, H.E. (2016), "Understanding community dynamics in the study of grand challenges: how nonprofits, institutional actors, and the community fabric interact to influence income inequality", *Academy of Management Journal*, Vol. 59 No. 6, pp. 1940-1964, doi: [10.5465/amj.2015.0746](https://doi.org/10.5465/amj.2015.0746).
- Biswal, A.K., Jenamani, M. and Kumar, S.K. (2018), "Warehouse efficiency improvement using RFID in a humanitarian supply chain: implications for Indian food security system", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 109 October, pp. 205-224, doi: [10.1016/j.tre.2017.11.010](https://doi.org/10.1016/j.tre.2017.11.010).
- Blackmon, L., Chan, R., Carbral, O., Chintapally, G., Dhara, S., Felix, P., Jagdish, A., Konakalla, S., Labana, J., McIlvain, J., Stone, J., Tang, C.S., Torres, J. and Wu, W. (2021), "Rapid development of a decision support system to alleviate food insecurity at the Los Angeles regional food bank amid the COVID-19 pandemic", *Production and Operations Management*, Vol. 30 No. 10, pp. 3391-3407, doi: [10.1111/poms.13365](https://doi.org/10.1111/poms.13365).
- Borch, A. and Kjærnes, U. (2016), "The prevalence and risk of food insecurity in the nordic region: preliminary results", *Journal of Consumer Policy*, Vol. 39 No. 2, pp. 261-274, doi: [10.1007/s10603-016-9316-x](https://doi.org/10.1007/s10603-016-9316-x).
- Brenner, N. (1998), "Global cities, glocal states: global city formation and state territorial restructuring in contemporary Europe", *Review of International Political Economy*, Vol. 5 No. 1, pp. 1-37, doi: [10.1080/096922998347633](https://doi.org/10.1080/096922998347633).

- 
- Carle, A. and Rosenberg, E. (2018), *Addressing food Insecurity in Northwest Arkansas Identifying Barriers and Ways to Strengthen the Charitable Food System*.
- Cason, K.L. (1999), "Hunger and food insecurity", *Journal of Family and Consumer Sciences*, Vol. 91 No. 1, pp. 49-52.
- Ciulli, F., Kolk, A. and Boe-Lillegraven, S. (2020), "Circularity brokers: digital platform organizations and waste recovery in food supply chains", *Journal of Business Ethics*, Vol. 167 No. 2, pp. 299-331, doi: [10.1007/s10551-019-04160-5](https://doi.org/10.1007/s10551-019-04160-5).
- Cohen, S., Glaser, B.G. and Strauss, A.L. (1969), *The Discovery of Grounded Theory: Strategies for Qualitative Research*, the *British Journal of Sociology*, 1st ed., Vol. 20, Aldine de Gruyter, Hawthorne, NY, doi: [10.2307/588533](https://doi.org/10.2307/588533).
- Coleman-Jensen, A., Rabbitt, M.P., Gregory, C. and Singh, A. (2020), *Household Food Security in the United States in 2019, ERR-275*, US Department of Agriculture, Economic Research Service. doi: [10.2139/ssrn.2504067](https://doi.org/10.2139/ssrn.2504067).
- Corbin, J.M. and Strauss, A. (1990), "Grounded theory research: procedures, canons, and evaluative criteria", *Qualitative Sociology*, Vol. 13 No. 1, pp. 3-21, doi: [10.1007/BF00988593](https://doi.org/10.1007/BF00988593).
- Davis, L.B., Jiang, S.X., Morgan, S.D., Nuamah, I.A. and Terry, J.R. (2016), "Analysis and prediction of food donation behavior for a domestic hunger relief organization", *International Journal of Production Economics*, Vol. 182, pp. 26-37, doi: [10.1016/j.ijpe.2016.07.020](https://doi.org/10.1016/j.ijpe.2016.07.020).
- Dhurandhar, E.J. (2016), "The food-insecurity obesity paradox: a resource scarcity hypothesis", *Physiology and Behavior*, Vol. 162, pp. 88-92, doi: [10.1016/j.physbeh.2016.04.025](https://doi.org/10.1016/j.physbeh.2016.04.025).
- Durisin, M. (2022), *Food Prices Jump Most on Record as War Sparks Supply Chaos. Bloomberg.Com*, available at: <https://www.bloomberg.com/news/articles/2022-04-08/food-prices-jump-most-on-record-as-war-sparks-supply-chaos> (accessed 3 December 2022).
