

Abstract: Farm to School (F2S) programs exist in many communities throughout the United States. They involve partnerships between farmers and neighboring K-12 school districts to provide students with fresh, local foods in school lunches, as well as educational opportunities surrounding nutrition, the environment, and food production. Proponents of these programs and current research on them suggests they may yield a range of potential benefits for the communities involved. These benefits may include improving nutrition and food security in children, creating more reliable marketing outlets for local farmers, strengthening community ties by keeping funds circulating within the local market, and increasing the overall resilience of the local food system.

However, the COVID-19 pandemic has disrupted the functionality of both our school systems and our food systems. In this project, I consider the characteristics of farms participating in Oregon's F2S program pre-COVID and explore which farm characteristics are associated with continued participation in F2S programs during COVID using multiple econometric methods. In order to accomplish this, I use data on F2S transactions provided by a community partner in Oregon and data I collected about the characteristics of farms participating in Oregon F2S programs using a systematic web search. By doing so, this work will advance our understanding of how the COVID-19 pandemic has altered connections within Oregon's local food systems, as well as highlighting important farm-level factors that impact food system resiliency, and areas for additional improvement and support.

Introduction

From sudden shortages, to increasing prices, to workers at risk, the COVID-19 pandemic has had tangible effects on our national food system, in ways that were apparent even to the average consumer. Following the initial outbreak, much academic work surrounding the pandemic and its impact on the food system has been conducted on a national level, yet relatively little has been done analyzing the impact of COVID-19 at the community-level in the United States. Many sources specifically discussing local food systems and COVID-19 pertain to areas outside of the U.S., such as Southern Africa and Indonesia¹, China², and the Netherlands³, whereas many sources about the U.S. tend to focus on the implications of the pandemic on our globalized, industrial food system.^{4,5,6} This is likely due to a variety of factors, although one of the biggest may be that collecting food system data on the local level simply has not been possible due to the amount of time and energy needed to compile information at such a

¹ Paganini, N., Adinata, K., Buthelezi, N., Harris, D., Lemke, S., Luis, A., ... & Stöber, S. (2020). Growing and eating food during the COVID-19 pandemic: farmers' perspectives on local food system resilience to shocks in Southern Africa and Indonesia. *Sustainability*, 12(20), 8556.

² Fei, S., Ni, J., & Santini, G. (2020). Local food systems and COVID-19: an insight from China. *Resources, conservation, and recycling*, 162, 105022. <https://doi.org/10.1016/j.resconrec.2020.105022>

³ Coopmans, I., Bijttebier, J., Marchand, F., Mathijs, E., Messely, L., Rogge, E., ... & Wauters, E. (2021). COVID-19 impacts on Flemish food supply chains and lessons for agri-food system resilience. *Agricultural Systems*, 190, 103136.

⁴ Hendrickson, M. K. (2020). Covid lays bare the brittleness of a concentrated and consolidated food system. *Agriculture and Human Values*, 37(3), 579-580.

⁵ Weersink, A., von Massow, M., Bannon, N., Ifft, J., Maples, J., McEwan, K., ... & Wood, K. (2021). COVID-19 and the agri-food system in the United States and Canada. *Agricultural Systems*, 188, 103039.

⁶ Orden, D. (2020). Resilience and Vulnerabilities of the North American Food System during the Covid-19 Pandemic. *EuroChoices*, 19(3), 13-19.

granular scale. However, the current work that does exist on this topic (such as Thilmany et al.⁷ and Marusak et al.⁸ on local food supply chain dynamics during the pandemic) provides a foundation for the general concepts of farmer adaptability and local food system resilience which I study in this thesis. Specifically, I focus on farm participation in Farm to School programs during the COVID-19 pandemic. In this case, I am looking to better understand the correlation between specific farm characteristics traits and farm participation in these programs before as well as during the COVID-19 pandemic. Looking at farm-to-school relationships in this manner provides a perspective not often seen when analyzing local food systems and may uncover new information relating to local food system resilience in the face of shocks.

Farm to School programs in the US that seek to connect K-12 schools with local foods are among those local food system activities impacted by COVID-19. Given the level of emphasis they place on the creation of local ties between farms and their neighboring school districts, data collected on these programs can be an important indicator of the robustness of the community food system that surrounds them. Therefore, in this project, farm participation in Farm to School programs will be used as a framework to better understand farmer engagement within local food systems, and how COVID-19 has impacted farmers' capacity for this engagement.

What is Farm to School?

⁷ Thilmany, D., Canales, E., Low, S.A. and Boys, K. (2021), Local Food Supply Chain Dynamics and Resilience during COVID-19. *Appl Econ Perspect Policy*, 43: 86-104. <https://doi.org/10.1002/aep.13121>

⁸ Marusak, A., Sadeghiamirshahidi, N., Krejci, C. C., Mittal, A., Beckwith, S., Cantu, J., ... & Grimm, J. (2021). Resilient regional food supply chains and rethinking the way forward: Key takeaways from the COVID-19 pandemic. *Agricultural Systems*, 190, 103101.

Farm to School (F2S) programs exist in many communities throughout the United States. They involve partnerships between farmers and nearby K-12 school districts to provide students with fresh, local foods in school lunches, as well as educational opportunities surrounding nutrition, the environment, and food production. First established in the late 1990s by staff from the US Department of Agriculture and partners in Florida and California, these programs were originally created with the primary goals of increasing the nutritional value of school lunches and supporting local farmers (particularly those belonging to minority demographics).⁹ Upon implementation, these programs proved to be very popular, with early research conducted on these emerging F2S programs finding that, as of 2003, “at least 400 school districts in twenty-two states were purchasing food from local farmers, providing fresh food to more than a half million students each day” (p. 417) referring specifically to produce procurement and distribution, not purely educational programs.⁹

Research on these programs over time has suggested many benefits associated with their implementation. Nutritional benefits for students are the most apparent. Students exposed to these programs exhibit higher levels of knowledge pertaining to food and nutrition, and improved access to fresh, seasonal produce, allows for increased dietary diversification (however, the literature has not demonstrated whether there is increased consumption of fruits and vegetables among students as a result of these conditions).¹⁰ These programs also offer benefits for farmers, through aiding in the viability of small-farming businesses via the

⁹ Vallianatos, M., Gottlieb, R., & Haase, M. A. (2004). Farm-to-school: Strategies for urban health, combating sprawl, and establishing a community food systems approach. *Journal of Planning Education and Research*, 23(4), 414-423.

