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Characterizing Crop Diversification in the U.S. Specialty Crop Industry

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Abstract

Previous research on-farm diversification has defined diversified farms as those growing four or more crops, yet recent studies have reported specialty crop farmers tend to grow 20 crops. This study brings a characterization of crop diversification for the specialty crop industry and investigates the factors influencing growers to diversify their crop mix. Using an ordered logit regression, we model how farmer demographics, farm characteristics, and attitudes influence farmer's decision to diversify. The results indicate that access to markets, value-added technologies, and organic practices foster crop diversification, while lack of access to labor, farmer's satisfaction, and contract agreements hinder crop diversification.

Keywords: crop diversification, fruit and vegetable, ordered logit, specialty crop

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Introduction

Pushed by improvements in production technologies as well as growth in domestic demand, the contribution of the specialty crop industry in the U.S. economy is expected to increase in the upcoming years (Lucier et al., 2006). To illustrate, the market value of fruits and vegetables increased by 134% and 77%, respectively, in the 1995–2016 period (Minor and Bond, 2017). According to the 2017 Census of Agriculture, specialty crop sales, including nursery and floriculture production, reached more than $60 billion in 2017, representing a 29% increase in the last decade (USDA-NASS, 2007; USDA-NASS, 2017). The 2017 census reported the existence of more than 161,000 operations growing vegetables, citrus, and non-citrus crops, harvesting nearly 7.5 million acres. Data from the 2019 Census of Horticultural Specialties showed that over two-thirds of specialty crop sales go through wholesale channels, while the rest go to local (e.g., farmers' markets) and intermediate markets (e.g., restaurants) (USDA-NASS, 2019).

On the consumption side, the U.S. Bureau of Labor Statistics (2020) reported that fruit and vegetables accounted for almost 19% of home expenditures. While the 2015–2020 Dietary Guidelines for Americans recommends eating at least 2 cups of fruits and 2.5 cups of vegetables per day (USDHHS, 2020), the average consumption of fruit and vegetables is below recommended guidelines. Yet, Glick-Bauer, and Wechsler (2016) reported that most Americans over the age of 4 consume only 1 cup of fruit per day. To address the consumption gap, policymakers and local and federal governments have implemented actions and initiatives to promote fruit and vegetables intake. For example, the U.S. Department of Agriculture (USDA), through their Supplemental Nutrition and Assistance Program (SNAP), supports the food budget of needy families to purchase nutritious foods, including fruits and vegetables (Rosenbaum, 2013). The (USDA-FNS, 2015) reported that SNAP recipients tend to have a direct impact on consumers and farming communities.

The increasing consumer demand for specialty crops presents economic opportunities for farmers (USDA-ERS, 2019; Torres, 2020). However, farmers face a myriad of decisions regarding which crop to grow and what markets to sell into in order to secure profitability. To help address these challenges, the USDA Sustainable Agriculture Research and Education (SARE) program has funded more than 7,468 research and education initiatives in the past three decades. This program has provided $311 million to support farm diversification, access to profitable markets, and overall long-term sustainability. Similarly, the National Sustainable Agriculture Coalition provides small loans (up to $50,000) to diversified farmers serving local markets to help them cover annual operating expenses. The Whole-Farm Revenue Protection (WFRP) supports farmers to insure all of their crops under one policy to assist with risk management strategies of diversified operations.

On-farm diversification is defined as the increase in the number of enterprises on a farm (Barbieri, Mahoney, and Butler, 2008). For example, farmers can diversify their operations by increasing the number of crops, adding value to a crop (e.g., making jams), providing services to other farmers, or accessing new markets (e.g., forward contracting with processors). Major benefits of on-farm diversification include spreading risk through more enterprises, better utilizing resources, improving cash flow, and increasing agronomic and financial resilience to changes to, ultimately, assure profitability (McNamara and Weiss, 2005). While there are many economic and

environmental benefits to on-farm diversification, few studies have investigated what drives specialty crop farmers to diversify their crop mix. For an industry in which operations typically grow more than 20 crops (Torres et al., 2016), defining diversified farms as those growing four or more crops does not accurately describe the diversity in the specialty crop sector (MacDonald, Korb, and Hoppe, 2013). The lack of an accurate characterization of crop diversification can have opposing effects in specialty crop operations when compared to row crop farms. Thus, a precise categorization for specialty crop operations can help policy makers and researchers to better understand the factors driving crop diversification across different degrees of farm diversification.

Recently, Lancaster and Torres (2019) provided a framework to capture the degree of crop diversification in the specialty crop industry. Using a quantile regression, their paper categorized specialty crop farms as highly, moderately, and low diversified, as well as specialized farms. Their study proposed that highly diversified operations are those growing 29 crops or more, moderately diversified operations grow between 16 and 28 crops, low diversified grow between 5 and 15 crops, and specialized operations grow less than 5 crops. To compare specialty crops and row crop agriculture, a diversified row crop operation (4 crops) grows the same number of crops as a specialized specialty crop farm.

Following Lancaster and Torres (2019), this study characterized specialty crop farmers at various degrees of diversification. A secondary goal of this study was to investigate the drivers and challenges to diversify. Specifically, this study explored how farm characteristics, farmer's demographics, and attitudinal factors influence their decision to diversify (or not) their crop mix. This information allows us to determine the main factors driving or deterring specialty crop farmers from growing more crops and how these factors influenced operations at different degrees of diversification. Findings can shed light on the market access and perceptions of specialty crop farmers at various degrees of diversification. Findings can also help researchers, policymakers, and Extension personnel to tailor incentives and programs to assist specialty crop growers in spreading risk over more crops.

Crop Diversification

The phrase, "don't put your all eggs in one basket," can be used to capture a farmer's intention of branching out their operation and diversifying income streams. The farmer's decision to diversify income streams is likely a response to market changes (Morris, Henley, and Dowell, 2017) and increasing demand for local and fresh nutrient-dense foods (Low et al., 2020). To respond to these opportunities, farmers can diversify their on-farm income stream by growing more crops, investing in adding value to their crops, or accessing new high-value markets (Lancaster and Torres, 2019).

This study focuses on crop diversification as a major on-farm diversification strategy and draws from Kremen, Iles, and Bacon (2012) to define it as the intentional broadening of crops in a specialty crop farm. We propose that crop diversification is the inclusion and/or rotation of multiple crops in a production system. Historically, studies on crop diversification have focused on traditional row crop systems, which defined a diversified operation as one growing four or more crops (Davis et al., 2012; MacDonald, Korbb, and Hoppe, 2013). Yet, studies of specialty crop

operations have reported that the average operation grows between 10 to 30 crops (Torres and Marshall, 2017; Torres and Lancaster, 2019), a major difference from row crop operations.

Studies have reported that diversifying crops can help specialty crop farmers achieve financial and environmental resiliency, manage risk, and compete in agriculture markets. For example, changing climatic conditions, availability of new technologies, market access, price volatility, and risk mitigation are examples of factors driving farmers to diversify their crop mix (Pingali and Rosegrant, 1995; Bradshaw, 2004; Barbieri and Mahoney, 2009; Hendrickson, 2015; Liebman and Schulte-Moore, 2015; Fusco, Miglietta, and Porrini, 2018). Several environmental benefits have been reported among farms diversifying their crop mix including the reduction of pesticide use (Roesch-McNally, Arbuckle, and Tyndall, 2018) and resilience to environmental impacts (Davis et al., 2012). To illustrate, extended crop rotations can reduce pest pressure, which in turn can decrease the use and expenses of pesticides (Hunt, Hill, and Liebman, 2017).

Studies have categorized the factors influencing farmers to diversify their operations as external and internal variables. External variables include factors outside of the farmer's control, such as access to markets and weather (Anosike and Coughenour, 1990). Farmers growing a variety of crops can sell and showcase their produce through a variety of market outlets, including direct-to-consumer (e.g., farmers' markets and roadside stands), intermediate (e.g., restaurants and food hubs), and wholesale markets. This is especially true as Lancaster and Torres (2019) reported specialty crop farmers tend to access up to five different market outlets. By increasing their crop mix, farmers can appeal to a wide variety of customers and leverage from the steadily growing U.S. population at times when the demand for specialty crops is rising. As agricultural production systems become larger and more specialized due to benefits from economies of scale, diversification seems to be a major strategy among smaller operations and those aiming to sell at high-value local markets (Lancaster and Torres, 2019).

Roesch-McNally, Arbuckle, and Tyndall (2018) reported that crop diversification is more likely for farmers already investing in diversified enterprises (e.g., livestock production) and those with less access to land. Having other enterprises in the farm helps farmers channel crop production into other value-added activities. Fusco, Miglietta, and Porrini (2018) suggested that farmers contemplate diversification as a risk mitigation strategy. Other factors motivating farmers to diversify their crop mix included the availability of new technologies, land, labor, and input costs, and access to markets (Pingali and Rosegrant, 1995; Barbieri and Mahoney, 2009).

While some researchers argue that farm diversification is mainly driven by external factors, other internal drivers have been cited by recent literature. Among internal factors impacting crop diversification include farmers' abilities, skills, and perceptions. Farmers expecting that crop diversification can increase farm income tend to be more likely to diversify (Barbieri and Mahoney, 2009). Having an entrepreneurial mindset has been correlated with diversifying farming operations (Barrett, Reardon, and Webb, 2001). In addition, farmland, human capital (i.e., family labor), and networks have been reported as factors motivating farmers to diversify on-farm income (McFadden and Gorman, 2016; Suess-Reyes and Fuetsch, 2016). For example, Valliant et al.

(2017) reported that diversifying on-farm enterprises has helped farmers balance the family-business interface.

Although multiple studies have reported on the advantages and benefits of crop diversification to improve the financial and agronomic resilience of agricultural systems, there are multiple barriers deterring farmers from diversifying their crop mix. First, technological advancements to produce drought-resistant crops have motivated farmers to become larger and specialize in fewer crops (Lin, 2011). In addition, Lin (2011) reported that fewer economic policies and incentives exist for diversified specialty crop systems as compared to row crop operations. To illustrate, Boody et al. (2009) reported that farmers growing row crops (i.e., corn, wheat, soybeans, cotton, and rice) received 89% of the $91.2 billion dedicated to boost income of row crop and livestock farmers from 1995 through 2002.

Drawing from Lancaster and Torres (2019), this study categorized specialty crop operations as highly diversified, moderately diversified, low diversified, and specialized. We investigated the drivers and barriers to crop diversification in the specialty crop industry. We also assessed the significant characteristics of specialty crop operations at different degrees of diversification. Factors influencing crop diversification include farm characteristics, the farmer's demographics, and perceptions. With the ongoing consolidation in the agriculture sector, increasing demand for specialty crops, and an increasingly competitive business landscape, exploring the diversification levels of specialty crop farms is critical for policymakers designing incentives and programs, as well as for research and outreach efforts looking to diversify agricultural systems.

Materials and Methods

Data for this study came from a 2019 web-based survey of specialty crop growers who were part of email lists of grower associations and the Food Industry Market database. The databases provided us with 3,487 email addresses of growers located in 32 states.[1] The compiled list of growers was screened to eliminate duplicate entries and operations. These databases facilitated the access of a wide variety of growers selling in direct-to-consumer (DTC) market channels, intermediate markets, and wholesale outlets. DTC markets are those where the farmer sells directly to consumers, such as farmers' markets (Torres et al., 2016), whereas intermediate markets are those where the farmer sells to local restaurants or independent stores. Lastly, wholesale outlets are those where the farmer sells to processors, distributors, and wholesalers (Woods et al., 2013).

To increase participation rate, we included an incentive of a $10 gift card to the first thousand farmers who completed the survey. Dillman, Smyth, and Christian (2014) reported that including token incentives is likely to increase online survey participation. We sent three email reminders with intervals of two weeks between March and April 2019. A total of 696 farmers growing fruits, vegetables, herbs, and horticulture crops completed the survey, for a response rate of 20%. The

[1] States included Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Rhode Island, Tennessee, Virginia, West Virginia, Wisconsin, and Wyoming.

questionnaire included questions related to the farmer's demographics (i.e., educational attainment, gender, farming experience), farm characteristics (i.e., crops, markets, and growing technologies), and the farmer's beliefs and perceptions toward their farm system. The questionnaire was approved by the corresponding Institutional Review Board for compliance with ethical standards for human subjects.

The sample of this study included 570 operations growing fruits, vegetables, and culinary herbs. For farmers who did not respond, their number of crops grown in 2018 were excluded from the study. A sample of specialty crop farmers exclusively responded that their crop mix provided clear-cut differences between farmer categories. Operations in our sample grew between 1 and 60 crops, with an average of 14 crops and a median of 7 crops. Figure 1 illustrates the distribution of number of crops grown by participants in our sample.

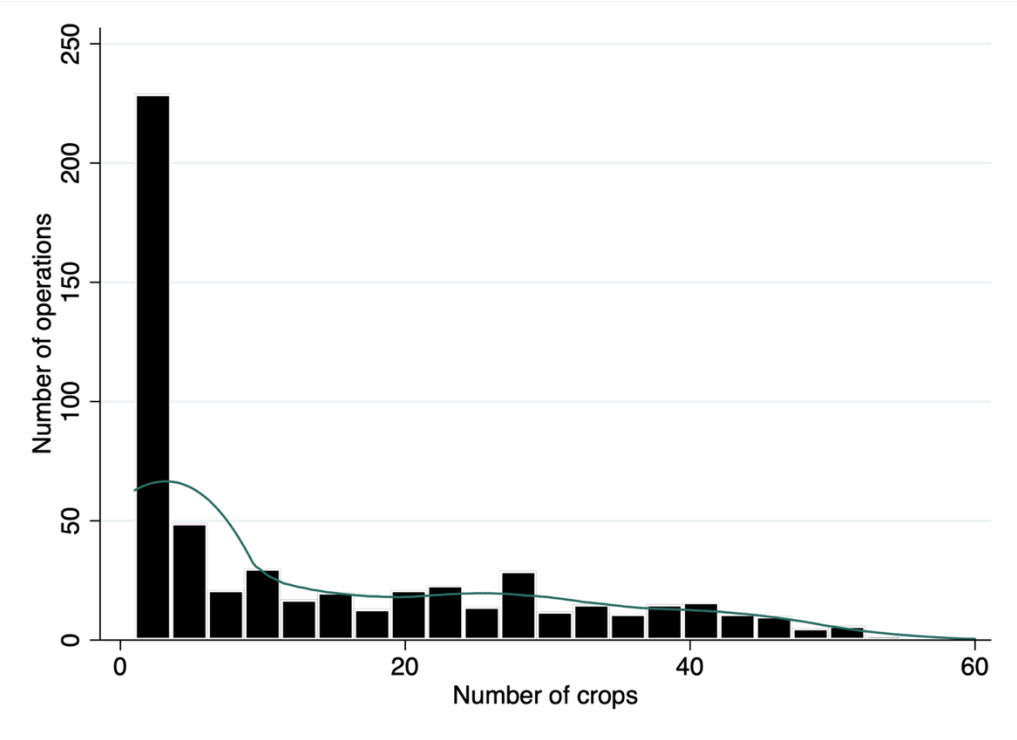

Figure 1. Frequency (bars) and Kernel Density (line) Distribution of the Number of Crops

Drawing from Lancaster and Torres (2019), operations were categorized based on the number of crops as specialized (1 to 4 crops), low (5 to 15 crops), moderately (16 to 28 crops), and highly diversified (29 crops or more). Thus, this study proposed that crop diversification is an ordered process, in which increasing the number of crops increases the level of diversification. Most of the growers in our sample fell into the specialized category (44%; N = 249), followed by highly diversified (20%; N = 114), low diversified (19%; N = 111), and moderately diversified (17%; N = 96) (Figure 2). Multiple comparisons were made among means in the analysis of variance (ANOVA) models using Tukey's honestly significant difference method at the 10% significance

level. Diversification level (i.e., specialized, low, moderately, and highly diversified) was considered as a treatment effect for means comparisons across columns. Chi-square tests were used to measure the relationship between means and yielded similar outcomes than ANOVA and Tukey's test. All analyses were conducted using Stata (release 16; StataCorp, College Station, TX).

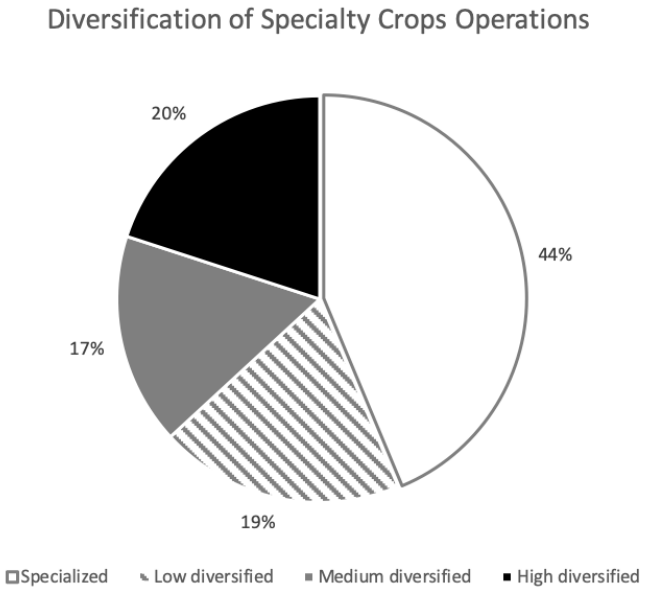

Figure 2. Proportion of Diversification Quantiles among Specialty Crop Operations

Using an ordered logit regression, we investigated the likelihood that farm characteristics, farmer's demographics, and perceptions influenced crop diversification. The ordered logit is an appropriate framework to model ordinal survey responses where the observed dependent variable (i.e., number of crops) has an ordinal scale (Greene, 2003). For instance, as the number of crops increases, diversification increases, following a naturally ordered scale. Thus, we assumed that diversification has a natural ordering (from specialized to low, moderately, and highly diversified).

The ordered logit is based on the random utility theory, which assumes that farmers choose the number of crops that would give them the highest level of utility (profit). The ordered logit is based on a latent continuous variable Y^*, which is a linear combination of vector characteristics (X) describing the individual, a set of parameter vectors (β), and an error term ε assumed to have a standard logistic distribution. Letting i = 1, 2, …, j index of clusters, and for the case of four diversification levels (i.e., $y_i \in [1,2,3,4]$):

$$Y_i^* = X_i\beta + \varepsilon_i \quad (1)$$

While the unobserved latent variable is Y_i^*, we were able to observe y_i, which is the observed ordinal variable:

$$Y_i = 1 \;\; if \; y_i^* \leq \kappa_1$$

$$Y_i = 2 \;\; if \; \kappa_1 < y_i^* \leq \kappa_2$$

$$Y_i = J \;\; if \; y_i^* > \kappa_{J-1}$$

Consequently:

$$\Pr[y_i = j] = \Pr\,[y^* \text{ is in the } j\text{th range}]$$

Hence, the probability of observing a level of farm diversification can be written as:

$$\Pr[y_i = j] = F\left[\kappa_J - \beta' X_i\right] - F\left[\kappa_{J-1} - \beta' X_i\right] \tag{2}$$

where F(.) = exp(.)/[1+exp(.)], implying that

$$\Pr[y_i = j] = \frac{1}{1 + e^{-\kappa_J + \beta' X_i}} - \frac{1}{1 + e^{-\kappa_{J-1} + \beta' X_i}}$$

which were used to derive the maximum likelihood estimates of κ and β.

Table 1 illustrates the set of covariates X_i, in Equation 1, which includes farm characteristics, farmer's demographics, and perceptions and attitudes toward their agricultural system. A correlation test performed to the set of covariates indicated the lack of correlation among independent variables, which suggests a lack of multicollinearity among the covariates in X_i. Farm characteristics include selling only in DTC market channels, number of markets, percentage of production under organic practices, use of growing technologies (e.g., hoop houses, greenhouses, irrigation, etc.), use of cooling system, use of traceability system, if farmer has insurance, use of value-added technologies (cutting, washing, or drying produce), percentage of production sold under contract in 2018, the legal structure of the farm, number of employees, farm location, and revenues size. Farmer's characteristics include educational attainment, gender, number of generations running the farm business, if farmer has an off-farm source of income, and farming experience. Lastly, farmers' perceptions include their satisfaction with the farming system, perceptions of success, and sources of useful information.