- Elmes, M.B., Mendoza-Abarca, K. and Hersh, R. (2016), "Food banking, ethical sensemaking, and social innovation in an era of growing hunger in the United States", *Journal of Management Inquiry*, Vol. 25 No. 2, pp. 122-138, doi: [10.1177/1056492615589651](https://doi.org/10.1177/1056492615589651).
- FAO (1996), *Report of the World*, Food Summit, Rome.
- FAO (2011), *The State of Food Insecurity in the World - How Does International Price Volatility Affect Domestic Economies and Food Security?*, Organization.
- Feeding America (2021), *About Us, Our History*, Feeding America, available at: <https://www.feedingamerica.org/about-us/our-history>
- FoodPantries.org (2022), *Search for Food Pantries*, available at: <https://www.foodpantries.org/ci-ar-fayetteville>
- Gearhardt, A.N. and Hebebrand, J. (2021), "The concept of 'food addiction' helps inform the understanding of overeating and obesity: debate Consensus", *The American Journal of Clinical Nutrition*, Vol. 113 No. 2, pp. 274-276, doi: [10.1093/ajcn/nqaa345](https://doi.org/10.1093/ajcn/nqaa345).
- Gehman, J., Glaser, V.L., Eisenhardt, K.M., Gioia, D., Langley, A. and Corley, K.G. (2018), "Finding theory-method fit: a comparison of three qualitative approaches to theory building", *Journal of Management Inquiry*, Vol. 27 No. 3, pp. 284-300, doi: [10.1177/1056492617706029](https://doi.org/10.1177/1056492617706029).
- Gibson, K. (2022), "Inflation has more Americans counting on food banks to eat", *CBS News*, available at: <https://www.cbsnews.com/news/food-banks-increase-demand-economic-struggle-inflation-pandemic/?ftag=CNM-00-10aac3a>
- Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013), "Seeking qualitative rigor in inductive research: notes on the Gioia methodology", *Organizational Research Methods*, Vol. 16 No. 1, pp. 15-31, doi: [10.1177/1094428112452151](https://doi.org/10.1177/1094428112452151).
- Glaser, B.G. and Strauss, A.L. (2017), "The discovery of grounded theory", in *The Discovery of Grounded Theory*, Routledge, pp. 1-18, doi: [10.4324/9780203793206-1](https://doi.org/10.4324/9780203793206-1).

- 
- Glaser, B.G., Bailyn, L., Fernandez, W., Holton, J.A. and Levina, N. (2013), "What grounded theory is...", *Academy of Management Proceedings*, Vol. 2013 No. 1, 11290, doi: [10.5465/ambpp.2013.11290symposium](https://doi.org/10.5465/ambpp.2013.11290symposium).
- Godfray, H.C.J. and Robinson, S. (2015), "Contrasting approaches to projecting long-run global food security", *Oxford Review of Economic Policy*, Vol. 31 No. 1, pp. 26-44, doi: [10.1093/oxrep/grv006](https://doi.org/10.1093/oxrep/grv006).
- Groenewald, T. (2004), "A phenomenological research design illustrated", *International Journal of Qualitative Methods*, Vol. 3 No. 1, pp. 42-55, doi: [10.1177/160940690400300104](https://doi.org/10.1177/160940690400300104).
- Gulati, R. (1998), "Alliances and networks", *Strategic Management Journal*, Vol. 19 No. 4, pp. 293-317, doi: [10.2307/3094067](https://doi.org/10.2307/3094067).
- Hanson, K.L. and Connor, L.M. (2014), "Food insecurity and dietary quality in US adults and children: a systematic review", *American Journal of Clinical Nutrition*, Vol. 100 No. 2, pp. 684-692, doi: [10.3945/ajcn.114.084525](https://doi.org/10.3945/ajcn.114.084525).
- Hasnain, T., Sengul Orgut, I. and Ivy, J.S. (2021), "Elicitation of preference among multiple criteria in food distribution by food banks", *Production and Operations Management*, Vol. 30 No. 12, pp. 4475-4500, doi: [10.1111/poms.13551](https://doi.org/10.1111/poms.13551).