¹⁰ Prescott, M. P., Cleary, R., Bonanno, A., Costanigro, M., Jablonski, B. B., & Long, A. B. (2020). Farm to school activities and student outcomes: a systematic review. *Advances in Nutrition*, 11(2), 357-374.

diversification of market outlets¹¹, incentivizing the preservation of farmland against the growing pressures of urban sprawl⁹, and offering an opportunity for farmers to make an impact in their local communities.¹²

However, there are also several barriers to success for F2S programs. For farmers, these often relate to difficulties surrounding fair product pricing, compatibility with their previously existing business models, and customer engagement.¹² For school districts, these barriers are primarily related to the expenses and logistics surrounding the process of purchasing from local farmers as opposed to pre-processed foods from the National School Lunch Program¹³, as well as the capacity for school nutrition staff to safely and effectively process the food items procured from these local transactions.¹⁴

Despite these challenges, F2S programs have continued to gain popularity and spread throughout the country. In their current form, F2S programs can vary widely from region to region, and even school district to school district, acting as a reflection of the local issues that spurred the adoption of the program in the first place, as well as the specific needs and resources available within a given community.¹⁵ In general, it appears that successful community implementation of F2S programs depends on key factors such as school capacity

¹¹ Izumi, B. T., Wright, D. W., & Hamm, M. W. (2010). Market diversification and social benefits: Motivations of farmers participating in farm to school programs. *Journal of rural studies*, 26(4), 374-382.

¹² Lehnerd, M. E., Sacheck, J. M., Griffin, T. S., Goldberg, J. P., & Cash, S. B. (2018). Farmers' Perspectives on the Adoption and Impacts of Nutrition Incentive and Farm to School Programs. *Journal of Agriculture, Food Systems, and Community Development*, 8(1), 147-165.

¹³ Joshi, A., Azuma, A. M., & Feenstra, G. (2008). Do farm-to-school programs make a difference? Findings and future research needs. *Journal of Hunger & Environmental Nutrition*, 3(2-3), 229-246.

¹⁴ Stokes, N., & Spruance, L. (2020). Processing and promoting local produce as part of farm to school programs: perspectives of school nutrition staff. *Journal of Hunger & Environmental Nutrition*, 15(6), 778-793.

¹⁵ Schafft, K., Hinrichs, C. C., & Bloom, J. D. (2010). Pennsylvania farm-to-school programs and the articulation of local context. *Journal of Hunger & Environmental Nutrition*, 5(1), 23-40.

(regarding available resources), strong social capital and social networks, stakeholder capacity (pertaining to skills and knowledge held by farmers and food processors), and overall community resources and motivations.¹⁶

Another influential factor in F2S program success is the existence of F2S-related policy region. The percentage of schools with F2S programs in place is relatively small, but in areas with policies supporting or enabling F2S programs, the implementation and success of these programs seems to be more prevalent, showing statistically higher numbers of F2S programs from year to year.¹⁷ Additionally, states with F2S-specific policies have also been shown to have a significantly increased level of fruit and vegetable availability in school lunches—with those having the biggest variety of produce available to students being the states with these policies in place, who also actively managed successful F2S programs.¹⁸ However, the existence of F2S-related policy is not the only factor in determining the continuation of F2S programming in a given region, since policy is lacking that specifically supports these programs in disadvantaged school districts with fewer resources available for students.¹⁹

Farm to School programs in Oregon

The state of Oregon has a reputation for its robust local food system. According to Oregon State University's Extension Service, there were 35,439 farms in the state farming a

¹⁶ Lee, E., Smathers, C., Zubieta, A. C., Ginnetti, S., Shah, A., & Freedman, D. A. (2019). Identifying indicators of readiness and capacity for implementing farm-to-school interventions. *Journal of School Health*, 89(5), 373-381.

¹⁷ Schneider, L., Chriqui, J., Nicholson, L., Turner, L., Gourdet, C., & Chaloupka, F. (2012). Are farm-to-school programs more common in states with farm-to-school-related laws?. *Journal of School Health*, 82(5), 210-216.

¹⁸ Nicholson, L., Turner, L., Schneider, L., Chriqui, J., & Chaloupka, F. (2014). State farm-to-school laws influence the availability of fruits and vegetables in school lunches at US public elementary schools. *Journal of School Health*, 84(5), 310-316.

¹⁹ Bonanno, A., & Mendis, S. S. (2021). Too cool for farm to school? Analyzing the determinants of farm to school programming continuation. *Food Policy*, 102, 102045.

total of 16,301,578 acres in 2012. These farms served a state population of 3,883,735 people, 17.9% of which are food insecure and 5.0% of which are considered low-income and/or have limited access to a grocery store. In terms of marketing between the farmer and the consumer, 6,680 farms were involved in direct sales, 391 farms utilized a Community Supported Agriculture (or CSA) model for distribution, while 1,898 farms marketed their produce directly to retail.²⁰

In addition, 57.2% of all schools in the state purchased local foods.⁶ Given this large share of schools participating, it is clear that Oregon's F2S programs are active in many communities and have the potential to play a substantial role in the region's food system. This is further evidenced by the fact that, in 2008, Oregon introduced a "Farm to School and School Garden Coordinator" position to its department of Agriculture, becoming the first state in the nation to incorporate a farm to school position in both its departments of agriculture and education.²¹

However, the introduction of the COVID-19 pandemic in March of 2020 disrupted both our food systems and our school systems, testing the resiliency of both the farms and communities involved in these programs. With the majority of schools forgoing in-person education for hybridized or distance-learning models during the 19-20 and 20-21 school years²², those who relied on meals from Oregon school districts faced challenges relating to

²⁰ Rahe, M., Gwin, L., Caplan, S. & Antolin, B. (2019, January 15). Oregon's Community Food System Indicators. OSU Extension Service. <https://extension.oregonstate.edu/collection/oregons-community-food-system-indicators>

²¹ Kane, D., S. Kruse, M.M. Ratcliffe, S.A. Sobell, and N. Tessman. (2010). The Impact of Seven Cents. Ecotrust: Portland, Oregon. 7-Cents-Report_FINAL_110630.pdf (ecotrust.org)

²² Ballotpedia (2022, April 16). School responses in Oregon to the coronavirus (COVID-19) pandemic - Ballotpedia. Ballotpedia. [https://ballotpedia.org/School_responses_in_Oregon_to_the_coronavirus_\(COVID-19\)_pandemic](https://ballotpedia.org/School_responses_in_Oregon_to_the_coronavirus_(COVID-19)_pandemic)

accessibility, due to lack of time and transportation for families, and operational challenges on the district level.²³ Given the transactional nature of the relationship between school districts and participating farmers in F2S programs, it is feasible that these challenges in implementing the program as a result of COVID-19 could also then impact the success of participating farmers in turn.

Why is this Important?

The disruptions to our national food system the COVID-19 pandemic have become common knowledge due to media coverage surrounding the meat and flour supply issues experienced in the United States during the early stages of the pandemic.^{24,25} However, the full impact that the COVID-19 pandemic has had on the US food system is still being explored. In this process, the impacts of COVID-19 on state and local-level food system relationships have not been given the same attention as those on the national level.