Following the U.S. Census Bureau, farmers were grouped in four geographic regions: Northeast, Midwest, West, and South. The Northeast region includes operations located in Maine, Massachusetts, and New York. The Midwest region includes farms located in Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, and Wisconsin. The West region includes operations

located in Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, and Wyoming. Lastly, the South region includes farms located in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, Tennessee, Virginia, and West Virginia. We followed Torres et al. (2016) to base small sales cutoff for farm size category. Small operations are those reporting sales of less than $50,000 in 2018.

Results and Discussion

Summary Statistics

Table 1 provides the summary statistics for the sample of farmers used in this study. Forty-five percent of specialty crop farmers sold their produce solely through DTC market channels. The average number of market outlets accessed by farmers was more than two markets. The average percentage of production sold under contracts in 2018 was 25%. On average, farmers in our sample reported a third of their production was produced using organic practices. Most farmers in our sample used growing technologies (91%), almost two-thirds used cooling systems, and less than a quarter of them had a traceability system (e.g., lot numbers, labeling guns, bar codes, and paper or electronic markets). About 80% of growers in our sample had a form of insurance, including crop, equipment, income, property, worker compensation, or liability insurance. The average operation farmed 271 acres and employed 18 workers, including family, full-time, and part-time employees.

Most farmers in our sample had at least some college education (59%), and about a third of respondents were women or farmed part-time. The average farm had been operating for two generations. Most growers (60%) reported being satisfied with their current farming system, but less than a third perceived themselves as more successful than the previous year. It is interesting to note that 49% of farmers reported Extension services as a useful source of information, whereas only 23% of farmers reported other farmers as useful sources of information.

Table 2 provides the results from the ANOVA analysis, which includes the mean differences for all the variables used in the model by level of crop diversification. Selling directly to consumers and selling through a high number of market channels were less common for specialized operations ($P < 0.1$). It is likely that focusing on a few crops and selling them through wholesale markets are helpful strategies for specialized operations to remain profitable. This is especially true as our findings suggest more specialized operations appeared to be reaching wholesale markets through contracts ($P < 0.1$). Results suggest that crop diversification is correlated with increasing market access, which are two common strategies adopted by small- and medium-sized operations (Pingali and Rosegrant, 1995).

The proportion of women, young, and beginning farmers was higher among moderately and highly diversified farms than their counterparts ($P < 0.1$). Our findings are consistent with researchers who have reported women farmers tend to favor diversified production systems (Trauger et al., 2010; Sachs et al., 2016). It seems that having a diversified crop mix enables female farmers to increase farm sustainability, access to local markets, and promote social and environmental goals for their community.

Table 1. Categories and Descriptions of the Variables Used to Investigate the Characteristics of Diversified Operations among 570 Specialty Crop Farmers of 32 States in the Uni'ted States

Variable	Obs.	Mean	Std. Dev.	Description
Farm characteristics				
Number of crops	570	14.09	14.82	Number of crops including fruits, herbs, and vegetables
Only DTC[Z]	570	0.45	0.50	1 = if farmer only uses direct to consumer market channels (at farm, farmers markets, CSA, internet, independent grocery stores, and restaurants)
Number of markets	570	2.32	1.45	number of market channels including DTC, wholesale, processors, schools, wineries, food hubs, and miscellaneous
Percent organic	570	37.76	46.59	Percentage of current production that falls under organic (certified and noncertified) practices
Growing technologies[Z]	570	0.91	0.29	1 = if farmer uses growing technologies such as artificial lighting, hydroponics, plasticulture, irrigation, hoop houses, greenhouses, etc.
Cooling system[Z]	570	0.63	0.48	1 = if farmer uses cooling system such as cold storage, forced air cooling, hydrocooling, ice cooling, modified atmosphere packaging, room cooling, vacuum cooling.
Traceability system[Z]	570	0.25	0.43	1 = if farmer uses a traceability system such as lot numbers, labeling guns, bar codes, and paper or electronic markets
Insurance[Z]	570	0.79	0.40	1 = if farmer paid for insurance in 2018, including crop, equipment, income, property, worker compensation, and liability insurance
Value-added[Z]	534	0.52	0.50	1 = if farmer used value-added technologies in 2018 including washing, cutting, or drying
Percent contracts	570	0.25	0.43	Percentage of production sold under contracts in 2018
Total land	570	270.69	843.61	Number of acres farmer rents or own
Sole proprietorship[Z]	570	0.40	0.49	1 = if farm's business structure is sole proprietorship
Labor	570	18.19	46.30	number of people working on the farm including family members and respondent, permanent, and temporary employees
Small[Z]	570	0.09	0.29	1 = if annual gross sales lower than $50,000
Northeast	507	0.05	0.21	1 = if farm is located in Maine, Massachusetts, New York, and Maine
Midwest	507	0.52	0.50	1 = if farm is located in Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, and Wisconsin

Table 1 (continued).

Variable	Obs.	Mean	Std. Dev.	Description
West	507	0.24	0.43	1 = if farm is located in Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, and Wyoming
South	507	0.19	0.39	1 = if farm is located in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, Tennessee, Virginia, and West Virginia. Reference group
Farmer characteristics				
College[Z]	570	0.59	0.49	1 = individual has college education or postgraduate work
Female[Z]	570	0.29	0.46	1 = if farmer is female
Generations	505	1.93	1.17	Number of generations the family has been running the farm business
Part-time[Z]	570	0.31	0.46	1 = if farmer works in the farm part-time
Years farming	513	24.33	15.59	number of years farming
Farmer perceptions				
Satisfied[Z]	570	0.59	0.49	1 = if farmer is satisfied with his/her present farming system
Successful[Z]	570	0.31	0.46	1 = if farmer perceived being more successful than previous year
Info farmer[Z]	570	0.23	0.42	1 = if farmer perceives other farmers provide useful information
Info Extension[Z]	570	0.49	0.50	1 = if farmer perceives university extension provides useful information

[z]The mean is the percentage of respondents with that attribute.

One might speculate that young and beginning farmers tend to operate diversified operations due to a lower risk aversion. Another explanation may be that these young and beginning farmers start diversified and become more specialized as they expand their operation and market access.

Lastly, Table 2 illustrates how specialty crop farmers' perceptions and attitudes differed depending on their diversification degree. For example, a higher percentage of farmers operating diversified farms (low, moderately, and highly) perceived themselves as more successful than specialized operations ($P < 0.1$). It is likely that diversified farmers associate success with building farming ecosystems that are highly diversified and contribute to their social and environmental motives. Similarly, the usefulness of information from Extension services was more common among diversified (low, moderately, and highly) than specialized farmers ($P < 0.1$).

Regression Results

Table 3 displays the coefficients and marginal effects of the likelihood of becoming highly diversified. This study used robust coefficients to provide conservative estimates and address potential heteroskedasticity. The main finding from Table 3 shows that the number of markets and use of growing and value-added technologies are significant drivers of crop diversification among specialty crop operations. Other major factors influencing crop diversification are demographics, farm characteristics, perceptions, and sources of information.

Findings from Table 3 show that using growing and value-added technologies have the highest impact on crop diversification. For instance, farmers using hoop houses, greenhouses, hydroponics, irrigation, or plasticulture were 13% more likely to highly diversify their crop mix ($P < 0.1$). Similarly, farmers washing, cutting, and/or drying their produce were 12% more likely to diversify ($P < 0.01$). Economies of scale and economies of scope can be used to explain the effect of technology adoption on crop diversification. On the one hand, by adopting growing technologies farmers may rely on economies of scale to increase outputs while decreasing the cost per crop unit (Robinson and Barry, 1987). To illustrate, hoop houses are common agricultural technologies helping specialty crop farmers control and extend the growing season of a specialty crop (Lamont, 2005). With longer growing seasons, farmers using hoop houses can add new crops to their agricultural system, increase yield, and potentially boost revenue. On the other hand, farmers may rely on economies of scope by differentiating their diverse crop mix through the adoption of value-added technologies (Womach, 2005). For example, converting a specialty crop into jams, sauces, and dried produce can help them access markets, increase off-season income, and receive price premiums for their products.

Access to markets is an important driver of farm diversification. Selling in DTC markets and increasing the number of market outlets increase the likelihood that a farm diversifies their crop mix by 5% and 4%, respectively ($P < 0.01$). The demand for local foods and the farm-to-fork movement have created important market opportunities for growers selling through local markets. By selling directly to consumers, growers have access to direct feedback to adjust their crop mix. For example, farmers selling at farmers' markets may be motivated to diversify their crop mix as a way to differentiate from other vendors and improve the display of their stand. Alternatively,

selling through contracts decreases the likelihood of crop diversification by 5% ($P < 0.05$). Following Wang, Wang, and Delgado (2014), contract farming may motivate farmers to focus on growing fewer crops as a way to minimize production costs and maximize output.

Female farmers are 4% more likely to increase crop diversification ($P < 0.1$). Women may be more likely to diversify their crop mix as a way to enhance biodiversity of their farming systems. Amekawa et al. (2010) proposed that women's motives to diversify are twofold: increasing income and improving agrobiodiversity. By diversifying the crop mix, women may be able to spread out risk among multiple crops (Amekawa et al., 2010), expand new sources of income, and exploit niche markets (Warren-Smith and Jackson, 2004). By improving agrobiodiversity, female farmers may be looking to promote ecosystem diversity (Warren-Smith and Jackson, 2004) while balancing family-farm demands (Anthopoulou, 2010). Warren (2002) proposed that the participation of women in diverse and innovative farm businesses tends to promote their empowerment, especially in rural areas.

Other factors increasing crop diversification include the use of organic practices, the legal structure of the farm, and useful sources of information. Operations using organic practices are more likely to diversify their crop mix ($P < 0.01$), which may be due to the use of intercropping and crop rotations practices commonly adopted by organic farmers (Ponisio et al., 2015). By diversifying crop production in organic systems, farmers aim to increase ecological interaction that helps improve yield and profitability of their operations. Operations structured as sole proprietorships were 4% more likely to increase crop diversification ($P < 0.05$). The flexibility and control of a sole proprietorship may encourage growers to engage in diversification and differentiation strategies that increase market access and profitability. Our findings show that access to information is a major determinant of increasing crop diversification. Farmers accessing useful information from Extension services are 4% more likely to diversify their crop mix ($P < 0.05$). Other researchers have reported having access to Extension information increases the adoption of farming practices and technologies (Oladele, 2005; Mussema et al., 2015; Mwololo et al., 2019).

Factors decreasing the likelihood of crop diversification include labor ($P < 0.01$), farming part-time ($P < 0.01$), and farmers' satisfaction with the current farming system ($P < 0.1$). The fact that increasing the number of employees increases the likelihood of becoming more specialized is unexpected. One explanation may be that larger operations (in terms of land) are more likely to need more labor, especially temporary and migrant workers. Another explanation may be that due to labor shortages, highly diversified operations may be able to lower labor costs by using mechanization and labor-saving technologies (Lin, 2011). This is especially true for operations growing tree fruits, grapes, and berries. We expect that part-time farmers are likely to have other sources of off-farm income (Evans and Llbery, 1993) and less time to engage in diversification strategies. Lastly, farmers satisfied with their production system are less likely to diversify their enterprise. This could be related to the belief that specialization can help achieve higher technical efficiency (Mugera and Langemeier, 2011); therefore, it is likely that farmers satisfied with their production system are not motivated to diversify their enterprise and prefer to opt for the best cost-effective method for their business model.

Table 2. Comparison of Characteristics of Specialty Crop Growers Categorized by Level of Diversification (full sample, $N = 570$; specialized, $N = 249$; low diversified, $N = 111$; moderately diversified, $N = 96$; highly diversified, $N = 114$)

	Specialized[y] 1 to 4 crops			**Low diversified 5 to 15 crops**			**Moderately diversified 16 to 28 crops**			**High diversified 29 crops and more**		
Farm characteristics												
Only DTC[Z]	0.35	0.48	C	0.54	0.50	B	0.61	0.49	A	0.46	0.50	BC
Number of markets	1.83	1.27	C	2.32	1.60	B	2.70	1.30	AB	3.09	1.39	A
Percent organic	18.38	37.28	C	27.51	42.66	C	50.07	47.56	B	79.72	37.00	A
Growing technologies[Z]	0.88	0.33		0.88	0.32		0.98	0.14		0.92	0.27	
Cooling system[Z]	0.51	0.50	B	0.63	0.48	B	0.79	0.41	A	0.76	0.43	A
Traceability system[Z]	0.29	0.46	A	0.19	0.39	AB	0.17	0.37	B	0.27	0.45	A
Insurance[Z]	0.76	0.43	B	0.77	0.43	B	0.90	0.31	A	0.82	0.38	AB
Value-added[Z]	0.29	0.45	C	0.50	0.50	B	0.78	0.42	A	0.78	0.42	A
Percent contracts	0.35	0.48	A	0.16	0.37	B	0.15	0.35	B	0.20	0.40	B
Total land	367.17	1011.07	A	295.38	1043.05	AB	169.72	386.48	AB	120.97	320.89	B
Sole proprietorship[Z]	0.33	0.47	B	0.42	0.50	AB	0.53	0.50	A	0.41	0.49	AB
Labor	25.99	61.92	A	15.73	29.93	AB	11.99	36.52	B	8.78	11.16	B
Small[Z]	0.09	0.29		0.14	0.35		0.05	0.22		0.08	0.27	
Northeast	0.03	0.18		0.07	0.26		0.05	0.23		0.04	0.20	
Midwest	0.51	0.50		0.52	0.50		0.58	0.50		0.50	0.50	
West	0.25	0.43		0.21	0.41		0.20	0.41		0.30	0.46	
Northeast	0.03	0.18		0.07	0.26		0.05	0.23		0.04	0.20	
Farmer characteristics												
College[Z]	0.56	0.50		0.57	0.50		0.67	0.47		0.61	0.49	
Female[Z]	0.21	0.41	B	0.23	0.43	B	0.41	0.49	A	0.43	0.50	A
Generations	2.06	1.19	A	2.16	1.23	A	1.79	1.17	AB	1.57	0.99	B
Part-time[Z]	0.36	0.48	A	0.36	0.48	A	0.29	0.46	AB	0.17	0.37	B
Years farming	25.55	15.24	A	25.91	17.76	AB	23.46	15.79	AB	21.03	13.40	B

Table 2 (continued).

	Specialized[y] 1 to 4 crops			Low diversified 5 to 15 crops			Moderately diversified 16 to 28 crops			High diversified 29 crops and more		
Farmer perceptions												
Satisfied[Z]	0.62	0.49		0.55	0.50		0.59	0.49		0.56	0.50	
Successful[Z]	0.27	0.44	B	0.31	0.46	AB	0.41	0.49	A	0.33	0.47	AB
Info farmer[Z]	0.25	0.43		0.26	0.44		0.21	0.41		0.18	0.38	
Info Extension[Z]	0.45	0.50	B	0.49	0.50	AB	0.59	0.49	A	0.49	0.50	AB
N. Obs.		249			111			96			114	

[z]The mean is the percentage of respondents with that attribute.

[y]Any two means within a row show the significant difference between the diversification categories at $P < 0.1$ using Tukey's significant different test.

Table 3. Coefficient and Marginal Effects Results from Ordered Logit for Diversification Categories of Specialty Crop Operations

	Coefficient	Std. Err.		Marginal Effect	Std. Err.	
Only DTC	0.55	0.22	***	5.27	2.14	***
Number of markets	0.45	0.09	***	4.28	0.91	***
Percent organic	0.02	0.00	***	0.15	0.03	***
Growing technologies	1.40	0.77	*	13.28	7.38	*
Cooling system	0.33	0.23		3.10	2.21	
Traceability system	-0.47	0.25	*	-4.45	2.37	*
Insurance	0.53	0.34		5.02	3.22	
Value-added	1.23	0.20	***	11.72	2.12	***
Percent contracts	-0.50	0.24	**	-4.79	2.34	**`
Total land	-0.01	0.00		-0.01	0.00	
Sole proprietorship	0.42	0.20	**	4.00	1.95	**
Labor	-0.01	0.01	***	-0.09	0.03	***
Small	0.21	0.35		1.98	3.36	
Northeast	0.12	0.50		1.11	4.74	
Midwest	0.35	0.26		3.32	2.51	
West	0.26	0.30		2.47	2.87	
College	0.29	0.20		2.75	1.93	
Female	0.38	0.20	*	3.59	1.95	*
Generations	0.14	0.10		1.31	0.93	
Part-time	-0.63	0.22	***	-5.98	2.16	***
Years farming	0.01	0.01		0.05	0.07	
Satisfied	-0.36	0.20	*	-3.42	1.89	*
Successful	0.08	0.20		0.74	1.91	
Info farmer	-0.19	0.22		-1.84	2.09	
Info Extension	0.41	0.19	**	3.89	1.82	**
Number of observations = 487						
Prob > Chi^2 = 0.00						
Pseudo R^2 = 0.22						

Notes: *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$. Marginal effects are expressed in percent points and provide the effect of each explanatory variable on the likelihood of increasing crop diversification.

Conclusions

Diverse agricultural systems have long been the goal of many federal and local programs aiming to support the economic, environmental, and social sustainability of U.S. agriculture. Yet, efforts to categorize farm-level diversification for specialty crop farms are still at their early stage. Using a framework proposed by Lancaster and Torres (2019), this study provides a baseline of crop diversification in the current specialty crop industry. The main contribution of this article is the empirical evidence of the key drivers and barriers of crop diversification among specialty crop growers.

Access to markets, use of growing and value-added technologies, selling in local markets, and using Extension services information are major drivers of crop diversification in the specialty crop industry. Other drivers of crop diversification include being female, having a sole proprietorship legal structure, and using organic practices. Alternatively, farming part time, increasing the percentage of sales via contracts, using traceability systems, and being satisfied with the current farming system were identified as major deterrents to crop diversification. These findings can help policy makers, researchers, and Extension personnel aiming to support farmers by tailoring incentives that assist farm diversification. Furthermore, a number of policy recommendations ascend as a result of the findings from our empirical analysis.

First, findings show that programs and education materials from Extension services are positively influencing farmers to increase cropping system diversity. One explanation may be the fact that Extension programs and information are interdisciplinary in nature. It seems that the integration of research-based Extension programming that crosses disciplines effectively motivates farmers to allocate productive resources to diversify their crop portfolio, which in turn may diversify U.S. agricultural systems. Our findings suggest that researchers and Extension personnel should develop research-based training and education programs that address a combination of production, handling, processing, and marketing needs of farmers wanting to diversify. Information related to cost-efficient technologies for value-added practices and organic agriculture seem to be especially important for specialty crop operations aiming to diversify their crop portfolio.

Second, initiatives that improve access to markets may benefit farmers in diversifying their crop mix. It seems the importance of linking markets to buyers and end-consumers goes beyond increasing diversified farming systems. Understanding market grade standards, purchasing and delivery agreements, packaging, and cleaning requirements are critical to support farmers having a profitable portfolio of crops with appropriate agricultural, handling, and storage practices. Initiatives supporting crop diversification are likely to improve the sustainability of local food systems by strengthening key linkages among farmers, local entrepreneurs, and consumers. Benefits will also accrue to rural and urban communities as access to fresh locally produced fruits, vegetables, and horticulture crops will increase and producers will continue farming.

Further research should investigate how diversified farmers tend to behave over a period of time. Farmers are likely to change or move out of production systems, markets, and technologies; thus, future investigation should focus on drivers and barriers that lead farmers to keep their systems

diversified. The economic literature suggests that on-farm diversification provides economic benefits, yet it is unknown the degree of economic benefit perceived from different levels of diversification. Future research should be conducted to measure how the diversification groups impact farmers' economic sustainability. Although the results of this study provide insights into the drivers and barriers to crop diversification, there are several limitations that should be acknowledged. The analysis relies upon farmers accurately reporting their production, market, and technological practices. Another possible limitation of this study may be the fact that by using an online survey, which is a convenient data collection technique, this study focused on farmers using internet and may not reflect the general farming population. Thus, further research should use other sampling and data collection techniques to include non-internet users.