- Holton, J.A. (2010), "The coding process and its challenges | grounded theory review", *The Grounded Theory Review*, Vol. 9 No. 1, pp. 21-40.
- Irani, Z. and Sharif, A.M. (2018), "Food security across the enterprise: a puzzle, problem or mess for a circular economy?", *Journal of Enterprise Information Management*, Vol. 31 No. 1, pp. 2-9, doi: [10.1108/JEIM-03-2017-0045](https://doi.org/10.1108/JEIM-03-2017-0045).
- Kahn, K.B. and Mentzer, J.T. (1998), "Marketing's integration with other departments", *Journal of Business Research*, Vol. 42 No. 1, pp. 53-62, doi: [10.1016/S0148-2963\(97\)00068-4](https://doi.org/10.1016/S0148-2963(97)00068-4).
- Kapoor, R. (2018), "Ecosystems: broadening the locus of value creation", *Journal of Organization Design*, Vol. 7 No. 1, 12, doi: [10.1186/s41469-018-0035-4](https://doi.org/10.1186/s41469-018-0035-4).
- Ketchen, D.J., Crook, T.R. and Craighead, C.W. (2014), "From supply chains to supply ecosystems: implications for strategic sourcing research and practice", *Journal of Business Logistics*, Vol. 35 No. 3, pp. 165-171, doi: [10.1111/jbl.12057](https://doi.org/10.1111/jbl.12057).
- Kirchoff, J.F., Omar, A. and Fugate, B.S. (2016), "A behavioral theory of sustainable supply chain management decision making in non-exemplar firms", *Journal of Supply Chain Management*, Vol. 52 No. 1, pp. 41-65, doi: [10.1111/jscm.12098](https://doi.org/10.1111/jscm.12098).
- Lambert, D.M., Emmelhainz, M.A. and Gardner, J.T. (1999), "Building successful logistics partnerships", *Journal of Business Logistics*, Vol. 20 No. 1, pp. 165-181, doi: [10.1007/978-3-8349-4064-3](https://doi.org/10.1007/978-3-8349-4064-3).
- Lecy, J.D., Schmitz, H.P. and Swedlund, H. (2012), "Non-governmental and not-for-profit organizational effectiveness: a modern synthesis", *Voluntas*, Vol. 23 No. 2, pp. 434-457, doi: [10.1007/s11266-011-9204-6](https://doi.org/10.1007/s11266-011-9204-6).
- Lentz, E.C. and Barrett, C.B. (2013), "The economics and nutritional impacts of food assistance policies and programs", *Food Policy*, Vol. 42, pp. 151-163, doi: [10.1016/j.foodpol.2013.06.011](https://doi.org/10.1016/j.foodpol.2013.06.011).
- Lincoln, Y.S. and Guba, E.G. (1985), *Naturalistic Inquiry*, Sage Publications, Beverly Hills, CA.
- Long, D.C. and Wood, D.F. (1995), "The logistics of famine relief", *Journal of Business Logistics*, Vol. 16 No. 1, pp. 213-229.
- Lusch, R.F. (2011), "Reframing supply chain management: a service-dominant logic perspective", *Journal of Supply Chain Management*, Vol. 47 No. 1, pp. 14-18, doi: [10.1111/j.1745-493X.2010.03211.x](https://doi.org/10.1111/j.1745-493X.2010.03211.x).
- "Map the Meal Gap Food Insecurity in the United States" (2020), Feeding America, available at: <https://map.feedingamerica.org/> (accessed 10 June 2020).
- Martins, C.L., Melo, M.T. and Pato, M.V. (2019), "Redesigning a food bank supply chain network in a triple bottom line context", *International Journal of Production Economics*, Vol. 214 April, pp. 234-247, doi: [10.1016/j.ijpe.2018.11.011](https://doi.org/10.1016/j.ijpe.2018.11.011).

- 
- McDevitt, S. (2018), "Food insecurity and assistance — making ends meet", *Social Work Today Magazine*, Vol. 18 No. 6, p. 20.
- Meade, B. (2019), *By 2029, Food Security Is Projected to Improve in 76 Low- and Middle-Income Countries* | USDA, US Department of Agriculture, Economic Research Service, available at: <https://www.usda.gov/media/blog/2019/08/20/2019-food-security-projected-improve-76-low-and-middle-income-countries> (accessed 25 February 2021).