The goal of this research is to explore how these community food system relationships have changed, using Oregon's F2S program as a case study. In particular, this thesis will focus on identifying farm characteristics associated with participation (or lack thereof) in the Oregon F2S program before and during COVID, with the hope that this process may point to important

²³ Clafin, C. (2021, February 1). Oregon School Meal Access During the COVID-19 Pandemic. Hungercenter. https://www.hungercenter.org/wp-content/uploads/2021/02/Oregon_School_Meal_Access_COVID-19_Cara_Clafin_PHFO.pdf

²⁴ Richards, S., & Vassalos, M. (2020). COVID-19 amplifies local meat supply chain issues in South Carolina. *Journal of Agriculture, Food Systems, and Community Development*, 10(1), 191-195.

²⁵ Weersink, A., von Massow, M., Bannon, N., Ifft, J., Maples, J., McEwan, K., ... & Wood, K. (2021). COVID-19 and the agri-food system in the United States and Canada. *Agricultural Systems*, 188, 103039.

farm-level factors that relate to food system resiliency, and areas for additional improvement and support. In order to accomplish this, I pose the following three questions:

1. What kinds of differences are there in the patterns of farm participation in Oregon's F2S program between the 2017-2018 school year, the 2018-2019 school year, the 2019-20 school year, and the 2020-21 school year?
2. Are there significant differences in the characteristics of farms participating in OR's F2S program before and during the COVID-19 pandemic?
3. What do these patterns over time say about the resilience of Oregon's local food systems, and do they suggest areas for future policy attention or support?

Materials and Methods

Data Access and Collection

Data regarding the purchasing patterns of K-12 institutions participating in Oregon's F2S programs were provided by partners in the state of Oregon (Departments of Education and Agriculture). Specifically, these data were transaction records provided by school districts to the state agencies in order to obtain partial reimbursement for local food purchases as part of Oregon's F2S reimbursement program. While this program is open to all districts in the state, not all districts participate, so these data may not capture all local food purchases by Oregon school districts. Four (academic) years of data were provided: 2017-18, 2018-19, 2019-20, and 2020-21. I then filtered the data to only include purchases for items that were produced in the

state of Oregon (Oregon processed foods are also included in the data set). In this dataset, producer names (if available) were listed as either as secondary sources, or as the primary vendor if no secondary source was named.

At this point, the list of observations was then narrowed down manually to include only farms through the process of data collection itself, described below. As the foundation of the food system at any level, my subjects of interest were specifically the individual agricultural producers participating in these F2S programs. This is especially true when looking at local and regional food systems, since processors and wholesalers often operate by moving bulk quantities of produce and other food products through the food system at a regional or national level, which does not accurately reflect the scope of this thesis.

Additional data collection was conducted via thorough web search on each of the farm names listed in the data set described above. Resources such as online databases (including the Oregon Harvest for Schools Directory)²⁶, personal farm websites and social media pages, as well as third-party websites like those run by farmer's markets were used to source information on the various organizations mentioned in the dataset. Specific types of information collected are described in the next subsection. A preliminary web search was conducted using these resources to first determine if there was any information available on this organization at all, and if yes, if the information provided was relevant to this project. A proportion of the organizations included in the filtered dataset were not relevant to this project, either due to their identity as food processors or wholesalers rather than farms, to their location outside of

²⁶ Ecotrust, Oregon Dept. of Education, Oregon Dept. of Agriculture, Oregon Farm to School and School Garden Network (2019). Oregon Harvest for Schools Directory. OH4S. <https://portal.oregonharvestforschools.com/>

Oregon, or due to a lack of usable information found through the process of the preliminary web search. Upon discovery, these data points were tagged with a descriptor of “No Data” and filtered from the data set during the process of analysis. Through this process, a total of 172 organizations were determined not to be farms, 42 organizations did not appear to be located in Oregon, and 76 organizations appeared to be farms yet had no information on their operation available, leaving a set of 229 farms that remained for analysis.

An important point to note is that research regarding these characteristics was conducted over a period of approximately six months during the latter portion of 2021 and into the first months of 2022. Given the nature of how these data were collected, the analyses and conclusions derived from it can only be applied to what we know about these farms at that point in time. In other words, while we know which farms were participating in the F2S program from the 17-18 school year and have information about their relationships with school district by year, we do not know if the farm characteristics gathered from websites were applicable during those earlier time periods, only that they are applicable to these farms as of 2021. This is something that must then be kept in mind through the analysis and discussion of these data.

Selection of Variables

A core part of the data collection process involved identifying farm-level characteristic variables that could potentially relate to a farm’s ability, or lack thereof, to participate in a given market (in this case, selling their products to local K-12 schools via F2S programs). In addition to this thesis, these characteristic variables are also being used in a larger project being pursued at Ohio State University and Colorado State University related to the farm and community impacts

of state policies that provide reimbursement for local foods purchases as part of F2S programs. Thus, a wide variety of variables were chosen for the data collection, before being narrowed down in the data analysis portion of this project. The variables of interest included:

- Size Description Availability (Is a farm's size described?)
- Single Family Ownership (Is the farm owned by a family rather than a corporation?)
- The number of Locations (How many addresses does the farm list as part of their organization?)
- Existence of a Personal Farm Website (Does the organization have its own website?)
- Social Media Presence (Is the organization present on any social media platforms?)
- Organic Certification (Are at least some products certified organic/transitioning?)
- Other Sustainability Practices Mentioned (Are sustainability methods besides organic certification mentioned?)
- Diversified Production (Does farm produce multiple crops/types of products on their operation?)
- Production/Marketing of Value-Added Products (Does farm produce or market value-added products?)
- Direct-to-Consumer Marketing Outlets (Does farm market products directly to the individual consumer? If so, via what channels?)
- Other Market Roles (Does the organization hold other roles in the food system, such as a wholesaler or processor or packer, in addition to being a producer?)
- Available Varieties Mentioned (Are the specific varieties of crops grown mentioned?)
- Pricing Availability (Is information regarding a farm's product prices available online?)

These variables can be categorized into three main topics: Farm Structure, Marketing Techniques, and Communication/Engagement. Since information such as size and number of locations, family ownership, organic certification, and diversified production relate to how a farm business is operated, these variables were selected to analyze trends in participation relating to specific farm structures. In a similar vein, since marketing strategies can also vary widely from farm to farm (depending in part on the structure of the organization), variables relating to different strategies, such as production/marketing of value-added products, direct-to-consumer marketing, and other market roles were selected to determine if certain marketing techniques appeared to be prevalent. Lastly, variables based on the level of communication upheld by a farm in various contexts, such as internet and social media presence, as well as language referring to sustainability, availability of varieties, and pricing, were selected to quantify the level of “outward” community-oriented engagement being demonstrated by participating farms. (Note: Some of these variables, namely availability of varieties and pricing information, were also included at the request of other members apart of the larger F2S project.)

Data Analysis

From the assortment of characteristic variables discussed previously, a smaller number was selected for further analysis as it pertains to this project. I identified the key characteristics that I hypothesized would most directly influence how a farm is able to operate within a food system (harkening back to the three main categories of Structure/Markets/Engagement mentioned in the “Selection of Variables” portion of this section) to pinpoint if any of these

characteristics correlated with a particular trend in farm participation in F2S programs through the COVID-19 pandemic.