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Seafood Consumption Preferences and Attributes Influencing Awareness of South Carolina Aquaculture Products

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Abstract

Seafood consumers in South Carolina participated in an online survey describing their seafood preferences, consumption trends, and perceptions toward aquaculture products. Previous research assessing the market channels of seafood in South Carolina were compared to survey results. Respondents indicated that taste and quality were the most important factors considered when purchasing seafood, while production method, wild-caught or farm-raised, was the least important attribute. Respondents (68%) overwhelmingly believed that the majority of seafood

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they purchase in South Carolina is locally or domestically (United States) sourced. Shrimp and salmon were the most frequently purchased aquaculture products. Overall recognition of ecolabelling was below 40%.

Keywords: aquaculture, consumer survey, seafood consumption, supply chain, ecolabelling, South Carolina

Background

Food fish production from aquaculture currently accounts for 53% of the global supply of seafood and since 2016, consumption of seafood has increased 3.1% annually (United Nations Food and Agriculture Organization, 2018). In the United States, total seafood consumption has increased 25% from 1980 to 2018 (National Marine Fisheries Services, 2018), while the United States Department of Agriculture (USDA) estimates that more than 80% of seafood consumed in the United States is an imported product and is the top seafood importing country in the world (FAO, 2018; USDA, 2018). A majority of the seafood that is imported to the United States is farm raised, lending to the overall impact aquaculture has on the seafood supply chains in the United States (Shamshak et al., 2019). Due in part to the high volume of seafood imports since the 1970s, the United States currently faces an annual seafood trade deficit of $18 billion, with aquaculture products accounting for roughly half of that deficit (Bostock et al., 2010; Abolofia, Asche, and Wilen, 2017; Love et al., 2020).

Historically, U.S. aquaculture production constituted a double-digit share of the global market (e.g., 10% in 1951), but production has declined and only represented 1% of global output in 2016, as global expansion of aquaculture production dramatically increased (Garlock et al., 2020a). Marginal growth in gross production of U.S. aquaculture has been documented since 2010, with the situation being referred to as a "stagnation" of U.S. aquaculture (Hargreaves, 2017; van Senten and Engle, 2017). While U.S. domestic aquaculture production has seen slower growth as compared to consumer demand since 2000, aquaculture products are now comparable in market price to wild-caught seafood, meaning a higher return on investment for aquaculture producers (Asche, Bjørndal, and Young, 2001; Verbeke et al., 2007). The National Aquaculture Plan, established by the U.S. Congress in 1980, seeks identification of "the economic, physical, legal, institutional, and social constraints that inhibit the development of aquaculture in the United States" (p. 3). More recently, an Executive Order promoting American seafood competitiveness and economic growth was signed on May 7, 2020. and outlines the expansion of sustainable U.S. production through more efficient and predictable aquaculture permitting, among other considerations (Exec. Order 13921, 3 C.F.R., 2020). It is in this vein that bridging the gap between consumers' knowledge regarding seafood and their purchasing habits continues to be an objective of many state and federal agencies in addressing the production deficit that the United States is facing.

Introduction

The U.S. aquaculture industry appreciably contributes to domestic seafood consumption, but despite recent increases, still lags behind worldwide production (Thong and Solgaard, 2017; Garlock et al., 2020b) and is unable to satisfy the demands of U.S. markets (Carlucci et al., 2014; Love et al., 2020). Barriers to increasing the gross aquaculture production in the United States, with barriers being defined as factors inhibiting the expansion of aquaculture operations, vary depending on suitable water quality, local infrastructure, labor, and the presence of existing markets (Tango-Lowy and Robertson, 2005; Gibbs, 2009). Some of the potential reasons for the stagnation of gross aquaculture production in the United States include the small-scale nature of

many aquaculture operations, production taking place in public waters, social opposition across a wide range of stakeholders, and the complex processes behind leasing and permitting as key reasons for the underutilization of aquaculture production in the United States. (Whitmarsh and Palmieri, 2009; Knapp and Rubino, 2016; Risius, Janssen, and Hamm, 2017). In terms of shellfish mariculture operations, regulatory costs remain a major barrier. A survey of producers on the West Coast of the United States who collectively made up 74% of the region's gross shellfish mariculture production found that regulatory costs associated with permitting make up 29% of the firm's operational costs (van Senten et al., 2020).

Research focused on consumer preferences for and perceptions of seafood products has focused on the attributes consumers consider when making purchasing decisions, segmenting the demographic and nondemographic factors that influence these decisions (Chu et al., 2010; Roheim, Sudhakaran, and Durham, 2012; Flaherty et al., 2019; Bouchard et al., 2021). A systemic literature review by Carlucci et al. (2014) identified numerous factors influencing global fish consumption, including the high cost of seafood products, concerns about health risks, adversity to preparing seafood, and concerns over fish stock abundances, among others. A survey investigating the perceptions of aquaculture products in the northeastern United States found that aquaculture products were perceived to be of higher food quality and safety than comparable wild-harvested seafood products (Gall and O'Dierno, 1993). Respondents from the same survey perceived aquaculture products to be more expensive than wild-harvested products (Gall and O'Dierno, 1993).

Empirical surveys documenting consumers' preferences for and perceptions of seafood have sought to elucidate the patterns associated with a higher affinity for seafood and aquaculture products and attributes considered when making seafood purchases, such as labelling associated with locality and sustainability (Chu et al., 2010; Thapa, Dey, and Engle, 2015; Carlucci et al., 2017). A metric that is commonly collected in seafood consumer surveys is the frequency of seafood purchases among consumers (Gall and O'Dierno, 1993; Hicks, Pivarnik, and McDermott, 2008; Davidson et al., 2012). In the northeastern United States, higher frequency of seafood purchases for in-home consumption was associated with older age groups, residence in urban or suburban areas, and participation in recreational fishing activities (Herrmann et al., 1994). Following the findings of Herrmann et al. (1998) regarding population segments of recreational anglers having higher frequency of seafood consumption, Perkinson et al. (2020) investigated seafood consumption patterns of recreational anglers in Charleston and Berkeley counties in South Carolina and found that more than 25% of respondents ate seafood twice a week or more.

Labelling schemes of seafood products and consumers' perceptions of where seafood is sourced continue to be a focus of consumer survey research. Specifically, surveys seek to extract empirical evidence on the impact labelling and other attributes have on consumer decision making. Bouchard et al. (2021) surveyed consumers across the U.S. East Coast and found that those who more frequently sought out labelled seafood products, such as being farm raised or regional identification, were more informed about aquaculture practices, older, and generally had a more positive attitude toward aquaculture products. However, consumers in Hawaii reported a higher affinity for wild-caught-identified seafood products (Davidson et al., 2012), while Fonner and

Sylvia (2015) found that consumers in Oregon had a higher willingness to pay for seafood that displayed eco-labelling and was marketed as locally sourced.

Aquaculture along the southeastern U.S. coast is largely concentrated on shellfish mariculture production, specifically of Eastern Oyster *Crassostrea virginica*, with the exception of Florida where 98% of shellfish mariculture production is Hard Clams *Mercenaria* (USDA-NASS, 2013). The need for feedback from seafood consumers on what products they purchase, where they purchase them, and the demand for alternative seafood options is evident as fledgling aquaculture operations have difficulty establishing themselves (Gibbs, 2009; Whitmarsh and Palmieri, 2009; Brayden et al., 2018). In this study, we investigated South Carolina coastal and inland consumer perceptions of local aquaculture seafood and their respective consumption across a variety of species and market outlets. The South Carolina aquaculture industry is embryonic: In 2018, the South Caroline aquaculture sector was valued at slightly more than $4 million with 24 farms, which is a loss of eight farms and 14% in revenue since 2013 (USDA-NASS, 2018). In South Carolina, the number of freshwater aquaculture farms specializing in the production of catfish and tilapia has declined 20% since 2013, while the number of mariculture operations has increased 40% (USDA-NASS, 2018). This increase is largely occurring on farms involved in the off-bottom shellfish production of oysters (USDA-NASS, 2018).

Evaluating the demand for seafood and aquaculture products in South Carolina has been documented previously in a comprehensive economic impact report conducted in 2008 on the market channels for seafood products in South Carolina and the breakdown of sales of imported and exported products (Henry, Rhodes, and Eades, 2008). Henry, Rhodes, and Eades (2008) provide vital information on the trends of local aquaculture production and accessibility of local aquaculture products to in-state distributors. For our purposes, we used the per capita consumption values of various seafood products from this report as a baseline for seafood consumption in South Carolina. Using data collected by Henry, Rhodes, and Eades (2008) as a baseline, our objective was to update our understanding of seafood consumption trends through empirical sampling of seafood consumers in South Carolina.

Materials and Methods

Survey

The perceptions and consumption of seafood in South Carolina focusing on aquaculture-produced species were evaluated utilizing the validated survey instrument, Qualtrics. Questions on the survey were pretested by select South Carolina residents, Clemson Extension, and South Carolina Sea Grant Consortium personnel and revised as necessary. Surveys were distributed to random households across all of the 46 counties in South Carolina. Surveys consisted of screening, lifestyle, shopping preference, and demographic questions. Screening questions were used to limit participants to the targeted population: South Carolina residents 18 years of age or older who consumed seafood. For simplicity, both marine and freshwater species were lumped under the term "seafood." A total of 1,947 respondents from all 46 counties in South Carolina matched screening criteria. Survey participants were queried about household consumption and their perceptions of

wild and raised seafood. Data on species, market outlets, and season preferences also were collected. A major portion of the survey inquired about consumers' perceptions of aquaculture in general and South Carolina's fledgling aquaculture industry specifically.

Respondents were asked to choose up to three most frequently consumed seafood products from a provided list. This list was comprehensive but not exhaustive; therefore, seafood products representative of certain localities may not be represented among the choices available. To account for choices not represented, the survey included an "other" option as a choice. Of note, canned tuna in this survey is not differentiated among fresh, frozen, and prepared products, which has been differentiated in similar surveys (Gall and O'Dierno, 1993). Shellfish options listed in the survey included bivalves, such as clams, oysters, and mussels, and crustaceans, such as crab and shrimp. Shellfish products in this survey were not differentiated between being consumed cooked or raw, as is the case with clams and oysters on the half-shell (Murray and D'Anna, 2015). To address the current gap in knowledge regarding intrastate travel relating to seafood consumption, we collected data on seafood preferences of inland residents who indicated they had traveled to a coastal county and purchased seafood.

Respondents were also asked to select up to three of the most commonly purchased farm-raised seafood products, in addition to the three most desired farm-raised seafood produced in South Carolina, assuming these products were available. The option "none" was included among the choices as a proxy for respondents who would not purchase farm-raised seafood products in any capacity. The objective of this question was to assess the market potential of local aquaculture products based on possible consumer demand. Other sections in the survey included asking respondents their three most frequently visited market outlets for purchasing seafood, familiarity with seafood certification labelling, the importance of attributes when making seafood purchases, and which sources of information about seafood are preferred.

One of the primary limitations of this study revolved around respondents' demographics. Utilizing online survey platforms is a cost-minimization strategy for data collection, but is inherently limited by selection biases of survey companies (Wright, 2006). Primarily, two selection biases occur. Online survey companies may not be able to recruit participants representative of the general population, and as such, may not be able to meet target demographic groups to ensure a representative sample population. Secondly, online surveys eliminate households without access to the internet. Based on the estimates from the American Community Survey (U.S. Census Bureau, 2019), 81.6% of households have broadband internet access. It is assumed that the exclusion of the population of households without internet may result in a geographic and socioeconomic sample bias at a minimum.

Results

Sociodemographic Data of Survey Respondents

Survey respondents resided in each county across South Carolina (f) and tended to be younger, well educated, and long-term state residents. A majority, 72%, resided in non-coastal counties,

with the seven most populous counties contributing 12% (Greenville), 9% (Charleston), 8% (Richland), 8% (Horry), 6% (Spartanburg), 6% (Lexington), and 5% (York) of all surveys collected. Sociodemographic data of survey respondents were weighted according to American Community Survey 1-year estimates to accurately report various sociodemographic characteristics of our sample population (U.S. Census Bureau, 2019). The average age of respondents was just under 44 years old, and a majority, 69%, were female (Table 1). Household income in 2019 was just under $65,000, and education level was 15.3 years, equaling between 3 to 4 years of postsecondary education. Households typically consisted of four family members including adults and were South Carolina residents for just under 19 years, highlighting that a majority of survey participants were long-term residents of the state.

Table 1. Sociodemographic Data of Survey Respondents

Variable	Definition	Obs.	Sample Average	Std. Dev.	Min.	Max.	State Average[c]
Respondent location	1 if inland, 0 if coastal county	1947	0.72	0.31	0	1	0.71
Gender	1 if male, 0 if female	1947	0.31	0.27	0	1	0.48
Age[a]	Average age in years	1947	43.6	15.82	18	100	39.9[d]
Income[a]	Average 2019 household income	1947	$65,000	$56,000	0	>$500,000	$56,277
Education[b]	Education in years	1947	15.34	1.98	9	19	13.46
Household members	Including survey respondent	1947	3.00	1.78	0	9	2.54
Residency[a]	Years residing in SC	1947	18.93	10.05	0	50	--
Race and ethnicity	Native American or Alaskan Native	15	0.008	--	--	--	0.004
	Asian	25	0.013	--	--	--	0.017
	Black or African American	393	0.2	--	--	--	0.26
	Hispanic or Latino	43	0.022	--	--	--	0.058
	Native Hawaiian or Pacific Islander	2	0.001	--	--	--	0.001
	White or Caucasian	1446	0.74	--	--	--	0.66
	Other	28	0.014	--	--	--	0.001
Employment	Employed	1208	0.62	--	--	--	0.58
	Unemployed	158	0.08	--	--	--	0.03
	Not in labor force	581	0.3	--	--	--	0.4

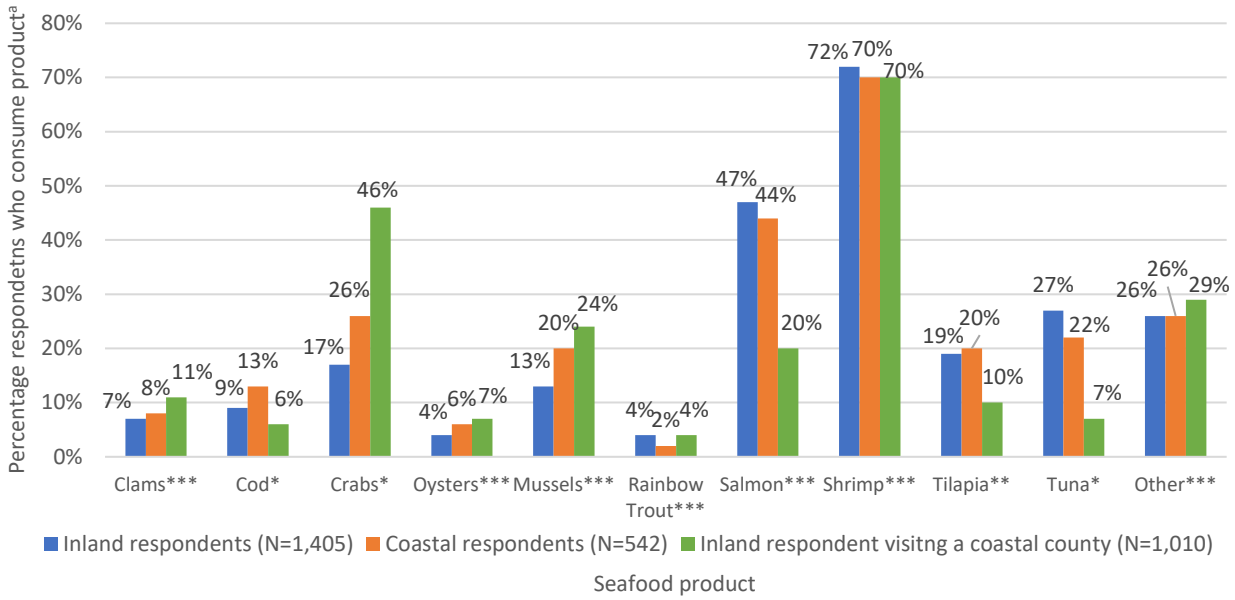
[a]Values are represented by using median values from categorical choices in the survey.
[b]Values are represented by categorical choices, starting with "Some High School" and increasing to a "Graduate Degree."
[c]State level values are based on 2019 ACS 1-year estimates.
[d]Age at the state level is based on individuals of 25 years or old.

Seafood Consumption

The frequency and seasonality of seafood consumption varied in South Carolina (Table 2; Figure 2). Home consumption of seafood occurred twice a month in a majority of households (Table 2). Restaurant seafood consumption only occurred once a month, but in a greater percentage of households (Table 2). While most species were consumed equally across seasons, oyster, crab, and shrimp consumption varied seasonally (Figure 2). Oyster consumption increased during winter months and crab and shrimp consumption increased during summer months (Figure 2). Consumption of crab species, such as the blue crab, is higher among coastal residents than their inland counterparts, while inland residents who traveled to the coast and purchased crabs had the highest rate of reported consumption among respondents (Figure 3).

Table 2. Summary of Respondent Seafood Consumption Frequency

Variable	Average Per Capita Frequency of Consumption	
Frequency of Seafood Purchases	**Prepared at Home (%)**	**Prepared at Restaurants (%)**
Several times per week	18.2	8.8
Weekly	22.7	12.8
Bi-weekly	21.8	20.8
Monthly	37.3	57.6

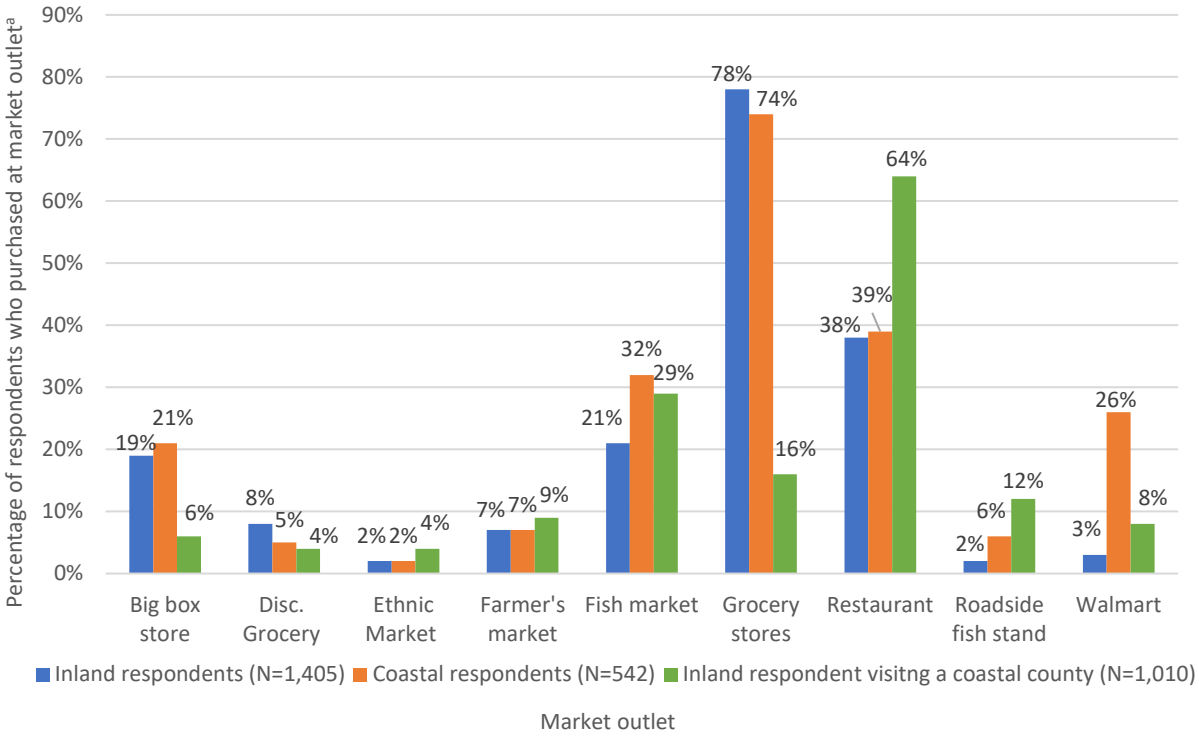


*Wild-caught seafood only
***Both wild-caught and farm-raised seafood
[a]Up to three seafood products could be selected

Figure 2. Seafood Product Choices by Season among Survey Respondent

Market Outlet

Grocery stores were the market outlet of choice (82%) for the majority of seafood purchased for in-home consumption. The segment of inland residents who indicated they had purchased seafood while visiting a coastal county were also asked to provide the three market outlets where they purchased seafood on the coast. The purpose of this question was to compare purchasing behavior among respondents purchasing seafood near their residence as opposed to when they visit coastal communities. Among coastal and inland respondents purchasing seafood near their residence, more than 70% revealed they purchased seafood from grocery stores (Figure 3). A majority of inland respondents visiting a coastal county (64%) purchased seafood at restaurants, and the proportion of inland respondents visiting a coastal county who purchased seafood at grocery stores fell to 16%. Respondents reported average monthly spending of $76.00 on seafood products across all market outlets, and nearly 56% of seafood purchased was cooked as opposed to raw.