- Mello, J.E. and Flint, D.J. (2009), "A refined view of grounded theory and its application to logistics research", *Journal of Business Logistics*, Vol. 30 No. 1, pp. 107-125, doi: [10.1002/j.2158-1592.2009.tb00101.x](https://doi.org/10.1002/j.2158-1592.2009.tb00101.x).
- Mendoza-Abarca, K.I. and Gras, D. (2019), "The performance effects of pursuing a diversification strategy by newly founded nonprofit organizations", *Journal of Management*, Vol. 45 No. 3, pp. 984-1008, doi: [10.1177/0149206316685854](https://doi.org/10.1177/0149206316685854).
- Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001), "Defining supply chain management", *Journal of Business Logistics*, Vol. 22 No. 2, pp. 1-25, doi: [10.1002/j.2158-1592.2001.tb00001.x](https://doi.org/10.1002/j.2158-1592.2001.tb00001.x).
- Moates, G., Cseh, B., Juul, S., Parry, A., Alessandro, P., Barbara, R., Silvia, S., Kirsi, S., Han, S., Christine, Z. and Karin, O. (2016), *Estimates of European Food Waste Levels*, IVL Swedish Environmental Research Institute - EU FUSIONS, available at: <http://eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf>
- Mullen, M. and Galia, L. (2020), *Kraft Heinz Commits \$12 Million Globally in Support of Communities Impacted by COVID-19 Outbreak*, The Kraft Heinz Company, available at: <https://www.businesswire.com/news/home/20200320005358/en/Kraft-Heinz-Commits-12-Million-Globally-in-Support-of-Communities-Impacted-By-COVID-19-Outbreak> (accessed 26 February 2021).
- Muzigaba, M., Puoane, T. and Sanders, D. (2016), "The paradox of undernutrition and obesity in South Africa: a contextual overview of food quality, access and availability in the new democracy", In Caraher, M. and Coveney, J. (Eds.), *Food Poverty and Insecurity: International Food Inequalities*, 1st ed., Springer, Cham, pp. 31-41, doi: [10.1007/978-3-319-23859-3\\_4](https://doi.org/10.1007/978-3-319-23859-3_4).
- O'Connor, G.C., Rice, M.P., Peters, L. and Veryzer, R.W. (2003), "Managing interdisciplinary, longitudinal research teams: extending grounded theory-building methodologies", *Organization Science*, Vol. 14 No. 4, pp. 353-373, doi: [10.1287/orsc.14.4.353.17485](https://doi.org/10.1287/orsc.14.4.353.17485).
- Patel, P.C., Azadegan, A. and Ellram, L.M. (2013), "The effects of strategic and structural supply chain orientation on operational and customer-focused performance", *Decision Sciences*, Vol. 44 No. 4, pp. 713-753, doi: [10.1111/dec.12034](https://doi.org/10.1111/dec.12034).
- Pathak, S.D., Wu, Z. and Johnston, D. (2014), "Toward a structural view of co-opetition in supply networks", *Journal of Operations Management*, Vol. 32 No. 5, pp. 254-267, doi: [10.1016/j.jom.2014.04.001](https://doi.org/10.1016/j.jom.2014.04.001).
- Pohl, C. (2011), "What is progress in transdisciplinary research?", *Futures*, Vol. 43 No. 6, pp. 618-626, doi: [10.1016/j.futures.2011.03.001](https://doi.org/10.1016/j.futures.2011.03.001).
- Pratt, M.G. (2009), "From the editors: for the lack of a boilerplate: tips on writing up (and reviewing) qualitative research", *Academy of Management Journal*, Vol. 52 No. 5, pp. 856-862, doi: [10.5465/amj.2009.44632557](https://doi.org/10.5465/amj.2009.44632557).
- Quarshie, A.M. and Leuschner, R. (2020), "Interorganizational interaction in disaster response networks: a government perspective", *Journal of Supply Chain Management*, Vol. 56 No. 3, pp. 3-25, doi: [10.1111/jscm.12225](https://doi.org/10.1111/jscm.12225).
- Randall, W.S., Hawkins, T.G., Haynie, J.J., Nowicki, D.R., Armenakis, A.A. and Geary, S.R. (2015), "Performance-based logistics and interfirm team processes: an empirical investigation", *Journal of Business Logistics*, Vol. 36 No. 2, pp. 212-230, doi: [10.1111/jbl.12084](https://doi.org/10.1111/jbl.12084).