The collection of variables selected for further analysis includes:

- Average Size
- Single Family Ownership
- Organic Certification
- Diversified Production
- Existence of a Personal Farm Website
- Social Media Presence (specifically Facebook and Instagram)
- Direct-to-Consumer Marketing Outlets

We also used the F2S transaction data provided by the state of Oregon to generate some additional variables:

- The Number of Farms Participating from Year to Year (The number of unique farm organizations that were recorded as participating in a given school year)
- Numbers of Entrances and Exits Per School Year (The number of new farms entering the program or leaving the program in a given school year)
- Average Number of Transactions per Farm (The average number of invoices per farm to a school district)
- Average Number of School District Connections per Farm (The average number of school districts that farms sold products to across each school year)

Data for each of these variables was organized by school year, and then further categorized into two groups, “Pre-COVID” (containing transaction information from the 17-18 and 18-19 school years) and “During-COVID” (containing transaction information from the 19-20 and 20-21 school years). These different categories allowed me to explore which characteristics were associated with participation from year-to-year. The statistical analysis process involved using the following analysis techniques:

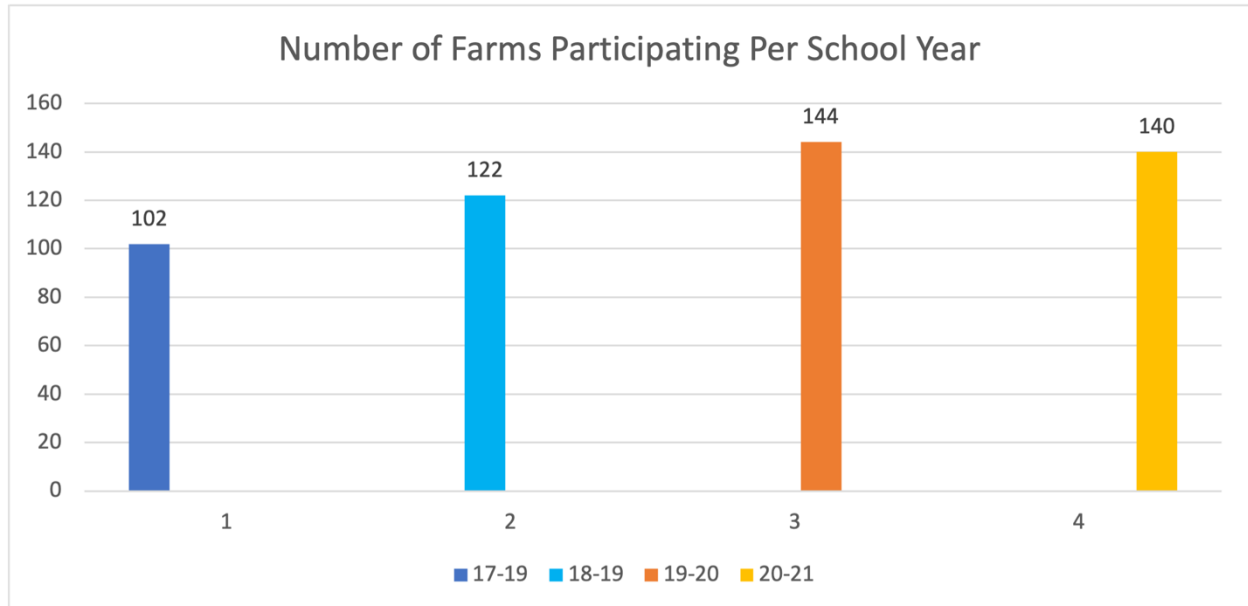
- Un-paired T-Tests, used for analyzing the means of two unrelated groups, to compare the average number of transactions and the average number of school district connections per farm in Pre-COVID school years (17-18, 18-19) to During-COVID school years (19-20, 20-21).
- Paired T-Tests, used for analyzing the means of two corresponding groups, to compare the average number of transactions over time and the average number of school district connections per farm over time, specifically for the subset of farms who showed continuous participation in the F2S program both before and during the pandemic.
- 2-proportion Z-tests, used for analyzing the likelihood of statistical difference between two proportions, in order to compare farm characteristic proportions from year-to-year. This test was done to compare the years 17-18 and 18-19, 18-19 and 19-20, 19-20 and 20-21, as well as the 17-18 and 20-21 school years, to measure the changes that were occurring as the pandemic developed, and to compare prevalence between school years before and during the pandemic.

Results

Participation and Transaction Data

Over the course of the four school years, the number of farms participating in Oregon's F2S program (based on our data) increased from 102 farms in the 17-18 school year, to 144 farms in the 19-20 school year and 140 farms in the 20-21 school year. As can be seen in Figure 1 below, while there looks to be a generally positive trend in the number of farms participating in this program as time goes on, it appears that increase was stifled slightly as the pandemic continued into the 20-21 school year, indicating the possible beginnings of a downward trend in the number of farms that are able to participate in these programs as a result of the pandemic.

Figure 1.



This trend is corroborated by the entry and exit data seen over time as well. As seen in Figure 2, the number of new farms entering the F2S program for the first time (within the

timespan of our data) made up 55% and 57% of the total number of participating farms in the 18-19 school year and 19-20 school year respectively. However, in the 20-21 school year, the number of new entries into the program dropped, comprising only 51% of all participants. Conversely, as seen in Figure 3, the number of farms exiting after a given school year increased from year to year, with total proportions of farm exits increasing from 46% in the 17-18 school year to 55% and 52% in the 18-19 and 19-20 school years, respectively.

Figure 2.