[a]Up to three market outlets could be selected.

Figure 3. Choices of Market Outlet among Survey Respondents

Labelling

We found that 47% of respondents have purchased seafood labeled as farm raised, 44% had not, and 9% indicated they did not know whether they had purchased seafood that was labeled as farm raised (Table 3). Survey respondents (68%) believed that the majority of the seafood they purchase is sourced either locally or domestically to the United States. When respondents were asked whether they recognized any labeling signifying their seafood was farm raised in South Carolina,

only 38% had any awareness of labeling for local farm-raised seafood. Table 4 reports respondent results related to seafood source recognition and labeling, including recognition of the Best Aquaculture Practices (BAP) label and the Marine Stewardship Council (MSC) and Aquaculture Stewardship Council (ASC) ecolabels. Table 4 shows that 57% of respondents recognized farm-raised seafood products labels, while a much smaller group of respondents recognized BAP, ASC, and MSC.

Table 3. Summary of Consumer Purchasing Attributes Data

Variable	Definition	Average of Respondents
Seafood preparation	1=cooked, 0=uncooked	0.56
Location of consumption	1=in-home, 0=restaurant	0.64
Seafood purchased for in-home (%)	Grocery stores	82.0
	Other sources	15.0
	I did buy seafood for in-home	3.0
Purchases of seafood labelled as farm-raised (%)	Yes	47.0%
	No	9.0%
	I do not know	44.0%
SC consumer perception of where the majority of seafood is sourced (%)	Locally (SC)	39.0%
	Domestically (besides SC)	29.0%
	Imported internationally	18.0%
	I do not know	14.0%

Table 4. Summary of Ecolabels for Seafood and Aquaculture Products

Variable	Definition	Average of Respondents
Recognition of aquaculture labelling organizations		
Label specifying seafood is farm raised	(1 = Yes, 0 = No)	0.57
Certified SC Seafood[a]	(1 = Yes, 0 = No)	0.38
Best Aquaculture Practices (BAP)	(1 = Yes, 0 = No)	0.29
Marine Stewardship Council	(1 = Yes, 0 = No)	0.37
Aquaculture Stewardship Council	(1 = Yes, 0 = No)	0.32

[a]As of 2019, the South Carolina Department of Agriculture created the South Carolina Certified Seafood Program including aquaculture products.

Seafood Attributes

Taste, quality, and cost were the three most important decision-making criteria for purchasing seafood. Conversely, cooking time and whether the seafood product is farm raised were found to be the least important factors when purchasing seafood. Table 5 highlights that respondents were satisfied overall with the quality and variety of seafood at both grocery stores and restaurants. Respondents were familiar with the differences between farm-raised and wild-caught seafood production methods; however, they were unfamiliar with the actual species that were farm raised in South Carolina. Finally, we found that consumers were very likely to purchase local aquaculture products as evidenced by a score of 4.1 on a 5-point Likert scale (1 = very unlikely, 5 = very likely).

Table 5. Summary of Consumers' Perceptions toward Seafood and Marketing Characteristics

Variable	Definition	Obs.	Scale	Std. Dev.	Min.	Max.
Attributes for purchasing seafood	5 = very important 1 = very unimportant	1947				
Cooking time			3.5	1.14	1	5
Cost/price			4.1	0.91	1	5
Farmed-raised			3.3	0.98	1	5
Location of production			3.7	0.95	1	5
Quality and/or freshness			4.6	0.81	1	5
Supporting local aquaculture			3.7	0.93	1	5
Sustainability			4.1	0.93	1	5
Taste			3.5	0.77	1	5
Market outlet satisfaction	5 = very important 1 = very unimportant	1947				
Quality at grocery stores			3.8	0.80	1	5
Quality at restaurants			4.0	0.78	1	5
Variety at grocery stores			3.6	0.9	1	5
Variety at restaurants			3.9	0.88	1	5
Familiarity with aquaculture products	5 = very familiar 1 = very unfamiliar					
Difference between wild and farm-raised seafood			3.6	1.11	1	5
Types of farm-raised seafood commonly produced in SC			2.8	1.12	1	5
Purchasing SC aquaculture products	5 = very likely 1 = very unlikely		4.1	0.96	1	5

Table 5 (continued).

Variable	Definition	Obs.	Scale	Std. Dev.	Min.	Max.
Information sources	5 = very frequently 1 = very infrequently					
Fisherperson			3.0	1.24	1	5
Friends			3.3	1.09	1	5
Locals			3.3	1.12	1	5
Online review			3.2	1.20	1	5
Restaurant staff			3.3	1.09	1	5
Seafood retailer			3.2	1.12	1	5

Information Sources

Respondents utilized local knowledge, friends, and restaurant staff most frequently for information regarding aquaculture and seafood products, while seafood websites and fisherpersons were the least frequently used sources (Table 5). Respondents preferred to use or receive information about aquaculture products from academia, followed by state agencies, nongovernmental organizations, federal agencies, and lastly, private organizations (Table 6).

Table 6. Summary of Consumers' Preference for Information Regarding Aquaculture Products

Variable	Average of Respondents
Consumer preference for obtaining information on aquaculture products	
Academia (e.g., Clemson University)	38.0%
State agencies (e.g., South Carolina Sea Grant Consortium)	24.0%
Non-governmental organizations (e.g., The Nature Conservancy)	15.0%
Federal agencies (e.g. NOAA)	14.0%
Private organizations	6.0%

Discussion

In this study, we investigated South Carolinians' seafood consumption and their perception(s) of buying and consuming aquaculture products from South Carolina. This research is valuable in that it informs producers and aquaculture industry stakeholders about consumers' demands and preferences. Comparing national and statewide trends of seafood consumption provides evidence of the potential market for aquaculture products in South Carolina, along with opportunities to enhance consumers' awareness of locally produced seafood in the state.

Our results found that salmon, particularly Atlantic salmon, is the most widely consumed aquaculture product, followed by shrimp. According to the National Marine Fisheries Service (2018), Atlantic salmon was the most widely consumed aquaculture product, while farm-raised shrimp was the second most consumed aquaculture product. The most consumed seafood products,

regardless of production method, among U.S. consumers are shrimp and salmon, ranking first and second, respectively (National Marine Fisheries Service, 2018; USDA-NASS, 2018). Our results follow global consumption trends of farm-raised seafood products, with the proportion of respondents in our survey reporting they consumed farm-raised shrimp (71%), Atlantic salmon (46%), tilapia (20%), and catfish (16%), which are also the four most valuable farm-raised fish species by revenue behind carp species (FAO, 2020). Regarding seafood production from recirculating aquaculture systems (RAS), South Carolina has 11 RAS facilities; however, these systems do not currently support the cultivation of shrimp, which is the most desired aquaculture product among respondents (USDA-NASS, 2018). Also, mussels and salmon cannot be feasibly cultivated in South Carolina.

Consumers may choose more frequent consumption of seafood at home given the higher cost of purchasing seafood at restaurants. This is an important signal to producers that the market for home seafood consumption is an important one for additional development and marketing as the industry grows (Hicks, Pivarnik, and McDermott, 2008). A majority of respondents purchased seafood two or more times per month for in-home consumption and once a month at restaurants. A similar trend in restaurant purchases was observed by Hicks, Pivarnik, and McDermott (2008), with respondents reporting two or fewer monthly seafood purchases at restaurants, while in-home purchases took place several times per week.

Understanding the relationship of seafood purchases in the home and at market outlets was of particular importance in our survey, as limited estimates exist for this type of consumer behavior in South Carolina. A majority (56%) of seafood purchased by respondents was cooked. This value is slightly higher than the findings by Cheng and Capps (1988), who found that less than 50% of seafood purchased by Americans was already cooked. Over the last 30 years, seafood preparation at market outlets has increased with more offerings of already prepared seafood available to consumers, particularly frozen and already cooked products (Thapa, Dey, and Engle, 2015). Interestingly, our findings showed that 64% of seafood consumption in South Carolina happens at home, as compared to outside the home or at a restaurant. Respondents purchased 36% of their seafood from restaurants, which is well below the findings of other similar studies regarding seafood consumption (Risius, Janssen, and Hamm, 2017; Brayden et al., 2018).

Similar studies found overall out-of-home seafood consumption as high as 65% (Love et al., 2020). Richards (2020) estimated that in South Carolina, an excess of 80% of farm-raised oysters are sold directly to restaurants where they are marketed as half-shell quality, which further explains the demand for out-of-home consumption of certain aquaculture products. A similar study by Zhang et al. (2004) on at-home and away-from-home consumption of seafood in the United States found that only 46% of respondents purchased seafood at restaurants, much lower than expected. Some studies in other U.S. locations have found that respondents purchased up to 80% of the seafood they consume at restaurants (Thapa, Dey, and Engle, 2015; Thong and Solgaard, 2017). Seafood purchases at roadside fish stands or directly from fishermen themselves were greatest among inland respondents visiting a coastal county (12%). This result is a sign that South Carolina residents potentially prefer freshly caught seafood sold directly from harvesters when they are visiting the coast. Additionally, inland respondents' seafood purchases at fish markets decreased

by 8% when compared to home location purchase versus visiting a coastal county. This finding revealed that there may be more limited availability of fresh seafood in inland counties and that seafood markets in South Carolina are predominantly distributed throughout coastal counties where a majority of locally sourced seafood products are purchased and consumed. This also could highlight that consumers may not be aware of where local seafood markets are located in their communities and may represent a source of educational and/or market opportunities.

Our survey instrument also included a component focused on intrastate travel by inland residents to coastal counties who purchased seafood while visiting the coast. The purpose of this distinction was to investigate which seafood products are more desired by visitors of coastal counties as opposed to the inland counties in which they reside, and at which market outlets inland residents visiting the coast are more likely to purchase seafood. We compared per capita seafood consumption among inland and coastal South Carolina residents to the values found in Henry, Rhodes, and Eades's (2008) study with the same eight coastal counties used to compare per capita consumption of seafood in South Carolina. Henry, Rhodes, and Eades (2008) found that fish accounts for 53% of seafood consumption, while shellfish comprised 47% of seafood consumption for both coastal and inland residents in 2006 (Table 7). Our survey showed similar results for inland county residents' consumption of fish (54%) and shellfish (46%) but differs with respect to coastal county residents' consumption of shellfish, which is higher than Henry, Rhodes, and Eades's (2008) estimates. These results may be attributed to the increase in shellfish mariculture production in South Carolina over the last 15 years (Jodice and Norman, 2020). The decline in grocery store seafood purchases when inland residents visit the coast highlights the relative importance that consumers place on purchasing seafood at market outlets other than grocery stores, such as at restaurants, seafood markets, and roadside fish stands.

Table 7. Percentage of Per Capita Seafood Consumption in South Carolina

Variable	**Source**	**Per Capita seafood consumption (%)**	
Respondent location		**Fish**	**Shellfish**[c]
Inland[a]		53%	47%
Coastal	*Henry et al., 2008*[b]	53%	47%
Inland		49%	51%
Coastal	Our survey, 2020	54%	46%

[a]Coastal counties in South Carolina include Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Jaspar and Horry.
[b]Per capita consumption by seafood type is derived from National Marine Fisheries Service database (2008).
[c]Shelllfish in our survey included clams, crabs, mussels, oysters, and shrimp.

Similar studies have found clear distinctions in the purchasing patterns of tourists and residents of coastal counties. For instance, Jodice and Norman (2020) and Tango-Lowy and Robertson (2005) found that the main attributes of seafood consumption, such as quality, taste, and price, typically differ little between geographic areas, while other attributes, such as preferred production method (i.e., wild caught versus farm raised) and origin, can vary widely between coastal and inland communities. Coastal and inland residents' differences may be related to the interactions that coastal residents have with aquaculture growers, resulting in a better understanding of the effects

of aquaculture on coastal ecosystems and a greater potential for supporting producers by purchasing locally (Hilborn et al., 2018).

Seasonality also had an effect on seafood consumption trends in our survey, particularly with shellfish. The increase in consumption of oysters in winter months can be attributed partly to consumers' concern about eating oysters during summer months when water temperature is higher, which can increase the risk of shellfish poisoning due to pathogens such as *Vibrio spp.* (Børresen, 2009). Fishery closures also contribute to trends in local seafood consumption, with no seasonal closure of crab species in South Carolina, while the fall white shrimp commercial fishery is open from September to December, and consumption of shrimp is consistently high throughout the year (South Carolina Department of Natural Resources, 2019). However, higher consumption rates of crab species commonly sold in South Carolina, such as blue crabs, were observed in the summer. This finding alludes to the demand-driven nature of blue crab purchases among tourists in the summer months, when the majority of blue crabs are sold in South Carolina, rather than the effect of harvesting effort, as a majority of landings take place from September to May (Henry, Rhodes, and Eades, 2008; South Carolina Department of Natural Resources, 2019; Jodice and Norman, 2020). Similar consumption trends between inland and coastal respondents were observed with salmon, with 47% and 44% of respondents, respectively, indicating they purchased salmon, while only 20% of inland respondents visiting the coast purchased salmon. Lower consumption of salmon by coastal tourists might be attributed to the relatively homogenous distribution of salmon, both farm raised and wild caught, across the state, and therefore may be less desired than other locally caught seafood sold in coastal counties (Henry, Rhodes, and Eades, 2008).

In South Carolina, the production method (i.e., capture fisheries and aquaculture) and locality of seafood are important considerations in valuation and willingness to pay (WTP). For example, in a study evaluating WTP of wild and farmed salmon, salmon labelled "wild-caught" on average sold for $15.62 per pound, whereas salmon labeled as "farm-raised" sold on average for $6.31 per pound (Bostock et al., 2010). This pattern illustrates consumers' potential preference for "wild-caught" seafood and the related market opportunities. The opposite valuation trend is observed for shellfish, specifically with farm-raised oysters where consumers preferred farm-raised oysters over wild-caught counterparts (Kecinski et al., 2017). Preference for local seafood and aquaculture products is a reoccurring interest that consumers have continued to show when making food purchases (Grebitus, Lusk, and Nayga, 2013; Chen et al., 2017). Similar studies along the Atlantic Coast have found that the proximity of oyster cultivation to consumers affects their willingness to pay for local products (Li, Ahsanuzzaman, and Messer, 2019). Jodice and Norman (2020) found that South Carolina residents' ratings of importance for the attributes "environmentally sustainable," "wild-caught," and "harvested locally" were significantly higher than tourist ratings for the same attributes. In future studies, it will be important to examine how proximity to local aquaculture production may impact residents' willingness to pay for locally harvested products.

Education and outreach continue to be instrumental in growing awareness of the domestic aquaculture industry with consumers who would otherwise overlook the source and production method of the seafood they consume. Respondents (68%) overwhelmingly believed that seafood purchased in South Carolina is either locally sourced or a domestic product of the United States.

the National Marine Fisheries Service (2018) reports that less than 20% of the seafood Americans consume is a domestic product. These results are in line with other studies that highlight the common misconception consumers have about the source of the seafood they purchase (Barrington et al,, 2010; Carlucci et al., 2017). Consumer awareness gaps appear even around the region that certain species are produced; for example, 94% of Atlantic salmon and more than 90% of various species of tropical shrimp (*Penaeid spp.*) are imported and are often misunderstood by consumers as being domestic products (National Marine Fisheries Service, 2018). Consumers' ability to access information regarding aquaculture products and the practices used in the industry has had a significant influence on awareness and acceptance of these products in states with strong aquaculture associations and university-based aquaculture extension programs. They have also served as a catalyst for more financially constrained aquaculture enterprises (Swann and Morris, 2001).

As of this study, the South Carolina Department of Agriculture, in conjunction with the South Carolina Seafood Alliance and the South Carolina Department of Natural Resources, has developed the South Carolina Certified Seafood Program, which is designed to help consumers easily identify locally sourced seafood (South Carolina Department of Agriculture, 2019). This program is available to wholesale dealers, distributors, retailers, and both aquaculture and shellfish mariculture permit holders, certifying that their grown or landed seafood is a product of South Carolina. This certification label includes South Carolina-certified grown seafood, which incorporates locally wild-caught seafood such as shrimp from the family *Penaeidae* and various finfish species commonly caught in South Carolina (South Carolina Department of Natural Resources, 2019). Market outlets sometimes use the terms "locally-sourced" or "farm-raised" as a label on seafood, signifying that the product is either farm raised or that the product is locally sourced. Our results showed that only 38% of respondents indicated they had purchased seafood with the South Carolina Certified Seafood label, signaling that this particular labeling is still relatively new in its implementation among locally sourced seafood and aquaculture products.

Research has shown that education and outreach of coastal mariculture practices and promoting additional market outlets, such as farmers' markets and oyster trails, continue to be effective steps in promoting local, farm-raised seafood products for which consumers are willing to pay a premium (Davidson et al., 2012; Fonner and Sylvia, 2015; Li, Ahsanuzzaman, and Messer, 2019; Kim et al., 2020). South Carolina has recently developed its own form of oyster trail known as the "Lowcountry oyster trail," which may be a valuable resource for introducing the role of mariculture in the region and building environmental and economic support in coastal communities. As mariculture continues to grow in both production and accessibility along coastal counties in South Carolina, the need for targeted surveys of rural communities where aquaculture is taking place is necessary to determine how preferences for aquaculture products may change in contrast to more urban areas of the state. Additional research exploring the preferences for and perceptions of aquaculture products among rural, urban, and underrepresented groups is imperative to better channel marketing opportunities for producers who plan to grow their markets.

Conclusion

This study is the first to elucidate South Carolina seafood consumers' perceptions of aquaculture products and the seafood industry as a whole through empirical reporting. Our survey findings on the preference for South Carolina aquaculture products is in line with the national preference for species including shrimp and salmon, the two most readily available aquaculture products on the market (FAO, 2018). Taste, quality, and/or freshness, and price were found to be the most important attributes when purchasing seafood, which mirrors the most important factors in consumer seafood purchasing found in other studies (Grebitus, Lusk, and Nayga, 2013; Chen et al., 2017).

Our findings about respondents' perceptions of the source of seafood and aquaculture products are important for the larger research stream. While the Certified South Carolina Seafood Program is still in its infancy, it currently has 11 organizational members and is growing annually (Jodice and Norman, 2020). Regulating seafood labeling-related fraud continues to be an important objective in South Carolina and beyond, and a study on national seafood labeling found that 33% of seafood tested for its origin was inaccurately labeled, showing that a significant proportion of U.S. seafood could be geographically misrepresented (Warner et al., 2012).