- Raskind, I.G., Haardörfer, R. and Berg, C.J. (2019), "Food insecurity, psychosocial health and academic performance among college and university students in Georgia, USA", *Public Health Nutrition*, Vol. 22 No. 3, pp. 476-485, doi: [10.1017/S1368980018003439](https://doi.org/10.1017/S1368980018003439).

- Richards, C., Hurst, B., Messner, R. and O'Connor, G. (2021), "The paradoxes of food waste reduction in the horticultural supply chain", *Industrial Marketing Management*, Vol. 93, pp. 482-491, doi: [10.1016/j.indmarman.2020.12.002](https://doi.org/10.1016/j.indmarman.2020.12.002).
- Rosenberg, E., Carle, A., Zappia, B. and Rosenberg, E. (2018), *Addressing Food Insecurity in Northwest Arkansas Identifying Barriers and Ways to Strengthen the Charitable Food System*, Vol. 14614 No. 585, available at: <https://reports.cgr.org/details/1876>
- Rossouw, J. (2006), "Accounting requirements for donor-imposed restrictions and the restricted funds of not-for-profit organisations", *Meditari Accountancy Research*, Vol. 14 No. 2, pp. 33-49, doi: [10.1108/10222529200600011](https://doi.org/10.1108/10222529200600011).
- Sanders, N.R. and Wagner, S.M. (2011), "Multidisciplinary and multimethod research for addressing contemporary supply chain challenges", *Journal of Business Logistics*, Vol. 32 No. 4, pp. 317-323, doi: [10.1111/j.0000-0000.2011.01027.x](https://doi.org/10.1111/j.0000-0000.2011.01027.x).
- Sanders, N.R., Fugate, B.S. and Zacharia, Z.G. (2016), "Interdisciplinary research in SCM: through the lens of the behavioral theory of the firm", *Journal of Business Logistics*, Vol. 37 No. 2, pp. 107-112, doi: [10.1111/jbl.12129](https://doi.org/10.1111/jbl.12129).
- Sanders, N.R., Boone, T., Ganeshan, R. and Wood, J.D. (2019), "Sustainable supply chains in the age of AI and digitization: research challenges and opportunities", *Journal of Business Logistics*, Vol. 40 No. 3, pp. 229-240, doi: [10.1111/jbl.12224](https://doi.org/10.1111/jbl.12224).
- Solak, S., Scherrer, C. and Ghoniem, A. (2014), "The stop-and-drop problem in nonprofit food distribution networks", *Annals of Operations Research*, Vol. 221 No. 1, pp. 407-426, doi: [10.1007/s10479-012-1068-7](https://doi.org/10.1007/s10479-012-1068-7).
- Ssenoga, F., Mugurusi, G. and Oluka, P.N. (2019), "Food insecurity as a supply chain problem. Evidence and lessons from the production and supply of bananas in Uganda", *Scientific African*, Vol. 3, e00076, doi: [10.1016/j.sciaf.2019.e00076](https://doi.org/10.1016/j.sciaf.2019.e00076).
- Stolze, H.J., Mollenkopf, D.A. and Flint, D.J. (2016), "What is the right supply chain for your shopper? Exploring the shopper service ecosystem", *Journal of Business Logistics*, Vol. 37 No. 2, pp. 185-197, doi: [10.1111/jbl.12122](https://doi.org/10.1111/jbl.12122).
- Strauss, A. and Corbin, J. (1994), "Grounded theory methodology", in *Handbook of Qualitative Research*. doi: [10.1007/BF00988593](https://doi.org/10.1007/BF00988593).
- Sundgren, C. (2020), "Supply chain structures for distributing surplus food", *International Journal of Logistics Management*, Vol. 31 No. 4, pp. 865-883, doi: [10.1108/IJLM-10-2019-0267](https://doi.org/10.1108/IJLM-10-2019-0267).
- Tansakul, N., Suanmali, S. and Shirahada, K. (2023), "Conceptualizing a transformative supply chain for ecosystem well-being", *Service Industries Journal*, Vol. 43 Nos 5-6, pp. 378-399, doi: [10.1080/02642069.2018.1515204](https://doi.org/10.1080/02642069.2018.1515204).