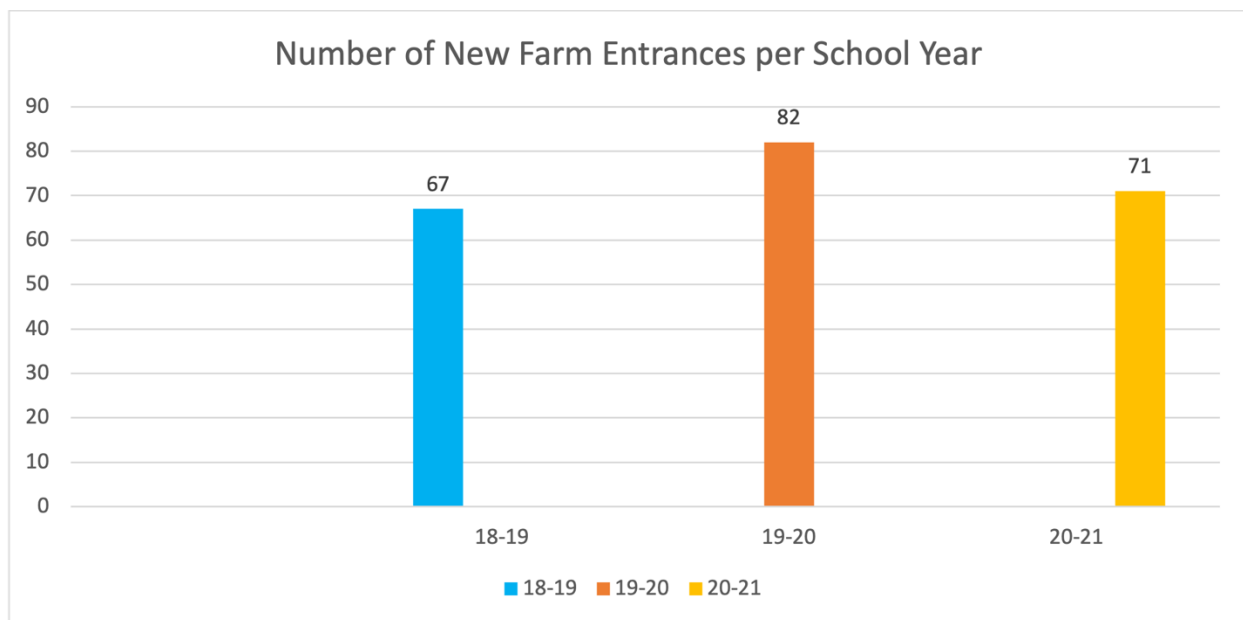
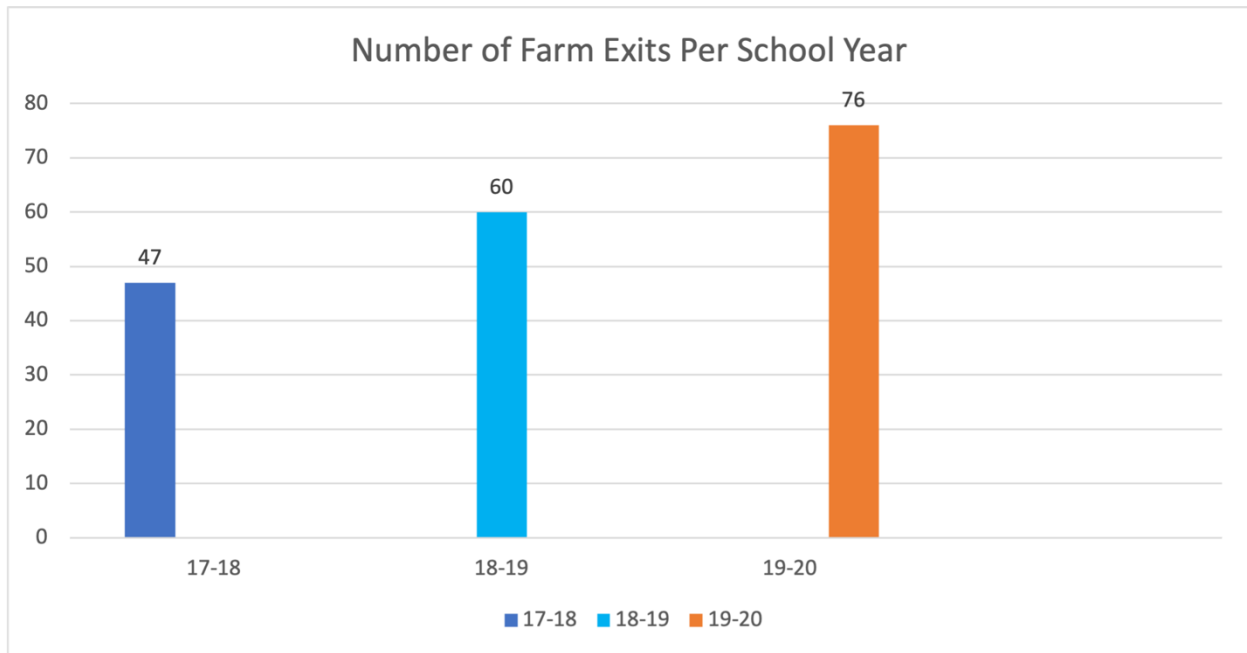
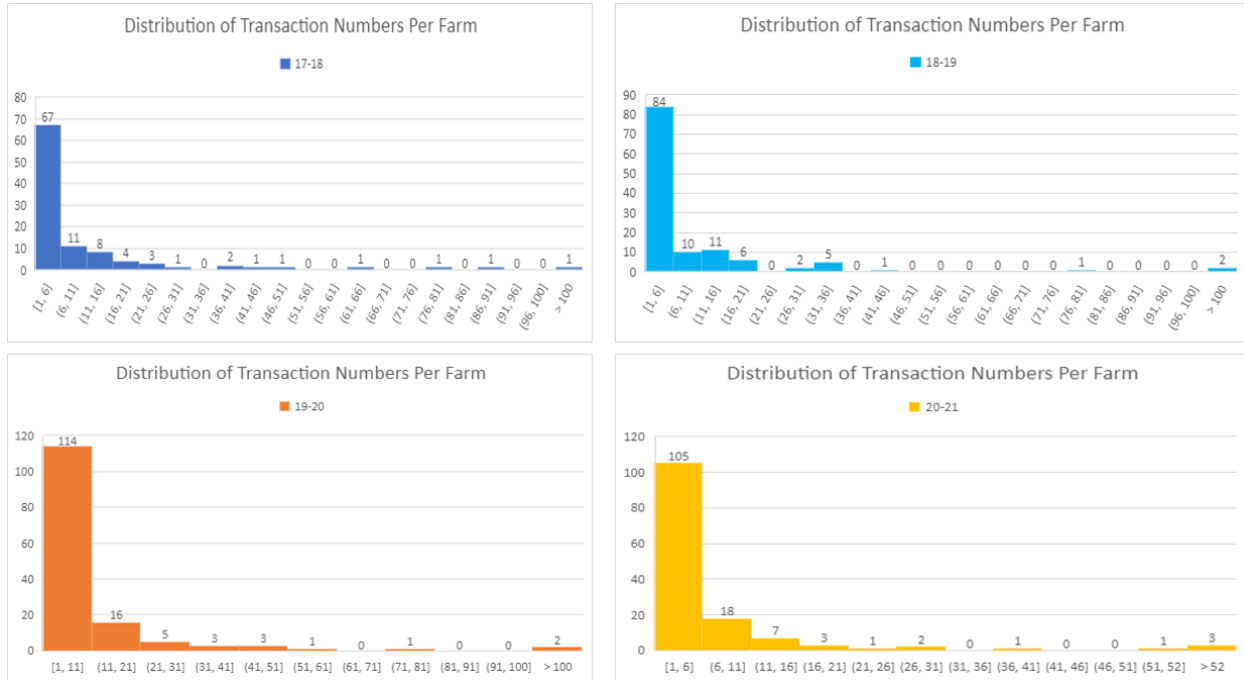


Figure 3.