In conclusion, this research provides valuable information to the broad set of stakeholders interested in aquaculture production in South Carolina. Our results highlight there is great potential for growth of this industry, and consumers are eager to purchase local South Carolina seafood products. Increasing awareness about the economic and environmental benefits of shellfish mariculture in South Carolina and how this industry could benefit our rural communities by being an engine of local entrepreneurship is an area of research and outreach that should be pursued in subsequent studies.

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How Much More to Pay? A Study of Retail Prices of Organic Versus Conventional Vegetarian Foods in an Australian Regional Area

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Abstract

Organic foods are popular around the world, with some consumer segments willing to pay price premiums. This study determined the price differential of a shopping basket of organic versus conventional vegetarian foods using an observation of retail prices across 13 conventional retailers in a regional area of Australia. The organic basket had a 60% price premium, with premiums varying widely by retailer. The higher premiums for fruits, vegetables, and grains relative to dairy and sugar may be due to higher costs of marketing channel logistics.

Keywords: consumer behavior, organic food, pricing, retailing

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Introduction

Organic foods (OF) are increasingly popular around the world (Golijan & Dimitrijević, 2018). They help to reduce the use of chemical pesticides and fertilizers and thereby increase sustainability indicators in agriculture (Mie et al., 2017). Governments around the world have identified organic agriculture as an important strategy to sustainably feed the world, particularly in the context of climate change and population growth (Diaz et al., 2019). Industry bodies, such as the International Federation of Organic Agriculture Movements (2018) and the Food and Agriculture Organization of the United Nations (2018), have aspirations for organics production to significantly scale up, to purportedly help provide more sustainable food production in view of perceived future challenges for food access, utilization, stability, and availability. Further, consumers value the perceived health benefits (Zander & Hamm, 2010; Gschwandtner, 2018; Lawson et al., 2018) and lower environmental impacts of OF (De Toni, Eberle, and Milan, 2018).

Consumer demand in the OF retail market in the United States is expanding with double-digit growth, and it currently accounts for more than 4% of total food sales. According to industry research, in 1999, the value of organic consumers' purchases globally was $15 billion, compared with $91 billion in 2017 (International Federation of Organic Agriculture Movements, 2018). This growth in demand is an international phenomenon. According to the Australian Organic (2019) market report, for instance, the organic food market in Australia is worth AUD$2.6 billion, a growth of 88% since the report's inception in 2012. In a random sample (N = 1,109) of Australian households, almost half (49%) indicated that they sometimes or often buy organic foods, particularly if they were employed full time, had one child, or were never married (Ward et al., 2012).

As a market-driven consequence of the growing demand for OF, the supply of OF has increased in recent years, and the nature of OF retailing in Australia has changed (Australian Organic, 2019). Initially, OF was the province of niche independent specialty grocery stores, cooperatives, and health-food stores, afforded predominantly by those with higher disposable incomes and "trendy or alternative" progressive leanings. OF was not always readily available, and when it was, the retail prices were high compared to the nonorganic counterparts. Within a relatively short period, conventional and popular food retailers, such as supermarkets, have been increasingly entering the OF market, and now routinely stock at least some OF items. Big supermarket chains have captured a large share of the OF market from organic grocery and health-food stores, which now sell less than 50% of all OF purchased. At the same time, the farmers' market movement (where consumers purchase directly from the farmers at local markets) has also grown. However, most farmers are struggling to keep up with the demand for organic produce, as the transition to full organic certification can take many years (Bernzen & Kristiansen, 2017).

Despite this growth in OF supply and demand, OF remains a niche market, both in Australia and globally, making up only 1% of the world's total food industry (Islam, 2014; International Federation of Organic Agriculture Movements, 2018). Some consumers are willing to pay more for environmentally friendly products (Laroche, Bergeron, and Barbaro-Forleo, 2001), including OF (The Nielsen Company, 2016). For instance, of six different consumer segments based on

knowledge and attitudes toward OF, Ghosh et al. (2016) identified the "organic motivator" consumer type as having a positive attitude toward paying a higher price for organic food products (Ghosh, Datta, and Barai, 2016, p. 634). Further, consumer segments characterized by pro-environmental behaviors tend to choose a plant-based diet, such as consumers who identify as vegetarians or vegans (Fan et al., 2019). Among the many reasons consumers give as motivation to adhere to a vegetarian dietary pattern, most are related to ecological and ethical issues, such as environmental concerns, sustainability, and animal rights (Fox and Ward, 2008). While vegans adhere strictly to plant-based diets, vegetarian diets are primarily plant-based but also include some animal products, such as dairy and eggs. The price premium of a vegetarian conventional shopping basket is still unclear in the literature. Because vegetarians are more likely to purchase OF products due to ethical and ecological concerns, it is essential to investigate the price premium of a twice-weekly vegetarian shopping basket of organic versus conventional food items (Fox and Ward, 2008).

This paper presents a methodology and empirical findings regarding the actual price differential between a conventional versus organic, twice-weekly, vegetarian shopping basket at the retail level in a regional area in Australia. A positive price differential, also known as a price premium, indicates that organic food is more expensive than the conventional (nonorganic) version. Conversely, when the organic food is cheaper than the nonorganic equivalent, the differential may be referred to as a negative price premium or sometimes a price discount. There is a widespread perception that OF products generally cost more. Several studies have investigated consumers' willingness to pay premiums for organic products (Hamzaoui-Essoussi and Zahaf, 2012; Islam, 2014; Aschemann-Witzel and Zielke, 2017; Gschwandtner, 2018). In general, the higher price to the consumer in purchasing organic versus conventional foods was found to be a critical barrier to the buying preference of most consumers (Henryks, Cooksey, and Wright, 2014; Lee and Yun, 2015).

The magnitude of the price premium is an important indicator of the value consumers place on OF and hence their demand for it (Hamzaoui-Essoussi and Zahaf, 2012). Therefore, to better understand and manage the demand for OF, it is important to measure the actual retail price premiums for OF items (Islam, 2014). Existing studies examining OF price premiums at the retail level have yielded different estimates. According to Brown and Sperow (2005), in 1999, Promar International, a consultancy service to farmers, food companies, and retailers, reported that OF were associated with a 70% price premium on average. Similarly, the Australian consumer advocate *Choice Magazine* reported in 2000 that organic fruit and vegetables were on average 70% more expensive than nonorganic, but by 2013 the premium was decreasing (Footprint Choices, 2013). More recently, industry reports on the price premium for OF in Australia places it around a 20% premium on average, with wide variation depending upon location (Footprint Choices, 2013). Hamzaoui-Essoussi and Zahaf (2012) have suggested that wide-ranging premiums for OF products depend upon the country.

To date, only one published paper has investigated price differences between organic and conventional foods using a shopping basket methodology. Brown and Sperow (2005) found that the equivalent of a twice-weekly basket of OF was 49% more expensive than a shopping basket

of the same conventional items in a metropolitan area in the United States. The authors identified the organic price premium for different product categories: grains, 23%; fats and oils, 122%; sugars and sweets, 108%; fruits, 61%; milk and cheese, 69%; vegetables, 15%; meat, 57%; and other food items, 22%. However, this study focused on an average conventional household shopping basket that contained meat. The price premium of a vegetarian conventional shopping basket has not yet been reported in the literature. There is a paucity of scholarly literature on the current price differential between organic and conventional products at the retail level (Islam, 2014), especially for a vegetarian household's OF shopping basket. As vegetarians are more likely to purchase OF products due to ethical and ecological concerns, it is important and informative to investigate the price premium of a twice-weekly vegetarian shopping basket of organic versus conventional food items (Fox and Ward, 2008). As existing research on the price differential for an organic versus conventional food shopping basket has predominantly been conducted in the United States (Brown and Sperow, 2005), the current study seeks to understand the price differential in another location, namely a regional area in Australia.

Materials and Methods

Context

The context for the study is the Byron Shire in the Northern Rivers area of Australia, the country that has been described as an organic champion concerning the area of land certified under organic management (Lawson et al., 2018, p. 1). Organic products in Australia were worth about $2.6 billion AUD in 2019, or approximately 1.5% of the Australian economy (AUD1.7 trillion in 2019). Collectively, food crops and dairy products comprise half of all organic sales in Australia (Lawson et al., 2018).

The Byron Shire is located in Australia's most easterly region in the Northern Rivers area of New South Wales. The Shire's population of around 34,000 residents is spread across five postcode areas. The Byron area is a popular tourist hub, attracting more than two million visitors annually. It is known for its natural beauty, strong community spirit, progressive values, and "green" lifestyle. Local farmers in the Byron Shire are country leaders in biodiversity, organic production, and management of soil and crops. There are numerous zero-chemical organic farms in the area that aim to protect the local fauna and flora, as well as provide sustainable and chemical-free produce to the local market (Byron Shire Council, 2020). The Byron Shire Council was the first in Australia to elect a Green mayor (2011), and the Council actively promotes organics through its policy to give preference to "organic, free-range, and fair trade" catering purchases to hosting events during National Organics Week (2017). The Byron Shire is often seen as a national leader in the production and consumption of organic produce (Department of Agriculture Water and the Environment [Australia], 2014). Food suppliers in the area offer a great variety of organic and nonorganic food products. The area is also well known for its ecotourism, wellness industry, and counter-culture. Local residents and tourists drive the demand for both vegetarian and organic produce (Byron Shire Council, 2020). In response to this demand there has been a proliferation of vegetarian and organic restaurants and cafes over the past 10 years.

Design

The study was designed as a cross-sectional in-store observation of shelf prices. The study method, as informed by Malhotra (2010), involved recording objects, or patterns of behavior in people, in a structured and systematic way. The phenomenon of interest, in this case, was the retail price of selected food items. By not giving prior warning to the retailers, the prices and the retail environment could be observed in a natural setting.

Sampling Frame

Thirteen retail food outlets in the Byron Shire Local Government Area (Lasky, 2020) were included. Retail stores (outlets) were included if they sold: (i) both organic and nonorganic foods and (ii) both fresh (fruit and vegetables) and processed (including coffee, bread, pasta, tins of tomatoes) foods. A sampling frame of food retailers in the Byron Shire was compiled through a brainstorming session with researchers and the industry partner (a nonprofit local health food retailer, see acknowledgments), all of whom had local knowledge of OF retailing in the area. Farmers' markets were excluded, as they generally sell only fresh produce. Thirteen conventional food retailers who met the study criteria were identified. Following Miller (2008), three retailer types were delineated: (i) supermarkets and grocery stores, which carry an extensive product range and adopt a mass-marketing approach; (ii) convenience stores, which carry some groceries, takeaway, and other merchandise, operate from a very convenient location, and have longer opening hours; and (iii) specialized food retailers, which focus on a narrow product range.

The Shopping Basket

A shopping basket was designed to represent the average twice-weekly purchase for a typical household—a family of four (two adults and two children). The definition of a vegetarian shopping basket was adapted from the 2014 Healthy Food Access Basket Survey (Queensland Department of Health [Australia], 2015). Food products were categorized according to the six core foods groups identified by the Australian Dietary Guidelines (National Health and Medical Research Council [Australia], 2006): (i) bread/cereals, (ii) dairy and eggs, (iii) fruits/vegetables, (iiii) nuts, (v) oils, and (vi) discretionary items (e.g., chocolate). These six food categories were also captured in Brown and Sperow's (2005) shopping basket, albeit in four food categories (breads/cereals, oils and discretionary items, fruits and dairy, vegetables, meat, meat alternatives, and other food items).

Within each of the six food categories, typical food items were chosen by the team of five researchers in consultation with the industry partner. Regular staples were included, such as bread and milk and tea and coffee, which would cover standard meals. For instance, the researchers agreed that most Australian households would probably have one pasta dish every two weeks, so tins of tomatoes, spaghetti, and olive oil were included in the basket. Fruit and vegetable choices were based on variety, including one starchy vegetable, one green leafy vegetable, and a variety of colors (red, orange, and green) and included a tinned rather than fresh variety of tomatoes. Eggs and almonds were selected in place of meat as common protein substitutes used in vegetarian dietary patterns. The final basket included 21 food items (see Table 1).

The quantities for each of the 21 items to be included in the shopping basket were then determined using the Queensland Healthy Food Access Basket, which specifies the quantities of commonly eaten foods for one- to six-person households (Queensland Department of Health [Australia], 2015). The items contained in the shopping basket were based on the nutritional needs of an Australian household for two weeks as recommended by the Australian Guide to Healthy Eating (National Health and Medical Research Council, 2016). This approach mirrors that of Brown and Sperow (2005), who based shopping basket quantities on the U.S. Department of Agriculture's Thrifty Food Plan quantities recommended for consumption, whereby calculated prices were for quantities consumed, rather than for quantity purchased, as per the package size. The quantities for the four-person household shopping basket of 21 items in the study at hand are included in Table 1.

Table 1. Food Items and Weights—Four Person Twice-Weekly Shopping Basket

Bread/Cereal	Vegetables	Fruit	Dairy and Eggs	Nuts	Discretionary	Oils
Flour (500g)	Tinned tomatoes (1.36 kg)	Apple (4.97 kg)	Milk (3 Ltr)	Almonds (780g)	Chocolate (400g)	Olive oil (165g)
Spaghetti (1 kg)	Carrots (2.4 kg)	Orange (4.19 kg)	Butter (1.06 kg)		Tea bags (252g)	
Sugar (900g)	Onion (1.08 kg)	Avocado (1.17 kg)	Eggs (2 dozen)		Freshly ground coffee (144g)	
Bread (2.8 kg)	Baby spinach (565g)					
Rice (900g)	Potato (2.61 kg)					

Source: Developed for this study based on food categories from the Australian Dietary Guidelines (National Health and Medical Research Council, 2006) and food weights from the Queensland healthy food access basket (Queensland Department of Health, 2015).

Data Collection Protocol

Prior to data collection, pilot data were collected across two retail outlets to refine the approach. On the first day, two researchers visited the first two stores together and manually entered the prices into handheld devices that contained a link to a data capture survey, hosted by the online survey platform Qualtrics (www.qualtrics.com). The researchers developed a consensus on which prices to collect to facilitate consistency in reporting through a process, including comparing the accuracy of the collected data and agreeing to a systematic approach for product selection. For example, mi-price range products were selected rather than more expensive or cheaper store-brand products, and the same brand was chosen across retailers where possible. Standard shelf price was used rather than any currently advertised discounted price. Packaged items were recorded in absolute terms (per item) and relative terms (per kilogram/liter). Fresh produce (loose) was priced in units or per kilogram, and the national average size of each item (Food Standards Australia and

New Zealand, 2018) was used to calculate the per-unit or kilogram price if it was not displayed in the retail outlet. For the remainder of the stores, the researchers collected data independently over five days.

Data Analysis Strategy

The retail price data collected was downloaded into an Excel spreadsheet for checking and descriptive statistics and then into Stata (StataCorp, 2019) for statistical analyses. The OF price premium was determined in two ways. First, the OF price premium was calculated by subtracting the price of the conventional item from the corresponding organic item per store. The "premium" was calculated as the price difference divided by the conventional price per item (i.e., premium = price difference/conventional price). Second, the quantities of each item that would typically go into a twice-weekly shopping basket for a family of four were used as weights to calculate the total a household typically spends on an organic and conventional shopping basket. This is consistent with how Brown and Sperow (2005) estimated OF price premiums.

The retailers' data were further explored for each of the three retailer categories: supermarket, general store, and fruit and vegetable store. Finally, OF price premium differences by retailer, location. and an overall average difference were calculated.

Results

Of the 19 food retailers identified in the Byron Shire who sold OFs, only 13 sold both organic and conventional foods; five retailers were health foods stores and did not sell conventional products; no retailers sold only conventional food (i.e., nonorganic options).

Organic Food Price Premium Based on Paired Observations

There were 152 paired observations of 21 organic and conventional food items. The means of the price premiums (of organic over conventional foods) per item, as a percentage, are provided in Table 2. While there was large variability in the mean OF price premiums, all means except for coffee were positive, indicating that OF products were more expensive than the matching conventional food items. The highest mean OF price premium was for carrots (143%). Negative price premiums (or discounts) were observed among only six OF food items—tinned tomatoes (-21%), carrots (-20%), coffee (-20%), bread (-18%), teabags (-17%), and rice (-11%). The three greatest price premiums were for rice (315%), butter (265%), and carrots (242%). The overall mean percentage OF price premium of the paired observations across the 21 food categories was 77.3% (unweighted for number of observations) and 74.8% (weighted for number of paired observations [i.e., frequency]).

Table 2. Mean Observed OF Price Premium Percentage (rounded to nearest %).

	Mean of Observed OFPP	SD of Mean	Min Observed OFPP	Max Observed OFPP	*N* of Paired Observations
Apple	75	56	19	180	6
Avocado	110	31	81	153	4
Onion	134	53	38	182	6
Spinach	39	25	12	60	4
Potato	84	55	33	186	6
Orange	75	47	27	144	6
Carrot	143	90	-20	242	8
Flour	63	16	50	82	4
Spaghetti	96	104	10	311	8
Sugar	58	16	41	72	3
Bread	60	61	-18	175	10
Rice	104	103	-11	315	8
Tinned tomatoes	50	94	-21	249	7
Milk	58	24	33	113	12
Butter	59	75	0	265	10
Eggs	71	44	0	168	9
Almond	95	16	77	106	3
Chocolate	121	53	60	190	10
Teabags	88	96	-17	229	8
Coffee	0	18	-20	34	12
Olive oil	41	45	1	117	8
Unweighted	77.3				
Weighted	74.8				

Shopping Basket Organic Food Price Premium

The OF premiums in Australian dollars (AUD) paid by the purchaser of a twice-weekly household shopping basket are given in Table 3. Using the average of the observed retail prices of each organic and conventional food item across all retailers for the standard weights, the total household cost of an OF shopping basket was calculated as AUD323.07, compared with AUD203,13 for the basket of conventional food items (see Table 3). The difference of AUD121.06 constitutes a 59.6% (95% CI: 39.79, 82.02) price premium of the basket of OF over the basket of conventional foods.

Table 3. Average Price of Food Items (per kg) in Twice-Weekly Shopping Basket (in AUD)

Food Item	Twice-weekly Household Total (kg or l)	Organic Average Price (kg or l)	Organic Basket Total	Conv. Average Price (kg or l)	Conv. Basket Total	Basket Diff	*N*
Apple	4.97	$9.38	46.62	$5.80	28.83	17.79	62
Avocado	1.17	$19.56	22.89	$12.61	14.75	8.14	55
Onion	1.08	$5.12	5.53	$2.89	3.12	2.41	77
Spinach	.57	$29.75	16.81	$24.25	13.70	3.11	23
Potato	2.61	$4.41	11.51	$3.21	8.38	3.13	37
Orange	4.19	$3.60	15.08	$3.82	16.01	-0.40	-3
Carrot	2.4	$5.09	12.22	$2.55	6.12	6.10	100
Flour	.50	$5.52	2.76	$2.93	1.47	1.29	88
Spaghetti	1.00	$8.30	8.30	$3.83	3.83	4.47	117
Sugar	.90	$4.34	3.91	$2.40	2.16	1.75	81
Bread	2.80	$7.44	20.83	$4.35	12.18	8.65	71
Rice	.90	$8.23	7.41	$4.32	3.89	3.52	91
Tin tomato	1.365	$5.41	7.38	$3.66	5.00	2.38	48
Milk	3.00	$2.71	8.13	$1.79	5.37	2.76	51
Butter	1.06	$22.16	23.49	$15.54	16.47	7.02	43
Eggs	1.62	$14.12	22.28	$8.59	13.92	8.95	64
Almonds	0.78	$38.03	29.66	$20.05	15.64	14.02	90
Chocolate	0.4	$59.29	23.72	$25.47	10.19	13.53	133
Teabags	0.25	$94.92	23.92	$52.56	13.25	10.67	81
Coffee	0.144	$44.48	6.41	$42.43	6.11	0.3	5
Olive oil	0.165	$25.50	4.21	$16.61	2.74	1.47	54
Total			323.07		203.13	121.06	
OFPP on total spend							59.6%

Note: Conv, Conventional; Diff, Price differential; OFPP%, Organic Food Price Premium Percentage

Using this measure of OF price premium (as a percentage), food items with the highest OF price premium were chocolate (133%), spaghetti (117%); and carrots (100%). Those with the lowest were coffee (5%) then spinach (23%) (see Figure 1). Organic oranges were 3% less expensive than conventional in the shopping basket. The items with the highest absolute mean price difference between organic and conventional foods were apples and almonds with differences of AUD17.79/kg and AUD14.02/kg, respectively. The AUD0.30/kg price difference between organic and conventional coffee was the lowest. There was more variability in the pricing for OF products than conventional (e.g., prices for 5 kilos of organic apples ranged from AUD28.00 to AUD46.80).