- Thapa Karki, S., Bennett, A.C.T. and Mishra, J.L. (2021), "Reducing food waste and food insecurity in the UK: the architecture of surplus food distribution supply chain in addressing the sustainable development goals (Goal 2 and Goal 12.3) at a city level", *Industrial Marketing Management*, Vol. 93, pp. 563-577, doi: [10.1016/j.indmarman.2020.09.019](https://doi.org/10.1016/j.indmarman.2020.09.019).
- Thome, K., Meade, B., Daugherty, K. and Chistensen, C. (2019), *International Food Security Assessment, 2018-28, GFA-29*, United States Department of Agriculture, Economic Research Service.
- UN (2019), "Can we feed the world and ensure no one goes hungry?", *UN News*, available at: <https://news.un.org/en/story/2019/10/1048452> (accessed 4 September 2020).
- USDA-Economic Research Service (2021), *Food Insecurity in the US*, US Department of Agriculture, available at: <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/interactive-charts-and-highlights/#States>
- Vargo, S.L. and Lusch, R.F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol. 68 No. 1, pp. 1-17, doi: [10.1509/jmkg.68.1.1.24036](https://doi.org/10.1509/jmkg.68.1.1.24036).
- Vargo, S.L. and Lusch, R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing Science*, Vol. 36 No. 1, pp. 1-10, doi: [10.1007/s11747-007-0069-6](https://doi.org/10.1007/s11747-007-0069-6).

- 
- Villena, V.H. and Gioia, D.A. (2018), "On the riskiness of lower-tier suppliers: managing sustainability in supply networks", *Journal of Operations Management*, Vol. 64 No. 1, pp. 65-87, doi: [10.1016/j.jom.2018.09.004](https://doi.org/10.1016/j.jom.2018.09.004).
- Von Jacobi, N. and Chiappero-Martinetti, E. (2017), "Social innovation, individuals and societies: an empirical investigation of multi-layered effects", *Journal of Social Entrepreneurship*, Vol. 8 No. 3, pp. 271-301.
- Walker, R.E., Keane, C.R. and Burke, J.G. (2010), "Disparities and access to healthy food in the United States: a review of food deserts literature", *Health and Place*, Vol. 16 No. 5, pp. 876-884, doi: [10.1016/j.healthplace.2010.04.013](https://doi.org/10.1016/j.healthplace.2010.04.013).
- Webb, P., Coates, J., Frongillo, E.A., Loreg Rogers, B., Swindale, A. and Bilinsky, P. (2006), "Advances in developing country food insecurity measurement measuring household food insecurity: why it's so important and yet so", in *Advances in Developing Country Food Insecurity Measurement*, Vol. 136 No. 2, pp. 1404S-1408S, doi: [10.1093/jn/136.5.1404s](https://doi.org/10.1093/jn/136.5.1404s).
- Wills, B. (2017), "Eating at the limits: barriers to the emergence of social enterprise initiatives in the Australian emergency food relief sector", *Food Policy*, Vol. 70, pp. 62-70, doi: [10.1016/j.foodpol.2017.06.001](https://doi.org/10.1016/j.foodpol.2017.06.001).
- Wood, D.F., Barone, A., Murphy, P., Wardlow, D.L., Long, D.C. and Wood, D.F. (1995), "Logistics of famine relief", in *International Logistics*, Springer US, Boston, MA, Vol. 16 No. 1, pp. 213-229, doi: [10.1007/978-1-4615-2085-6\\_15](https://doi.org/10.1007/978-1-4615-2085-6_15).
- Wowak, K.D., Craighead, C.W. and Ketchen, D.J. (2016), "Tracing bad products in supply chains: the roles of temporality, supply chain permeation, and product information ambiguity", *Journal of Business Logistics*, Vol. 37 No. 2, pp. 132-151, doi: [10.1111/jbl.12125](https://doi.org/10.1111/jbl.12125).
- Zivkovic, S. (2017), "Addressing food insecurity: a systemic innovation approach", *Social Enterprise Journal*, Vol. 13 No. 3, pp. 234-250, doi: [10.1108/sej-11-2016-0054](https://doi.org/10.1108/sej-11-2016-0054).

### Supplementary Material

The supplementary material for this article can be found online.

### Corresponding author

Sebastián Javier García-Dastugue can be contacted at: [sgarciad@fiu.edu](mailto:sgarciad@fiu.edu)