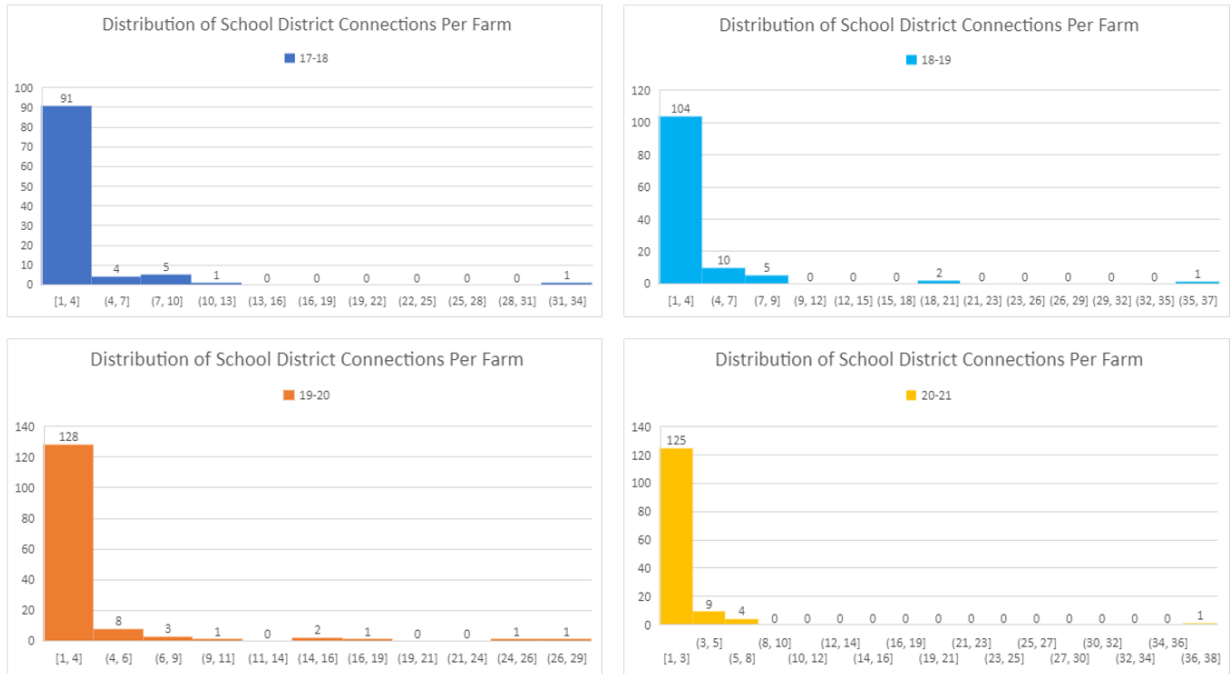
In terms of transaction data, there also seems to be a decreasing trend in the average number of transactions with school districts by farms participating in these programs as time goes on, going from an average of 17 transactions per farm in the 17-18 school year to an average of just 7 in the 20-21 school year (as represented in Table 1 below). However, despite the apparent trend in the mean value, neither the average transaction numbers of all farms, nor specifically the farms that continued to participate both before and during the pandemic, yielded any statistically significant differences when comparing pre-COVID school years with during-COVID school years. Since the median number of transactions per farm remained stable at 3 transactions per farm Pre-COVID and 2 transactions per farm during-COVID, it is clear that the changes in mean number of transactions came from outliers in the data as opposed to a wide sweeping trend across all participants, as seen in Figure 4 below, which shows histograms of transactions per farm by school year.

Figure 4.



A similar relationship was also seen when comparing the average number of school districts that farms sold products to across each school year, albeit without any extreme outliers to skew the data as notably. From year to year, the average number of school district connections (school districts farms sold to) remained stable at 2 school districts per farm, as depicted in Table 1 and Figure 5, below. Figure 5 shows histograms of school district connections per farm by school year.

Figure 5.



Farm Characteristic Data

As noted in row two of Table 1 below, as well as in the first set of horizontal bars in Figure 6 below, the number of farms participation that had characteristic data publicly available at the time of data collection in 2021 varied from year to year. Thus, in an effort to provide an effective comparison between school years, characteristic data will be discussed in terms of their relative proportions from year to year.

Table 1: Farm Participation Data Across School Years

	17-18 School Year	18-19 School Year	19-20 School Year	20-21 School Year
Number of Farms Participating	102	122	144	140

Number with Characteristic Data Available in 2021-2022	85	98	105	111
Number of Entrances	N/A	67	82	71
Number of Exits	47	60	76	N/A
Avg # of Transactions	17	13	11	7
Median # of Transactions	3	3	2	2
Avg # of School District Connections	2	2	2	2
Median # of School District Connections	1	1	1	1

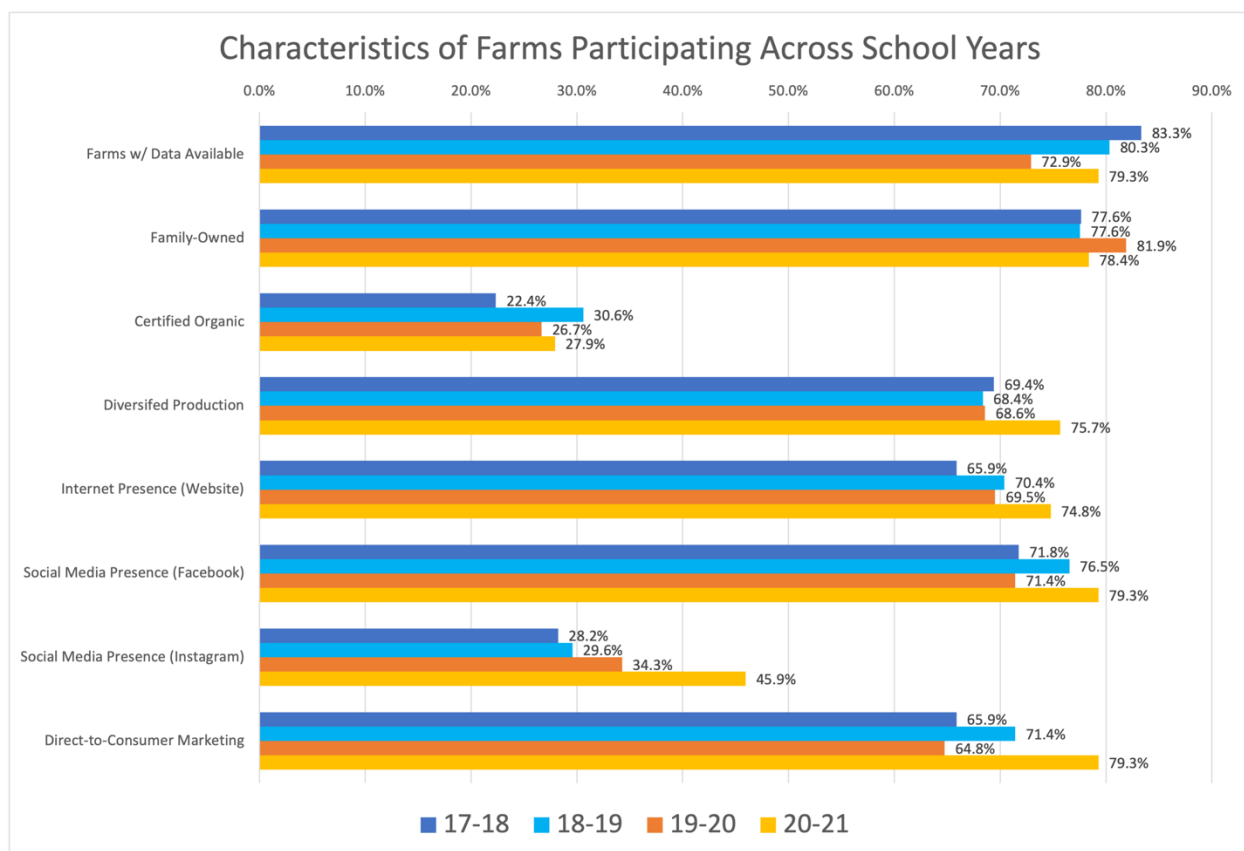
(Note: No data was available for entrances during the 17-18 School Year or exits after the 20-21 School Year.)