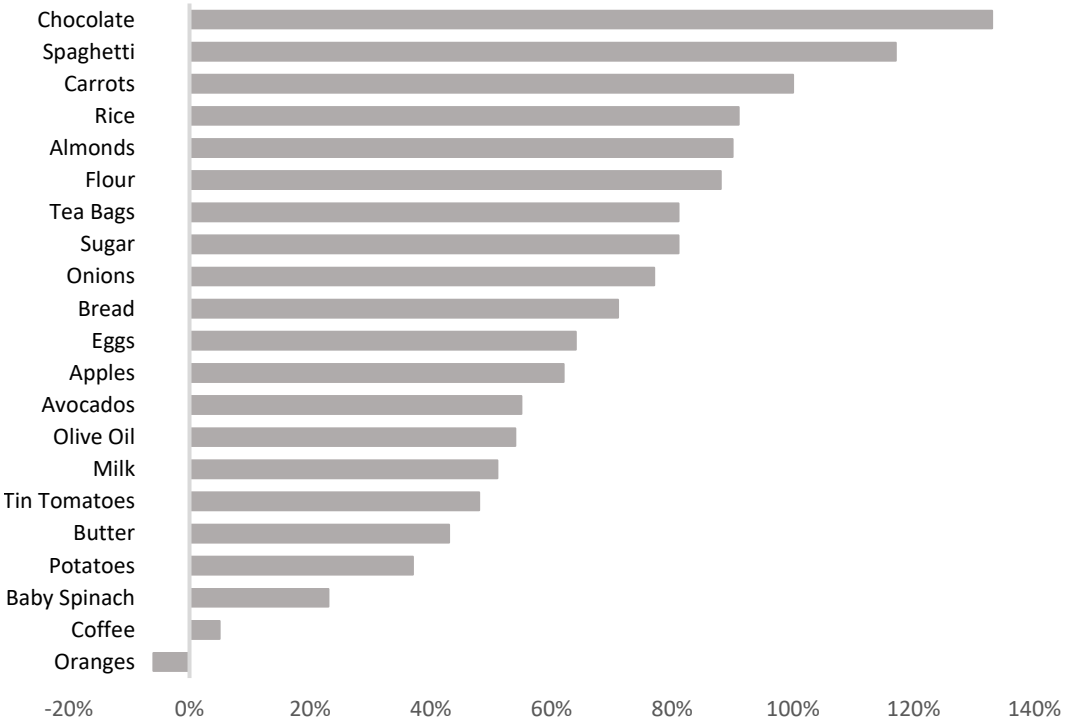

Figure 1. Organic Food Price Premium for a Twice-Weekly Shopping Basket (in AUD)

Organic Food Price Premium by Retailer Type

The type of retailer had a significant impact on organic price premiums ($F(2,10) = 4.26$, $p = 0.046$). General stores had the highest premiums (110% [95%CI: 82%, 138%]). Compared with general stores, supermarkets had a significantly lower price premium (-40% [95%CI: -72%, -0.09%]), as did fruit and vegetable stores (-26% [95%CI: -66%, 0.14%]). The R-square statistic indicates that 35% of the variance in the price premium was explained by retailer type (see Table 4). A full list of all the price premiums by item and retail store is available in the supplementary material.

Table 4. Regression of Store Type on the Proportion of Price Difference between Organic and Conventional

	Coef.	Std. Err.	*t*	*P > t*	[95% Conf.	Interval]
Reference category: General Store						
Supermarket	-0.40	0.14	-2.87	0.017	-0.72	-0.09
F&V Store	-0.26	0.18	-1.44	0.182	-0.66	0.14
_cons	1.10	0.13	8.64	0.000	0.82	1.38

Note: $F(2,10) = 0.0459$, $p = 0.0459$, R-squared = 0.352, $N = 13$.

Discussion and Conclusions

This paper is one of the few empirical studies to report on actual retail price premiums of organic versus conventional foods using a shopping basket methodology. It is the first study to determine the actual price differential between a twice-weekly shopping basket for a family of four for vegetarian OF items compared with an equivalent shopping basket of conventional food items in retail outlets, and it does so in a regional area in Australia. Consumers in the Byron Shire were found to pay considerably more for a twice-weekly shopping basket of OF items: approximately 60% more when the premium was measured for the weighted aggregate shopping basket across multiple retailers. The shopping basket premium of 60% takes into account twice-weekly consumption habits of a typical family of four on a vegetarian diet.

The OF premiums determined in the study are about 10% higher than the those reported in a similar study in the United States (Brown & Sperow, 2005), where a twice-weekly shopping basket of organic products (including meat) was 49% more expensive than a comparable basket of nonorganic products. This may be due to the higher cost of agri-food supply chains providing "farm-to-fork" functions (Tsolakis et al., 2014) in Australia, where the population is small and widely dispersed. The relatively higher premiums for fruits, vegetables, and grains found in the current study may reflect these costs. By contrast, the relatively lower OF price premiums for dairy products (e.g., butter, milk) and sugar in the Byron Shire found in the study may reflect lower supply chain costs, as these foods are being grown within or near the Shire.

The OF price premiums identified in the Byron Shire varied widely by food category, retailer, and location. The current study found that even within the supermarket segment, there is a wide variation of the same shopping basket premiums, ranging from 51% to 78%. Store type also influenced the OF price premium, with general convenience stores demanding a higher premium than supermarkets. There was a significant effect of retailer type explaining one-third of the value in price premiums. However, caution in interpretation is required here as there were only two general stores in the sample (see Table 5). Larger samples in other regions are required to estimate whether this is a consistent trend for general stores.

Table 5. Average Price of Food Items (per kg) in Twice-Weekly Shopping Basket (in AUD) by Retailer

	Supermarket					General Store					F&V				
	N	Mean	Std. Dev.	Min	Max	*N*	Mean	Std. Dev.	Min	Max	*N*	Mean	Std. Dev.	Min	Max
Apple	4	0.81	0.71	0.19	1.80	0					2	0.64	0.16	0.53	0.75
Avocado	3	0.96	0.15	0.81	1.10	0					1	1.53	.	1.53	1.53
Onion	4	1.17	0.59	0.38	1.64	0					2	1.66	0.22	1.51	1.82
Spinach	2	0.60	0.00	0.60	0.60	0					2	0.18	0.09	0.12	0.25
Potato	5	0.85	0.61	0.33	1.86	0					1	0.80	.	0.80	0.80
Orange	5	0.70	0.51	0.27	1.44	0					1	1.03	.	1.03	1.03
Carrot	6	1.60	0.97	-0.20	2.42	0					2	0.90	0.46	0.58	1.23
Flour	4	0.63	0.16	0.50	0.82	0					0				
Spaghetti	6	0.60	0.65	0.10	1.45	1	3.11	.	3.11	3.11	1	1.00	.	1.00	1.00
Sugar	2	0.52	0.16	0.41	0.63	0					1	0.72	.	0.72	0.72
Bread	7	0.52	0.54	-0.18	1.56	2	0.30	0.25	0.12	0.48	1	1.75	.	1.75	1.75
Rice	7	1.21	0.99	0.19	3.15	1	-0.11	.	-0.11	-0.11	0				
Tin tomato	7	0.50	0.94	-0.21	2.49	0					0				
Milk	9	0.63	0.26	0.39	1.13	1	0.48	.	0.48	0.48	2	0.46	0.17	0.33	0.58
Butter	8	0.31	0.19	0.00	0.51	1	2.65	.	2.65	2.65	1	0.73	.	0.73	0.73
Eggs	8	0.80	0.38	0.44	1.68	0					1	0.00	.	0.00	0.00
Almonds	3	0.95	0.16	0.77	1.06	0					0				
Chocolate	8	1.10	0.54	0.60	1.90	2	1.63	0.07	1.58	1.68	0				
Tea bags	6	0.44	0.57	-0.17	1.40	1	2.29	.	2.29	2.29	1	2.17	.	2.17	2.17
coffee	9	0.03	0.20	-0.20	0.34	2	-0.06	0.08	-0.12	0.00	1	-0.17	.	-0.17	-0.17
olive oil	6	0.32	0.38	0.01	1.01	0					2	0.67	0.70	0.18	1.17

Note: Data is for paired items (conventional versus organic item).

Price Premiums by Item and Store Type

It appears that the price premium for organic fruits, vegetables, and grains is higher in the Byron Shire of northern New South Wales than in a mid-Atlantic region of the United States (86% compared to 61%; 100% compared to 15%; 84% compared to 23%, respectively). However, the price premium for organic fats and oils, milk and cheese, and sugar and sweets is lower in the Byron Shire (50% compared to 122%; 58% compared to 69%; 90% compared to 108%, respectively). These differences may, in part, be due to the difference in the number of food items included in each category. For example, nine fruits were included in the American study, whereas the present study included only three. These three fruits were intended to represent the amount of fruit that a family of four would consume every two weeks by weight, although it did not account for seasonal variety.

Limitations and Further Research

There are several limitations to this study. First, sales data were not included for OF and conventional food equivalents. Studying turnover volume in addition to retail prices would help validate the appropriateness of the retail prices, as sales result from consumers' willingness to pay more. Also, there were a small number of stores, which was reflected in the wide confidence intervals. Nevertheless, all stores in the region were included, making this a census study of stores selling both conventional and organic foods in the local Shire. Future studies could widen the data capture area to increase the number of stores and the statistical analysis, perhaps across multiple local government areas.

Due to the cross-sectional nature of the data collection, differences in prices due to seasonality were not taken into account. Future research may benefit from a longitudinal study design to assess the seasonality of the fresh produce included in the twice-weekly shopping basket. Further, researchers used their discretion regarding the classification of some items in the food basket (e.g., ground coffee versus instant coffee as a conventional item). Other researchers may have made different choices; however, the impact on the results of the study are likely to have been minimal.

While the Byron Shire could be representative of regions seeking to increase the consumption of OF across the country (Franklin, 2015), it is possible that the OF price premiums for organics will vary across a country like Australia, as the flow of supply and demand may differ by geographical region. Further research would be required to determine the extent to which this occurs. Future research into how retail store attributes influence consumer decision making regarding OF, including the willingness to pay more for OF, is also recommended.

In conclusion, few studies have investigated the price of an average twice-weekly shopping basket of staples comparing organic versus conventional foods. In determining the actual price premiums, the present study extends current knowledge and addresses calls to determine the actual retail price premium for OF (Islam, 2014). It helps to inform the decision making of OF producers and marketers, for example, in terms of the level of production and pricing of OF. In turn, consumers

who have previously been skeptical about the high OF price premiums may be attracted to the market.

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Financial Sustainability of Nonprofit Organizations Covering Multiple Goals of the Food Justice Mission: The Case of New Roots, Inc.

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Abstract

Using semistructured interviews, financial records, and secondary information, this study evaluated the financial sustainability of New Roots, Inc., a nonprofit organization aiming to address the food justice mission, as defined in this study. The results presented in this study show achievements and challenges of New Roots, Inc. in managing activities that fulfill its mission. With an exception in 2018, the organization addressed food justice mission goals and remained financially healthy from 2014 to 2019. Revenue volatility and human capital requirements are identified as challenges that could put at risk the long-term financial viability of New Roots, Inc.

Keywords: financial sustainability, food justice, nonprofit organizations

Introduction

Food justice concerns fairness and equity in the food economy. In the last two decades, the number of studies on food justice has soared. There are many ways of defining what constitutes food justice and what a "just food" economy looks like (Tanaka, 2020). Foci of food justice work can include sustainability, food security, land access, gender equity, racial justice, fair trade, and fair labor, to name a few (e.g., see Allen, 2004; Jaffee, 2007; Alkon and Agyeman, 2011; Alkon, 2012; Holmes, 2013). In the context of local food systems, and for the purpose of this study, we defined food justice as sharing risks and benefits among participants of a given food system, with an emphasis on rectifying historical inequalities and structural exclusions (Gottlieb and Joshi, 2010). In order to empirically observe how the mission of food justice is translated into actual business activities, we operationalized food justice work as pursuing the food justice mission through three goals, including: (i) facilitating low-income food-insecure households' access to healthy foods (*food access*), (ii) connecting small and medium-sized, limited-resource farms to markets (*market access*), and (iii) supporting community engagement that promotes and supports sustainable food systems and healthy eating (*community engagement*).

Food justice organizations' performance has not been evaluated nationally in the United States. Research associated with food justice organizations has been comprised mainly of case studies of specific organizations (Hislop, 2015). Nonetheless, there have been extensive analyses of organizations that address at least one of the goals of the food justice mission, such as food hubs and organizations and businesses from the community food services sector (Wallace Center, 2018; Roth, 2019; Bielaczyc et al., 2020).

Food hubs are defined as businesses and organizations that aggregate, distribute, and market food products mainly from local and regional producers, aiming to strengthen the ability of these producers to reach wholesale, retail, and institutional markets (Barham et al., 2012). Although food hubs' main mission usually focuses on the supply side, according to the 2019 National Food Hub Survey, about 50% of food hubs have a social mission that they fulfill by selling farm products to lower-income communities or operating in lower-income areas (Bielaczyc et al., 2020). Results from this survey also suggest that food hubs are actively engaging the communities they serve in their decision-making processes (Bielaczyc et al., 2020).

Community food services organizations focus on the collection, preparation, and delivery of food to low-income and vulnerable populations. Food banks, meal delivery programs, and fixed and mobile soup kitchens are included in this category. Although these organizations indirectly address the food justice component related to food access among low-income food-insecure households, they do not necessarily focus on their access to *healthy* fresh foods, specifically farm fresh produce. There are about 5,500 organizations in the United States included in this sector, with a large percentage of these organizations incorporated as nonprofit operators (Roth, 2019).

Finally, there are organizations with a broad mission addressing the three goals of the food justice mission, as defined above, such as New Roots Inc. New Roots Inc. is a nonprofit organization that was founded on the idea that fresh food is a basic human right, like water and air (New Roots Inc.,

2021). The signature initiative from New Roots Inc. is the Fresh Stop Markets (FSM). The FSM are "pop-up" farm-fresh food markets set up at local churches, community centers, and businesses (e.g., B corps, public benefit corporations) every two weeks from June to November in fresh-food insecure neighborhoods. The term "pop-up" simply means that the markets appear or are set up every two weeks at a specific location in a neighborhood. In FSM, the food is paid for by consumers in advance to New Roots Inc.; these consumers are referred to as "shareholders." This payment-in-advance scheme reduces farmers' level of marketing risk relative to alternative market outlets such as farmers' markets. Further, people from a fresh-food insecure community pay on a sliding scale, with higher-income residents (from in or out of the community) paying higher prices to ensure that all families can access the same quantity and quality of farm-fresh produce.

An important element of New Roots Inc. that makes this organization unique and the focus of this study, is the community-organizing approach, where communities define the need for FSM, and New Roots Inc. supports leadership development among those communities that help create and sustain FSM. As suggested by Hyden (2017), the FSM model is unique in that it allows the communities to define their problems and needs in terms of food justice, as the communities themselves are the ones that contact New Roots Inc. as they see the need for a FSM in their neighborhood (Figure 1). Additionally, New Roots Inc. uses and invests in the human and social capital of the communities it serves, as it relies on volunteers that belong to the same communities it serves and provides food justice classes and FSM training to leaders interested in bringing this initiative to their communities. New Roots Inc. also provides seed funding to launch new FSM. Figure 1 shows the steps to set up a FSM in a neighborhood as described above.

In this study, we analyzed New Roots Inc. as a case study of an organization pursuing the food justice mission through the three goals defined above (i.e., *food access*, *market access,* and *community engagement*) and compared it to food hubs and community food services organizations. We specifically focused on the factors that put at risk the financial sustainability of organizations focusing on the three goals mentioned above, such as New Roots Inc. We used semistructured interviews, New Roots Inc.'s financial statements, and secondary information from other food sectors addressing the food justice mission to achieve the proposed objective of this study.

Source: New Roots Inc website (https://newroots.org/).

Figure 1. Infographic Explaining How Fresh Stop Markets are Created and Run with Farmer Liaisons

Data and Methods

We conducted two interviews with the executive director of New Roots Inc., in April and October 2019. The April interview, which lasted about one hour, was conducted by telephone following a semistructured questionnaire designed to understand how New Roots Inc. operationalizes the food justice goals defined in this study. In October, we met personally for about two hours and discussed New Roots Inc.'s history and business model, opportunities and barriers the organizations have faced in the last few years, and the organizations' vision for the future.

In addition, between January 12 and 15, 2020, we conducted semistructured interviews with farmers who are currently selling or have sold farm products through FSM. In particular, we conducted two interviews with farmers working with New Roots Inc. providing farm products for their FSM, and three interviews with farmers who used to sell products for FSM but were no longer working with New Roots Inc. at the time of the interview. We specifically asked farmers about the advantages and disadvantages of selling products through FSM, benefits and challenges from selling products through FSM, about how FSM compare in terms of prices and labor needs to other market outlets they sell products to, and about the factors that make FSM a successful and sustainable business model from the consumers' and the farmers' perspectives. Analyzing information elicited from farmers selling or who have sold products through FSM is important because a key element of assessing the financial sustainability of this market model is the ability to retain producers and cover operating expenses while paying fair prices to farmers. Additionally, we collected information from farmers to have a perspective of New Roots Inc.'s financial sustainability different than the one obtained from the executive director of New Roots Inc. and the one portrayed by the financial records.

To better understand the financial sustainability of New Roots Inc., we also collected and analyzed the 990 forms from this organization for the years between 2014 and 2019. These forms, which were provided to the authors by New Roots Inc., are filed by nonprofit organizations with the Internal Revenue Service and contain income statements and balance sheet information, among other data. We used this information to evaluate major sources of revenue and revenue variability, cost structure, and financial viability.

Finally, we used secondary information from food hubs and organizations and businesses from the community food services sector that helps understand the financial sustainability of these sectors and factors influencing that sustainability compared to New Roots Inc.

Analysis and Discussion

In this section, we discuss challenges and opportunities related to New Roots Inc. financial sustainability and compare elements of financial sustainability among food hubs, the community food services sector, and New Roots Inc.[1]

Additionally, we describe farmers' perceptions about the FSM model, the main program supported by New Roots Inc., including benefits and challenges related to selling farm products through FSM, long-term sustainability and replicability of the model, and the implications of these perceptions for New Roots Inc.

New Roots Inc.

New Roots Inc. was formed by five residents of West Louisville, Kentucky, a USDA-designated food desert,[2] in May of 2009 with the support of some members of the West Chestnut Street Baptist Church and the Concerned Association of Russell Resident, a neighborhood association aiming to address the long-term sustainability of the Russel Neighborhood in Louisville, Kentucky. Three of the initial founders self-identified as African Americans. Karyn Moskowitz, who identifies herself as ethnically Jewish, is currently the executive director of New Roots Inc. All founders had roots in community organizing. New Roots Inc. officially became a 501(c)3 nonprofit organization at the end of 2010.