As shown in the second set of horizontal bars in Figure 6, the percentages of farms participating in Oregon's F2S program that were family-owned did not change dramatically across time, ranging less than 5% in value across all four years, the highest of which occurred in the 19-20 school year at 81.9%.

The proportion of farms participating that were certified organic at the time of data collection in 2021 was relatively low across all four school years, and highest in the 18-19 school year at just above 30%. However, the proportion of farms participating that utilized diversified production strategies in 2021 was much higher, hovering between 68.4% and 69.4% for the first three school years, before showing a marked increase to 75.7% in the 20-21 school year (although not enough to be considered statistically significant). In other words, these data suggest that

farms participating in these earlier academic years were less likely to be certified or transitioning to organic at the time of data collection in 2021-2022.

Figure 6.



The proportion of farms participating that had a personal website attached to their organization (as of 2021) showed a slight upward trend over time, ranging from 65.9% in the 17-18 school year to 74.8% in the 20-21 school year, although this upward trend was not strong enough to be considered statistically significant. A somewhat similar pattern was observed in the proportion of farms participating that had a social media presence on Facebook as of 2021. While there was an increase in the prevalence of farms with Facebook accounts as of 2021, particularly when comparing the 17-18 and 20-21 school years, the difference between the two was less than

10%, and showed more variation in the interim years compared to the prevalence of a personal website in those participating in the program.

However, when looking at the proportion of participating farms with a social media presence on Instagram (the seventh set of horizontal bars in Figure 6), a much clearer trend becomes apparent. Across all four years, the percentage of farms participating that had an Instagram account in 2021 ranged from 28.2% in the 17-18 school year to 45.9% in the 20-21 school year. This notable difference was also shown to be statistically significant when comparing farms in the 20-21 school year to the 17-18 school year.

The proportion of farms participating who used Direct-to-Consumer marketing outlets as of 2021 also displayed a similarly dramatic increase over time (albeit in a less linear fashion than the upward trend exhibited in the prevalence of organizations with an Instagram account). Across all four years, this value ranged from 64.8% in the 19-20 school year to 79.3% in the 20-21 school year. This difference was also proven to be statistically significant, both when comparing the 19-20 school year versus the 20-21 school year, as well as when comparing the 17-18 school year to the 20-21 school year.

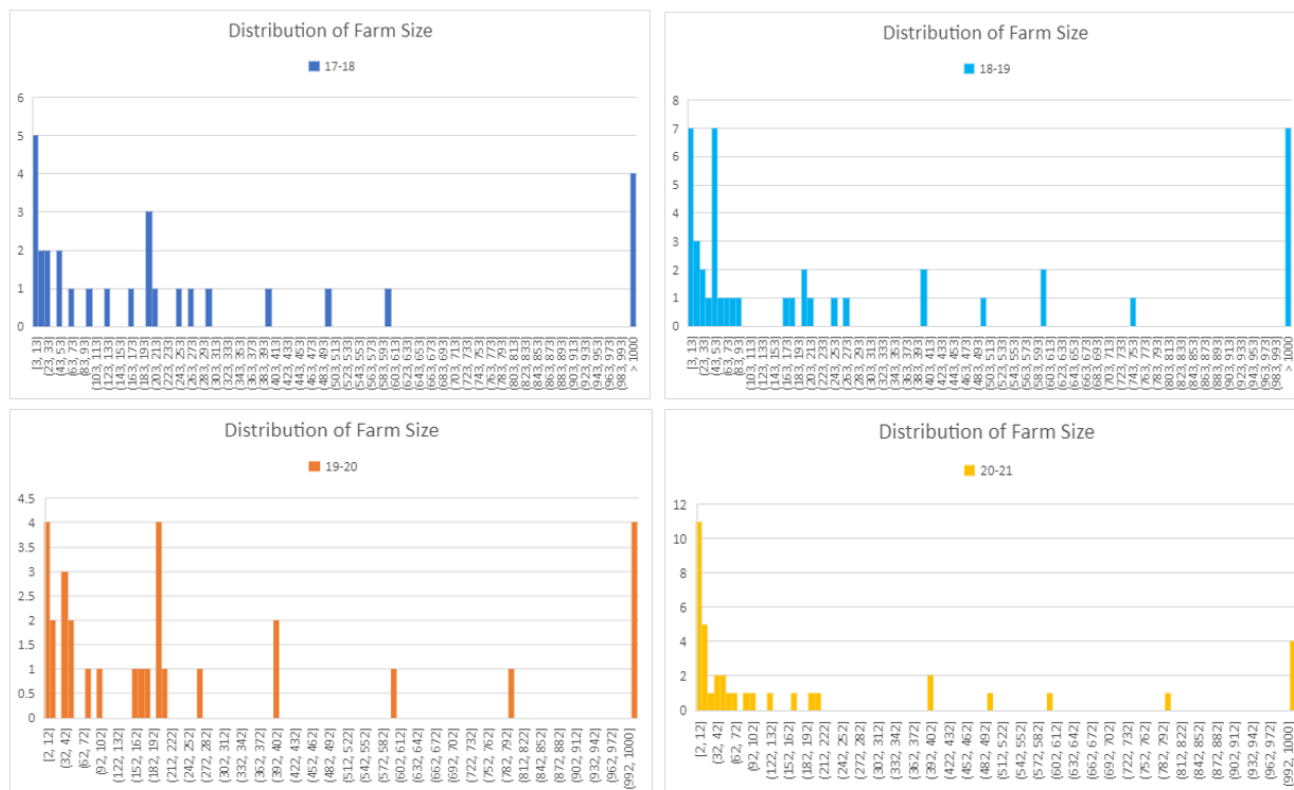
Table 2: Characteristics of Participating Farms at Time of 2021 Data Collection