While working as a community organizer for the Community Farm Alliance (CFA) in Louisville, Kentucky, and before she became part of New Roots Inc., Karyn Moskowitz had the opportunity to meet with staff and volunteers of a Cleveland, Ohio, initiative called City Fresh. City Fresh[3] is a program offering preordered fresh food boxes (e.g., a share is a box of produce that could feed a family of two to five people, depending on the share size) at discounted prices for limited-income families located in food deserts. Share pick-up locations (Fresh Stops) are set up at institutions within the communities served by City Fresh (e.g., churches, schools). Karyn Moskowitz brought the idea back to her community and received the support of other community members, including the leaders of community churches. The City Fresh model was slightly modified to fit the needs and resources available in the Louisville area. New Roots Inc. set up FSM only in areas identified as food deserts by the U.S. Department of Agriculture. Additionally, no large investments were made to handle the logistics of food distribution. Finally, New Roots Inc. decided to invest in the human and social capital of the communities being served by the FSM through leadership development and education.

[1] Financial sustainability for a nonprofit is defined as its ability or flexibility to maintain or expand services within the organization while developing resilience to occasional economic shocks in the short-term (Sontag-Padilla, Staplefoote, and Gonzalez-Morganti, 2012).
[2] USDA defines food desserts as low-income census tracts (i.e., county subdivision containing between 1,000 and 4,000 people) with a large percentage of the population (i.e., 500 and/or 33% of the tract population) having low access to supermarkets and large grocery stores (i.e., living more than 1 mile from a supermarket or large grocery store in urban areas) (Dutko, Ver Ploeg, and Farrigan, 2012).
[3] https://cityfresh.org/

As of the end of 2019, New Roots Inc. had two program services or operational segments: Fresh Stop Markets (FSM) and leadership development, skills-building, and food education (LFE). FSM is the main program supported by New Roots Inc. The LFE operation segment has been critical in supporting community leadership that promotes and supports sustainable food systems and healthy eating. New Roots Inc. identifies leadership qualities in the FSM shareholders and helps them strengthen those qualities by allowing them to participate as volunteers in the FSM and giving them the opportunity to eventually become New Roots Inc. board members or paid FSM managers. Furthermore, New Roots Inc. promotes professional development for the leaders by supporting their participation in professional conferences. An example of how New Roots Inc. has supported leadership development is the creation of a food justice workshop for Latinx communities for middle schoolers and parents created by one of the FSM leaders.

FSM are "pop-up" markets set up in fresh-food-insecure neighborhoods. FSM are set up every two weeks at a designated location (e.g., church, community center, business). Previous literature has determined food-insecure neighborhoods by utilizing zip codes (Kaiser, Dionne, and Carr, 2019). For example, Kaiser, Dionne, and Carr (2019) determined food-insecure neighborhoods as a set of zip codes with statistically significant higher rates of food-insecure households when compared to other zip codes within a city. They measured food security using the Six-Item Food Security Scale developed by the National Center for Health Statistics (USDA ERS, 2012). In contrast, New Roots Inc. defines fresh-food-insecure neighborhoods as those areas within a city identified as food deserts or areas where households are facing limited resources[4] or have limited access to healthy and affordable food (Hyden, 2017). New Roots Inc. has expanded the definition of food deserts to include shareholders that might live close to a grocery store and/or a farmers' market but might not be able to afford fresh foods due to high prices compared to processed or fast-food prices. The demographic composition of the areas where FSM are set up is represented by an average of 35% of African Americans, with an average age of 45 years old, and 75% of individuals that fall at or below 185% of the U.S. poverty guidelines.[5]

Shareholders of FSM sign up for the entire 22-week season and pay one week in advance to receive about nine varieties of produce (1 share), including certified organic vegetables and some fruit. Although each shareholder receives the same amount of food, they pay a different price based on household income, with prices set at $6, $12, $25, or $40 per share. Only shareholders who have ordered shares in advance are able to pick up shares at the FSM. In 2019, the largest percentage of shares were sold at $12 per share. On average, 70% of shares, which represent about 540 shares of the total 770 shares sold in 2019, were sold either at $6 or $12. These shares were purchased by 540 families (feeding about 1,400 individuals) who were considered facing limited resources. About 26% of shares (i.e., 200 shares) were sold at the $25 price level, and only 4% (i.e., 30 shares) were sold at the food justice share price of $40. New Roots Inc. called the $40 per share product

[4] New Roots Inc. defines households facing limited resources based on USDA income requirements for participation in the WIC program (between 100% and 185% of the federal poverty income guidelines) (USDA Food and Nutrition Service, 2021).

[5] https://aspe.hhs.gov/poverty-guidelines

the "food justice share," because households choosing this product pay a higher amount to subsidize the value of shares for those households facing limited resources.

FSM are run by shareholders who volunteer their time. New Roots Inc. allows communities to run their markets to empower them in meeting their fresh-food needs. With a few exceptions (i.e., residents from the pediatric residency program from the University of Louisville), New Roots Inc. does not encourage volunteers from outside of the community or outside of their shareholder base to participate in FSM.

Although the FSM model differs from the traditional community-supported agriculture (CSA) model, where members share production risk with farmers and shareholders pay for shares before each growing season, the FSM model is similar to CSA-like models that better accommodate multifarm scale economies with payment flexibility where shareholders do not have to pay for all shares before the growing season (Woods, Ernst, and Tropp, 2017). Interest has grown among farms or organizations running CSA-like models to access a broader base of customers, including lower-income shareholders, but the interest has not necessarily translated into a critical mass of CSA-like models targeting low-income consumers (Woods, Ernst, and Tropp, 2017). In contrast to New Roots Inc., those who are running CSA-like models targeting residents of low-income neighborhoods, like Farmer Dave's Northeast Organic Farming Alliance located in Boston, Massachusetts, tend to focus on delivering products to families located in these neighborhoods with the support of local organizations without necessarily engaging the individuals they serve in the planning and logistics of running these kinds of market models (Woods, Ernst, and Tropp, 2017). Furthermore, as stated above, unlike CSA-like models, the need for FSM is not imposed by an organization or farmers themselves; rather, community members are the ones identifying the need for FSM in their community.

Farmers selling produce to FSM are considered small- and medium-sized local farmers. Currently, FSM procure products from nine farms, and three of them provide more than 50% of the products purchased by New Roots Inc. Before 2018, FSM procured products from more than 50 farms (Hyden, 2017). New Roots, Inc. tries to purchase produce from small farms producing fruits and vegetables using organic practices that can guarantee a consistent supply of products to meet the shareholder needs. The three farms currently providing more than 50 percent of FSM products have between 2 and 22 acres in vegetable production and diversify their operations with cattle, sheep, chicken, and pork production. Before 2018, New Roots Inc. used to purchase products from a larger proportion of smaller vegetable farms (less than one acre), but the logistics associated with coordinating purchases in this model demanded staff time that, as we will explain later in this paper, was not available any longer after 2018 due to the financial challenges New Roots Inc. faced in 2018. In 2019, farm sales through FSM represented about $142,238. Between 2014 and 2019, farm sales to New Roots Inc. increased by about 500%, from $23,248 to $142,238.

Before 2017, farmer liaisons coordinated the procurement of farmer-fresh products for FSM. Farmer liaisons were FSM shareholders who volunteered to communicate with farmers regarding produce needs for markets, shareholder preferences, and purchase orders (Hyden, 2017). The communication between farmers and farmer liaisons became chaotic as multiple individuals

(farmer liaisons) were communicating with farmers and placing orders last minute, as they did not fully understand farmers' ability or lack of fulling orders last minute. In 2018, New Roots Inc. tried to address communication problems by creating an uber farmer liaison position. The uber farmer liaison was a paid position that coordinated the procurement of farmer-fresh products for FSM with farmers and farmer liaisons. The uber farmer liaison specifically communicated with farmers to assess produce supply for each week and created a spreadsheet with this information. This individual shared supply information with farmer liaisons from each FSM. The farmer liaison selected the products they needed for the specific FSM based on shareholder preferences and communicated those preferences to the uber farmer liaison and not the farmers. The uber farmer liaison was responsible for placing orders with farmers and managing orders and invoices. Shareholders (i.e., individuals paying in advance for food shares) and farmers met every year in January to discuss what vegetables and fruits communities wanted to purchase and what producers could grow. Based on previous years' information, staff from New Roots Inc. projected the number of shares to be provided for a specific year. Similarly, based on historical price trends, New Roots Inc. negotiated with farmers product prices based on a share cost goal established by New Roots Inc. For example, in 2019, the share cost was set at $19 per share.

At harvest time, farmers transported the produce to the FSM location. Alternatively, farmer-liaisons tried to accommodate farmers' needs by picking up farm products from farmers when needed. Given the financial challenges experienced by New Roots Inc. that we will explain later in this section, the FSM model was slightly modified to reduce the required staff coordinating FSM. In 2019, New Roots Inc. decided to eliminate the uber farmer liaison and farmer liaison positions and created a non-paid farmer leader or "farmer-anchor" position. The executive director of New Roots, Inc. took over some of the uber farmer liaison and farmer liaisons' responsibilities. A farmer anchor, a farmer selling produce through FSM, coordinated the aggregation of food from various farms and delivered products to FSM. The farmer-anchor communicated with only one staff member at New Roots Inc. (the executive director) to coordinate purchase orders and product delivery. Those farmers providing more than 50% of the produce for FSM communicate with the farmer anchor, but other farms providing specific products in smaller quantities (e.g., fruits) communicate directly with the executive director of New Roots Inc. to coordinate orders and deliveries. This new model has worked well given that New Roots Inc. reduced the number of farms they procure farm-fresh products from to adjust to the financial challenges experienced in 2018. Figure 2 summarizes some of the logistics related to FSM with the model adopted after 2018. The arrows mainly represent communication channels among all individuals involved with the FSM supply chain. We used a Stacked Venn diagram to represent overlapping relationships among New Roots Inc. staff, shareholders, volunteers, and leaders. Additionally, we used this kind of diagram to show how the idea of FSM comes from within the fresh-food insecure neighborhood it serves and that the food justice needs defined by these communities are the ones driving the need for FSM. Also, this diagram reflects the fact that New Roots Inc. is embedded within the communities it serves and depends on the community members to support the FSM program.

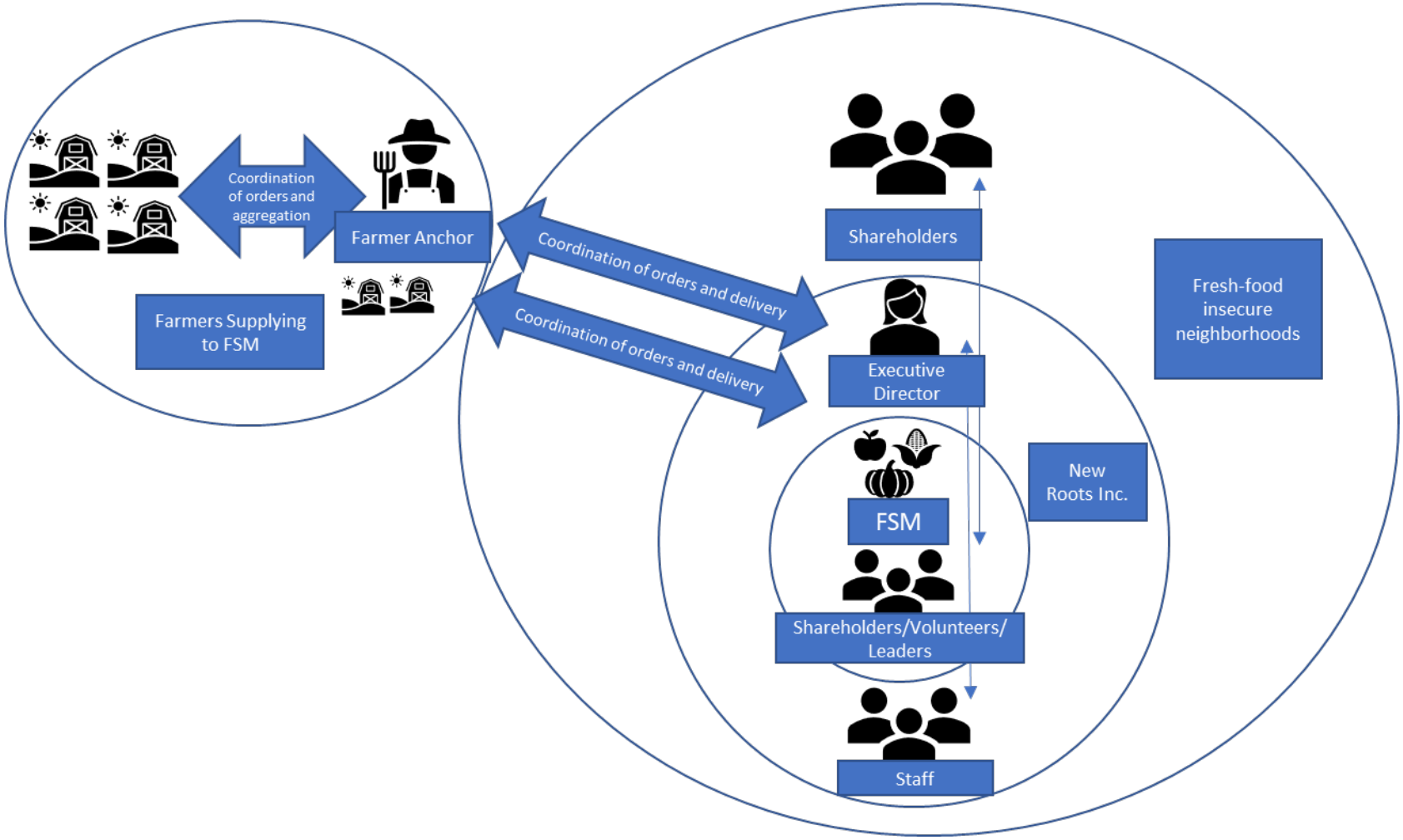

Figure 2. Stylized FSM Supply Chain after 2018 with an Emphasis on Communication Flows

A large percentage of New Roots Inc.'s total revenue was received from grants and similar contributions. For example, in 2019, New Roots Inc. received a total of $226,120 (Table 1) in contributions (60% of the 2019 total revenue) from various government organizations and foundations, including the Norton Foundation, Presbyterian Hunger Program, Lift a Life Foundation, Southern Sustainable Agricultural Research and Education (through the University of Kentucky), the Gendler Grapevine Project, Brown-Forman, and the Louisville Metro Government. Table 1 provides selected items of New Roots Inc.'s income statements and balance sheets from 2014 to 2019. Grants and similar contributions have represented around 70% of New Roots Inc.'s total revenue since 2014.

Table 1. New Roots Inc.'s Selected Income Statement and Balance Sheet Items ($)

	2019	**2018**	**2017**	**2016**	**2015**	**2014**
Total revenue[1]	377,754	320,608	500,772	372,640	303,674	235,979
Contributions, grants, and similar	226,120	162,160	378,970	293,302	223,656	175,411
Program service (consulting, training)	705	10,050	1,965	2,176	100	4,868
Sales revenue (FSM)	150,317	148,398	119,837	77,162	79,918	55,700
Cost of goods sold (FSM)	142,238	151,575	121,196	83,155	83,974	23,248
Expenses[2]	201,665	339,567	320,958	234,924	209,114	122,680
Net Income (loss)	33,851	-170,534	58,618	54,561	10,586	90,051
Cash plus savings and temporary investments	110,239	70,529	192,503	181,148	160,849	122,576
Pledges and grants receivable			44,582			
Net land, buildings, and equipment	15,139	20,794	24,048	19,356	3,507	2,243
Total liabilities	3,489	3,285	2,561	550	30,770	2,469
Unrestricted net assets in fund balance	120,593	81,372	214,489	185,486	133,586	123,000
Restricted net assets in fund balance	1,296	6,666	44,083	14,468		

Source: Assembled by authors using information in New Roots Inc.'s 990 forms, provided by the organization.
[1]Revenue were adjusted by authors as follows. Total revenue in New Roots' 990 forms is reported as Revenue = contributions, grants, and similar + program service + net income (or loss) of from sales of inventory. We disaggregate net income (or loss) of from sales of inventory into "sales revenue" and "cost of goods sold". This disaggregation increases total revenue (and total costs) but does not change net income. This adjustment was necessary to compare New Roots' financial performance with performance of Food Hubs and Community Food Service Organizations.
[2]Dissagregated expenses by category can be found at https://bit.ly/3lSEZJm.

As shown in Table 2, which presents New Roots Inc.'s financial ratios, about 19% of those contributions were related to government grants during 2014–2019. The majority of contributions were related to foundation donations. Table 2 also shows that a large percentage of expenses was related to employees' salaries and benefits, which could be explained by the high level of coordinating activities required in food justice-related organizations. About 67% of total expenses were related to salaries, other compensations, and employee benefits from 2014 to 2019. During the same period, New Roots Inc. employed on average 6.5 employees. In 2014, New Roots, Inc. had only two employees, while between 2015 and 2018, the organization employed between seven and nine employees, with this number dropping to five in 2019 due to a financial problem faced by New Roots Inc. in 2018. Aside from employees covering various activities related to coordinating the FSM and other functions related to leadership development, skills-building, and

food education, New Roots Inc. depended heavily on volunteers to run their programs. New Roots Inc.'s average reported number of volunteers between 2014 and 2019 was 233.

The FSM program covered the full costs of goods sold related to farmer products' purchases in 2014 and 2019. In other words, the average price per share was at least equal to the average price paid to farmers. However, this was not the case between 2015 and 2018, as shown in line "cost of goods sold to sales revenue" in Table 2. The median value of the cost-to-sale ratios during 2014–2019 is 1.02, indicating that New Roots Inc. works around breakeven, defined as sale revenue minus cost of sales. This means that the combined share price paid by both low- and high-income shareholders is completely passed on to farmers, achieving the organization's mission to pay producers fair prices. However, New Roots Inc. has the challenge of covering its operating expenses from other sources of revenue in order to be financially sustainable.

Between 2014 and 2017, New Roots Inc. reported an average net income of $53,454 (Table 1). However, total revenues variability was highly sensitive to two sources of cash inflows—grants and foundation donations—and less sensitive to revenues from shares or produce sales. Grants and donations varied from year to year depending on changes in federal and state government budgets, and foundations' budgets and missions. This source of variability caused New Roots Inc.'s $170,534 loss in 2018 (Table 1), the only year the organization reported negative profit from 2014 to 2019, and a relevant event as the focus of analysis in this case study.

A critical event occurred in 2018 when New Roots Inc. did not receive anticipated funding from a foundation associated with a for-profit U.S. health insurance company and reported a net loss in the 2018 fiscal year. This foundation (labeled as contributor #8 in Table 3) had been New Roots Inc.'s main contributor from 2014 to 2017, with its contribution representing around one-third of New Roots Inc.'s total contribution. Given New Roots Inc.'s revenue growth (Table 1) and expected continuation of funding by contributor #8 given historical trends (Table 3), the organization decided to build capacity by expanding the number of FSM in 2016 from three to six. To support this expansion, New Roots Inc. hired additional staff, purchased other resources to run the markets (e.g., tents, tables), and trained their staff.

In 2018, the foundation (contributor #8) changed its focus away from food justice to focus on other determinants of people's health, including financial literacy and post-secondary education, and decided to fund alternative initiatives, ending funding for New Roots Inc. after four years of contributions. Thus, New Roots Inc. lost the contributor that represented the highest source of revenues for the organization. Although volunteers supported some of the organization's expanded operations, at this point, New Roots Inc. depended heavily on paid labor to run the organization and the increased number of FSM.

As a result of the 2018 funding problem, in 2019, New Roots Inc. revisited its business model. The organization reduced staff to run their FSM as explained above, increased reliance on volunteers to run FSM, added a software (FARMINGO) to receive recurring shareholder payments and improve operational efficiency, reduced the number of FSM by consolidating existing markets to guarantee a minimum of 70 shareholders per market, and reduced the number of farmers they

worked with to source fresh food for FSM, as explained above. These two last changes allowed New Roots Inc. to reduce the number of staff members necessary to coordinate FSM.

Table 2. Selected Financial Ratios of New Roots Inc.

	Median	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**
Government grants to total contributions	0.19	0.31	0.34	0.06	0.06	0.24	0.14
Salaries and related to total expenses	0.67	0.60	0.68	0.61	0.66	0.67	0.71
Cost of goods sold (COGS) to sales revenue	1.02	0.95	1.02	1.01	1.08	1.05	0.42
Operating expenses (excluding COGS) to total revenue	0.57	0.49	0.96	0.58	0.58	0.56	0.41
Total expenses to total revenue	0.85	0.86	2.01	0.85	0.81	0.95	0.58
Net income (loss) to total revenue	0.10	0.09	-0.53	0.12	0.15	0.03	0.38
Year-to-year revenue growth	0.23	0.18	-0.36	0.34	0.23	0.29	NA
Year-to-year expenses growth	0.12	-0.41	0.06	0.37	0.12	0.70	NA
Net income (loss) to total assets	0.25	0.27	-1.87	0.22	0.27	0.06	0.72
Cash plus savings to total assets	0.89	0.88	0.77	0.74	0.90	0.98	0.98
Total revenue to total assets	1.90	3.01	3. 51	1.92	1.86	1.85	1.88
Liabilities to assets	0.02	0.03	0.04	0.01	0.00	0.19	0.02
Debt to assets	0.00	0.00	0.00	0.00	0.00	0.07	0.00

Source: Estimated by authors using financial data in New Roots Inc.'s 990 forms, provided by the organization.

Table 3. Main Entities Contributing with Gifts, Grants, and Similar Revenue to New Roots Inc. (share relative to total contributions)

ID	2019	2018	2017	2016	2015	2014
1	41%	34%	7%	6%	11%	4%
2	21%	0%	3%	4%	3%	7%
3	12%	0%	0%	0%	0%	0%
4	9%	0%	3%	4%	0%	0%
5	9%	0%	5%	0%	0%	0%
6	6%	6%	3%	4%	5%	0%
7	3%	9%	5%	9%	14%	20%
8	0%	0%	31%	36%	22%	27%
9	0%	6%	3%	4%	5%	13%
10	0%	28%	14%	15%	11%	0%
11	0%	0%	5%	5%	0%	0%
12	0%	0%	3%	0%	0%	0%
13	0%	0%	19%	0%	0%	0%
14	0%	0%	0%	9%	8%	0%
15	0%	11%	0%	2%	0%	0%
16	0%	0%	0%	4%	0%	0%
17	0%	0%	0%	0%	3%	12%
18	0%	0%	0%	0%	6%	4%
19	0%	0%	0%	0%	8%	0%
20	0%	0%	0%	0%	3%	0%
21	0%	0%	0%	0%	0%	7%
22	0%	6%	0%	0%	0%	0%
23	0%	0%	0%	0%	0%	7%

Source: Estimated by authors using information in New Roots Inc.'s 990 forms (Schedule B), provided by the organization. ID is an identifier to disguise the contributor's name.

Revisiting New Roots Inc.'s business model proved to be financially sound for the organization. As shown in Table 2, most financial ratios improved in 2019, reaching again levels observed from 2014 to 2017. As results in Table 2 show, with the exception of 2018, New Roots Inc. has been a financially healthy organization given its relatively high return on assets, revenue growth rates, and high levels of cash, among other financial metrics.

The analysis in this section reveals several aspects of the business model and financial performance of New Roots Inc. from 2014 to 2019. The organization: (i) provided affordable healthy fresh food to households facing limited resources by implementing a sliding scale price policy encouraging higher-income residents to contribute to those households facing limited resources, (ii) passed on prices paid by shareholders to small- and medium-scale farmers, thus achieving the organization's mission to connect farmers to markets that pay them fair prices, and (iii) supported community leadership that promotes and supports sustainable food systems and healthy eating. With an exception in 2018, the organization addressed the three goals of the food justice mission, as defined in this study, and remained financially healthy. However, as shown precisely during 2018, fulfilling all food justice goals and remaining financially healthy presented some challenges.

The organization relied on soft money coming from contributions, gifts, and grants to cover all its fixed and variable expenses not related to the cost of goods sold. Those contributions highly varied from year to year, as shown in Table 3. To cover this risk, New Roots Inc. followed a financially conservative approach by saving relatively high amounts of cash over time, which allowed the organization to face its 2018 financial difficulty. Additionally, New Roots Inc. depended on a high number of volunteers that support its activities and on the willingness of groups to organize FSM. This required high human capital within the organization (i.e., strong leadership) and outside of the organization (i.e., grassroots organizations' willingness to collaborate). Finally, New Roots, Inc. relied on active and persuasive leadership to maintain funding from contributors.

Moving forward, by the end of 2019, the executive director of New Roots Inc. believed that diversifying the organization's revenues might contribute to long-term financial viability. Specifically, she wanted to explore New Roots Inc.'s ability to generate income from its LFE segment, and to access corporate donations sponsorships to support FSM operations. She specifically was evaluating the ability to offer leadership and community organization consulting services. New Roots Inc. would also like to explore the possibility of merging with other nonprofit organizations to run the programs more efficiently and at a lower cost.

Differences and Similarities between New Roots Inc. and Food Hubs

As stated in the introduction section, food hubs aggregate, distribute, and market food products from local and regional producers (Barham et al., 2012). Although New Roots Inc. aggregates food on a limited basis (e.g., they have a donated walk-in cooler they use when needed), and therefore does not require significant investment related to infrastructure to aggregate food, it does focus on distributing and marketing farm fresh produce to households facing limited resources. New Roots Inc. also tries to source products from small- and medium-scale local and regional producers. Therefore, there are similarities between food hubs and organizations pursuing multiple goals related to the food justice mission, such as New Roots Inc. (Table 4). There are some food hubs that have a social mission that they fulfill by selling farm products to lower-income communities or having businesses in lower-income areas (Bielaczyc et al., 2020). Similar to New Roots Inc.,

food hubs are actively engaging the communities they serve in their decision-making processes (Bielaczyc et al., 2020). Nonetheless, as stated above, New Roots Inc. is different from food hubs in the way it fulfills its social mission. Instead of simply providing access to farm products to low-income families, New Roots Inc. allows the communities to define their problems and needs in terms of food justice, and uses and invests in the human and social capital of the communities it serves (Table 4).

The majority of food hubs focus mainly on increasing human health by providing access to fresh, healthy foods and increasing market access for small- and medium-scale producers. A study on Michigan food hubs suggests that there is a small percentage of food hubs committed to addressing equitable food access, one of the main missions of New Roots Inc. (Hoey, Fink Shapiro, and Bielaczyc, 2018). This study suggests that those food hubs committed to increasing healthy food access to low-income households are newer food hubs, are highly dependent on external funding, and are more likely to have a nonprofit status, just like New Roots Inc. Results from this study also suggest that factors that prevent food hubs from focusing on equitable food access are operational constraints and financial viability (Hoey, Fink Shapiro, and Bielaczyc, 2018).

Similar to New Roots Inc., most food hubs are mission-driven businesses and therefore tend to trade off or sacrifice profits to fulfill their social goals related to paying fair prices to farmers and facilitating low-income communities' access to healthy foods (Wallace Center, 2018). A food hub benchmark study conducted by the Wallace Center, which included information from 50 food hubs in the United States, suggests that those food hubs that perform better (e.g., top 25% of all food hubs ranked by net margin) are close to breaking even or generating a profit. This study advises that regardless of the tax status of food hub businesses, whether they are for-profit or nonprofit, food hubs need to generate a profit to guarantee the sustainability of the business model. As discussed in the previous section, New Roots Inc. has managed to maintain a financially healthy position while fulfilling its food justice mission

According to the 2019 National Food Hub Survey, about 40% of food hubs were nonprofit organizations, about 36% were for-profit organizations, and the rest were cooperatives or reported not having a formal legal structure. Since New Roots, Inc. is a nonprofit organization, it is important to highlight specific characteristics of those food hubs that are nonprofit organizations. In 2019, nonprofit food hubs generated on average a 7% net profit margin, defined as 1 minus total expenses divided by gross revenue. In 2019, New Roots Inc.'s net profit margin was 9% (Table 4), which indicates that, in 2019, New Roots Inc. performed slightly better than aggregated nonprofit food hubs in terms of profitability (Table 4).

Table 4. Comparison between Food Hubs, Community Food Services Organizations, and New Roots Inc.

	New Roots Inc.	**Food Hubs[1]**	**Community Food Services Organizations[2]**
Functions covered by the organization	Distributes and markets food. Community organizing, leadership development, and food education.	Aggregate, distribute and market food.	Collects and distributes food, provides soup kitchens and on-site meals, food pantry and food bank services.
Sources of revenue	Foods sales, government grants, and similar contributions (e.g., foundation donations).	Food sales, federal/state/local government funding, foundation grants, donations, membership fees, in-kind support, income from other organization programs.	Funding and donations from public and private sectors.
Strategies to fulfill the food justice mission or food justice-related goals	Lets communities define their problems and needs in terms of food justice. Uses and invests in the human and social capital of the communities it serves to run programs. Uses a sliding-scale based on household income strategy to allow limited resource households access fresh foods.	Locate in low-income and low-food access areas, sell food to low-income businesses or customers, accept SNAP benefits.	Collect, prepare, and deliver food to persons at risk of hunger.
Profit margins	(2019) = 0.09	Average profit margin (2019)[3] = 0.07	Average profit margin (2019) = 0.07[4]

[1,2]General characteristics based on the 2019 National Food Hub Survey and IBIS*World* Industry Report. There might be specific cases of organizations similar to New Roots Inc. that are not captured by these information sources.
[3]The 2019 National Food Hub Survey report shows an average operating efficiency ratio for nonprofit food hubs (total expenses divided by gross revenue) of 0.93, which is equivalent to an average profit margin of 1-0.93 = 0.07. It is unclear whether this estimate includes interest expenses in total expenses.
[4] https://my.ibisworld.com/us/en/industry/62421/competitive-landscape

Similar to New Roots Inc., those food hubs with a nonprofit designation are more likely to depend on grant funding. According to the 2019 National Food Hub Survey, more than half (62%) of those hubs that reported being highly dependent on grant funding had a nonprofit designation like New Roots Inc. About half (54%) of the food hubs represented in the 2019 survey perceived their dependence on grants would stay the same, while about 16% recognized their dependence on grant funding would increase over time (Bielaczyc et al., 2020). As stated above, New Roots Inc.'s executive director perceives that income diversification and the ability to generate income from the LFE segment might contribute to the financial sustainability of the organization. Therefore, in contrast to food hubs with a nonprofit designation, we can infer that New Roots Inc. is hoping to slightly decrease dependence on grant funding to guarantee long-term financial viability.

Differences and Similarities between New Roots Inc. and Community Food Services Sector

Similar to New Roots Inc., businesses in the community food services sector are not profit-driven and depend on funding from the public and private sectors (Table 4). An important source of revenue for this sector is government programs, specifically the USDA Food and Nutrition Service's programs. This source of revenue represents a more stable source of revenue compared to private donations, but private donations, specifically individual and corporate donations, represent a large percentage of this sector's donations (Roth, 2019).

Similar to New Roots Inc., operators in the community food services sector have experienced higher operating costs due to higher demand and expansion of their services. The expansion of operating costs is mainly due to expanded budgets for food purchases. Employment in this sector increased at an annualized rate of 2.8% between 2014 and 2019 to 47,218 employees, representing $1.5 billion in wages, to meet the growing demand for food services. Similar to New Roots Inc., operators in this sector rely heavily on volunteers as a strategy to minimize costs while expanding services, with some small and local organizations being entirely operated by volunteers. As operators expand their services and increase their operating costs, profits fall. In general, this sector's profit margins are low to moderate, as most operators' expenses are close to the revenue they generate. In 2019, estimated profit margins for this sector were 7% (Le, 2020). New Roots Inc.'s profit margins are higher than this sector's (Table 4). Most of the surplus revenue reported in this sector is related to restricted contributions that cannot be easily spent, which is not the case with New Roots Inc.'s balance sheet position (Table 1).

The long-term financial sustainability of these organizations is related to changes in consumers' disposable per-capita income, corporate profits, and federal funding (Le, 2020). It is expected that as consumer disposable income increases, private donations will increase. Additionally, it is expected that as corporate profits recover after the COVID-19 pandemic, corporate charitable contributions will increase and become a stable source of income for these organizations. Interestingly, New Roots Inc. foresees corporate donations as a potential source of income for its organization that could help stabilize revenue over time. But given the community food services sector outlook suggests this source of income is an important source of revenue for this sector, New Roots Inc. might be competing with this sector for corporate charitable contributions.

Farmers' Perceptions about FSM and Implications for New Roots, Inc.

We conducted personal interviews with five farmers, two selling products to FSM at the time of the interview and three who used to sell products through FSM but were no longer selling produce through FSM. The two farms currently selling produce through FSM reported they had between 15 and 22 acres in vegetable production. For these farms, sales to FSM represented between 8% and 20% of total gross sales. In contrast, the three farms no longer selling products through FSM reported having less than 4 acres in vegetable production. Although these farmers did not estimate the percentage of gross sales through FSM, information gathered through the interviews suggests FSM represented a small percentage of overall gross sales for these farms. Some of them reported selling to FSM surplus produce they were not able to sell through other market outlets such as CSA and farmers markets. The differences in farm size between farmers selling and farmers no longer selling through FSM reflect changes in the FSM business model. As stated above, New Roots Inc. reduced the number of farms they procure farm-fresh products from to adjust to financial challenges. Reducing the number of farms New Roots Inc. procures products from also resulted in procuring more products from larger and fewer farms that could provide products regularly. All farmers we interviewed for this analysis perceived many benefits associated with selling products through FSM, including (i) less labor-intensive market outlets compared to other outlets such as farmers markets and CSA; (ii) guaranteed and timely payment; (iii) lower marketing efforts compared to other market outlets; and (iv) ability to move larger volumes of product compared to other outlets. Below we present opinions from some of the farmers we interviewed regarding the benefits associated with FSM:

"We are going to be investing in advertising and Facebook advertising and stuff like that this year to build our CSA, and we did not have [to make] that investment with the FSM."

"It is a guaranteed payment and a timely payment which is not consistent across other markets."

"Packing 350 shares worth of produce for FSM is less labor-intensive than packing 350 individual shares for CSA members because we are sending items wholesale packed to them, [for instance,] we are sending 200 bunches of kale and 200 bunches of radishes and 200 pounds of yellow squash, and [we] are just sending that to neighborhoods, and they [New Roots Inc.] are assembling that market box."

"We sold to restaurants for a long time, we did [sell in] farmers markets, but none of those outlets for us ever generated the volume that FSM is generating, and so we have enjoyed being able to grow our business and grow our production to meet that demand."

Another motivation or benefit some farmers perceived related to their participation in FSM is that of the food justice mission of FSM that allows farmers to sell products to households facing limited resources without compromising their farm business financial viability:

"FSM allow us to build food justice into our business plan."

"FSM is making it affordable and accessible to people who maybe couldn't afford our CSA."

Most of the farmers' opinions related to the challenges of selling farm products through FSM were related to communication problems, specifically, communication with the uber farmer liaison and farmer liaisons. As described above, prior to 2018, farmers were informed by the uber farmer liaison or farmer liaisons about the products that were needed to satisfy shareholder needs, and delivery times were set around FSM schedule and not farmer availability and logistics. This model posed some logistical challenges for farmers selling products to FSM because delivery times and days, as well as the distance to be traveled, imposed high transaction costs to farmers. Additionally, there were some communication problems related to multiple individuals (farmer liaisons) communicating from different FSM, with some of them not understanding farmer logistics and their ability to deliver products quickly. Two farmers who used to sell products for FSM said:

"Yeah, it started to get a little bit chaotic with the last-minute orders, and then it was too much for the coordinator to handle."

"The communication could have been better."

As explained above, the FSM model changed in 2018 to address New Roots Inc.'s financial challenges associated with losing one of their main sources of income. New Roots Inc. reduced the number of FSM and the number of individuals to run the FSM. The uber farmer liaison and farmer liaison positions were eliminated, the executive director of New Roots Inc. took over some of these positions' responsibilities, and a farmer anchor position (i.e., farmer selling produce to FSM and coordinating aggregation and delivery with other farmers) was created, improving communication between New Roots Inc. and farmers (see Figure 2). The FSM model has changed to pursue a better balance between shareholder and farmer needs. Some farmers perceived the previous model to be slightly "chaotic" as different individuals representing different FSM were communicating with farmers trying to fulfill shareholder needs:

"So each different market was communicating with all the different farms to try to order, and that was a bit chaotic, that was hard."

The distribution model revisited by New Roots Inc. in 2019 tried to reconcile what the farmer was producing with the market's needs. Furthermore, this new model reduced transaction costs associated with participating in FSM by having one individual (e.g., farmer anchor or New Roots Inc.'s executive director) rather than multiple individuals (i.e., uber farmer liaison or farmer liaisons) communicating with farmers and coordinating the distribution of produce. The new model also considered the timing of growing cycles and the variability of products available due to weather risk. A farmer who used to sell farm products to FSM also perceived the new model as one that reduces transaction costs for both farmers and New Roots Inc., as after revising its business model the organization started to work with larger farms that still classify as small- and medium-sized farms and consistently supply larger volumes and achieve scale economies than the ones it used to work with. Additionally, this farmer believed that working with larger farmers might be the only way for New Roots Inc. to meet the needs of an increasing number of shareholders.

Regarding the sustainability of FSM, some farmers were concerned about the financial viability of the model. They perceived that it might be challenging to provide fair prices to farmers while covering overhead costs associated with running all operations associated with FSM:

"I feel very confident that we as a farm are getting compensated very fairly for the product that we are sending. But I am also seeing New Roots [Inc.] have to infuse a lot of their nonprofit capital into making the whole thing work."

The long-term viability of New Roots Inc. is also a priority for farmers as it is this organization that provides them the opportunity to sell large volumes of products at a fair price:

"I think about all the other things beyond the check that comes to my farm, I feel very invested in the long-term viability. And there is economic viability because FSM is about 20% of our overall sales so [FSM's long term viability] is very important."

Closing

The analysis presented in this study reveals New Roots Inc.'s ability to cover multiple goals of the food justice mission, as defined in this study, while remaining financially healthy. Nonetheless, this study also reveals some challenges associated with remaining financially healthy over time. Specifically, sources of revenue volatility and human capital requirements are some of those challenges that could put at risk the long-term financial viability of an organization trying to address multiple goals of the food justice missions such as New Roots Inc.

Similar to other organizations related to the food justice mission, such as community food-service organizations, New Roots Inc. depends heavily on donations and grants from the public and private sectors. Decreasing dependency on these sources of revenue is not feasible given the mission and nature of the organization. Like community food-service organizations, New Roots Inc. needs to evaluate periodically the mix between private and public funding that could help address revenue volatility.

Although New Roots Inc. foregrounds its mission of access to healthy food as a human right while providing access to markets to small- and medium-scale, limited resource farmers, operational constraints, and financial viability make it challenging for this organization to address various problems in the food system. The logistics necessary to purchase produce from some small limited-resource farms create additional needs in terms of personnel/staff, potentially putting at risk the financial viability of the organization. As Hoey, Fink Shapiro, and Bielaczyc (2018) note in their evaluation of Michigan food hubs, any organization trying to address food system problems needs to address financial viability before being able to address all problems in this system. For an organization to address multiple problems of the food system while remaining financially viable, it might need to partner with other organizations related to the food justice mission. For example, to support New Roots Inc.'s ability to work with more small farms with low sales and/or beginning minority farms, they would need to partner with organizations that can provide technical assistance to support product quality and consistency to meet New Roots Inc.'s needs. Although New Roots Inc. works closely with farmers in planning, there are limitations regarding the support they can give to farmers requiring additional technical assistance.

Finally, high human capital needs (e.g., volunteers, leadership) associated with running an organization such as New Roots Inc. might not pose a problem in the short run or for the region where the organization is located. There might be a big pool of volunteers willing to help run activities related to FSM in this region. Additionally, organization leaders are not planning to retire

anytime soon. Nonetheless, in the absence of strong leaders or a strong pool of volunteers, one might question the long-term sustainability and replicability of a business model that is highly dependent on specific human capital requirements that are likely to change over time and by location.

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