	17-18 School Year (85 Farms)	18-19 School Year (98 Farms)	19-20 School Year (105 Farms)	20-21 School Year (111 Farms)
Family Owned	66 (77.6%)	76 (77.6%)	86 (81.9%)	87 (78.4%)
Number organically certified	19 (22.4%)	30 (30.6%)	28 (26.7%)	31 (27.9%)

Number with diversified production	59 (69.4%)	67 (68.4%)	72 (68.6%)	84 (75.7%)
Number with website	56 (65.9%)	69 (70.4%)	73 (69.5%)	83 (74.8%)
Number with Facebook	61 (71.8%)	75 (76.5%)	75 (71.4%)	88 (79.3%)
Number with Instagram	24 (28.2%)	29 (29.6%)	36 (34.3%)	51 (45.9%)*
Number doing Direct Marketing	56 (65.9%)	70 (70.4%)	68 (64.8%)	88 (79.3%)**
<p>* = shown to be significant using a 2-proportion Z-test comparing 17-18 and 20-21 School Years (P-value <.05)</p> <p>** = shown to be significant using a 2-proportion Z-test comparing 19-20 and 20-21 School Years, as well as the 17-18 and 20-21 school years. (P-value <.05)</p>				

Lastly, I address size description availability and average farm size. Given the limited number of datapoints available for this metric, and the high level of variability in those that were reported, very few useful analyses were able to be drawn from this data regarding trends in participating farms across time. However, as shown in Figure 7 below, there is evidence of a dichotomy of size being seen in the farms participating in these programs across all four years, with some being quite small and others quite large, but relatively few existing in the mid-size range.

Figure 7.



Discussion

Some of the most notable trends emerging from these results include the rise in the number of farms participating over time, the increase in farms with a Social Media Presence (specifically regarding Instagram use) participating during the COVID-19 pandemic, and the percentage of farms involved in Direct-to-Consumer Marketing Strategies also increasing significantly during the COVID-19 Pandemic (namely during the 20-21 school year).

The general increase of farms despite the onset of a pandemic was a surprising discovery, since it was expected that a shock of this magnitude would disrupt normal business channels enough that many producers would be forced to decrease their business or maybe even go out of business. However, the fact that this does not seem to be the case (at least during the initial stages of the pandemic), acts as a testament not only to the resilience of these

farm businesses, but also to the food system as a whole. It is also worth noting that this may have more to do with the capacity of the F2S program itself to support local farmers, and not necessarily the resilience of farms that allows them to remain in this partnership. Additionally, as was mentioned briefly in the previous section, there is also the possibility that the full ramifications of the COVID-19 pandemic on farm participation in these programs cannot yet be fully seen from the information in this dataset. The levelling off in farm participation numbers in the latest school year, as opposed to continuing to increase, may instead be an early indication of decreasing participation numbers. However, a trend either way cannot be confirmed without additional data from upcoming school years.

The increase in participation by farms with a presence on Instagram was also an intriguing trend, especially since this does not correlate with results regarding farm participation by those with other virtual engagement methods such as a personal website or a Facebook account, which stayed relatively consistent over each of the four school years being analyzed. This can be attributed to a variety of potential factors, including that social media engagement is simply becoming a more common strategy for businesses to implement due to the prevalence of technology within our society, as well as the fact that Instagram is swiftly becoming one of the most popular social media platforms among all demographics, coming in at second place behind Facebook. Additionally, due to the issue regarding how the data was collected, it is not clear exactly at what time these farms adopted this social media tool, only that they have done so as of 2021. However, regardless of the exact nature of this change, it is clear that a stronger presence on social media is indeed connected to a farm business's capacity to continue functioning throughout the COVID-19 pandemic and may act as a sign attesting to

the overall adaptability of those farms, which could have aided in their survival through such a shock.

This is also true regarding the increase in farms involved with direct-to-consumer marketing strategies, although I would argue the development of such a trend is much more connected to the pandemic itself than the latter. Given the shutdowns in the restaurant and food processing industries due to COVID-19, it is understandable that farms with marketing initiatives directed toward the individual consumer would fare better, since these business relationships are less reliant on the structure of the national food system, and thus proved to be less vulnerable to the national disruptions that occurred because of the pandemic.

Overall, what these results suggest is that the farms who managed to continue participating in Oregon's F2S program are those who have a high degree of attention dedicated to cultivating an "outward-facing" brand for their business. With the rise of social media usage and direct marketing, these farms have succeeded in connecting with individual members of their communities, which strengthens local ties to the organization, and helps to create a "social safety-net" to support themselves with. It is this practice of strengthening inter-community relationships that has been shown to increase resilience, not only for individual

people and organizations, but also for entire communities within the context of a sustainable food system.^{27, 28}

Conclusion

While the full impact of COVID-19 on farm participation in Oregon's F2S program cannot yet be fully understood simply on the basis of this research, the significant increases in Social Media Presence on Instagram and Direct-to-Consumer Marketing Strategies suggest that an important indicator of continued participation has to do with the strength of community connections between farms and the individual consumer, which could potentially aid in these farms' capacities to weather large-scale shocks. However, further research will need to be conducted to confirm this relationship.

Ideally, to accomplish this, more information would be useful regarding how these tools and characteristics were actually being leveraged by farmers throughout the COVID-19 pandemic, as well as their perception of how these characteristics impacted the survival of their operation. This information could be collected at the individual farmer level, through a more direct approach, such as through surveys or interviews, to gain a fuller understanding of how

²⁷ O'Connell, C., Gay, R., McDonald, N., & Tayal, S. (2021). COVID Connections: Lessons from Adaptations to COVID-19 as Strategies for Building Food System Resilience. *Culture, Agriculture, Food and Environment*, 43(2), 123-136. doi:10.1111/CUAG.12276

²⁸ Robinson, J., Mzali, L., Knudsen, D., Farmer, J., Spiewak, R., Suttles, S., Burris M., Shattuck, A., Valliant J., Babb, A. (2021). Food after the COVID-19 Pandemic and the Case for Change Posed by Alternative Food: A Case Study of the American Midwest. *Global Sustainability*, 4, E6. doi:10.1017/sus.2021.5

these characteristics impacted the farmers themselves, as well as to potentially clarify any new trends that might not have been addressed through this research.

Overall, if evidence of this social safety net concept discussed in the previous section can be further corroborated by future research, particularly regarding the survival of farms that are small, resource-limited, and/or minority operated, as well as with farms that exist outside of the Oregon F2S program, this information could be highly useful in informing farmers and other community actors on what helps create a resilient operation, specifically within the context of a local food system. In addition, this information also bodes well for the resilience of Oregon's food system as a whole, given the region's reputation for its tight-knit communities and the importance place on the relationships formed within.

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