

Farmers' perspectives on adoption and impacts of nutrition incentive and farm to school programs

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Abstract

Recent increases in consumer demand for local food have resulted in more opportunities for food to be purchased in close proximity to where it is produced. However, local markets can be challenging retail outlets for farmers and not uniformly affordable and accessible to all consumers. Farmers market nutrition incentive (FMNI) and farm to school (F2S) programs are two community-based initiatives that support farmers while simultane-

ously lessening the burden of local food access for lower income populations. In this study, we explore farmer perceptions, barriers to adoption, and impacts of FMNI and F2S programs. A survey was developed based on the Diffusion of Innovations theory to assess (1) the key factors that influence adoption of FMNI and F2S programs; (2) farmer perceptions of the most significant barriers to program adoption; and (3) the influence of non-economic impacts on farmers' motivation to participate in those programs. A total of 155 Mid-Atlantic fruit and vegetable farmers completed the

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survey. Participating farmers perceived FMNI and F2S as providing advantageous social impact and various economic opportunities. However, participants and non-participants had differing perspectives on program complexity, compatibility with their business model, and the degree to which others have succeeded when participating. The most significant barriers relate to issues with product pricing, customer engagement, and logistics. Three-quarters of farmers ranked social/community impacts as most important to them. A deeper understanding of farmers' involvement in FMNI and F2S programs will help address barriers and modify program components to increase economic, social/community, and environmental impacts.

Keywords

Farmers Markets, Farm to School, Mid-Atlantic Farmer, Fruit and Vegetable Farmer, Survey Design, Motivation, Barrier, Impact

Introduction

In recent years, farmers and consumers have become increasingly interested in selling and buying food within a local system. While the boundaries of "local" can vary, the Food, Conservation, and Energy Act of 2008 defined "local" or "regional" as an agricultural food product that was raised, produced, and distributed within 400 miles (644 km) of the product's origin or within the state where it was produced. According to the USDA National Agricultural Statistics Service's most recent Local Food Marketing Practices Survey, 167,009 farms nationwide took in US\$8.7 billion at local markets in 2015, with 35% of these farms using direct-to-consumer (DTC) marketing channels, including farmers markets, community supported agriculture (CSAs), and roadside stands (USDA National Agricultural Statistics Service [USDA NASS], 2016). In addition, 39% of these farms sell to institutions and intermediary channels such as schools, hospitals, food hubs, and wholesalers (USDA NASS, 2016).

Proponents of local food systems often associate them with benefits including more diversified farm income, environmental sustainability, farmland preservation, improved food quality, support for the local economy and community, and

better health, nutrition, and food security (Abate, 2008; Martinez et al., 2010). Those with a more critical view warn that "local" as a geographic boundary cannot be inherently tied to any particular set of benefits (Born & Purcell, 2006; Hinrichs, 2003). Over time, equity issues also have become apparent within the local food movement, as affordability and accessibility can be barriers to low-income consumers (Colasanti, Conner, & Smalley, 2010; Leone et al., 2012; Lerman, 2012; Lowery, Sloane, Payán, Illum, & Lewis, 2016). However, responses to these consumer inequities must also consider the need for farmers to have efficient access to profitable markets. The lack of clarity around the impact of local food systems and the tension between equity for farmers and consumers provide the primary motivation for this study: to explore farmer motivations for adoption, barriers to adoption, and the impacts surrounding two specific local food programs—farmers market nutrition incentive (FMNI) and farm to school (F2S) programs.

FMNI is an umbrella term referring to a collection of programs that offer financial incentives to increase the buying power of low-income consumers at farmers markets and other direct-to-consumer marketing channels. At the same time, they increase revenue for farmers selling at markets in lower-income neighborhoods or to lower-income customers (Cole, McNeese, Kinney, Fisher, & Krieger, 2013; Community Science, 2013). FMNI programs originate at the federal level and are administered by state and local agencies. The incentive structure of the programs may include a free voucher, as in the WIC¹ Farmers' Market Nutrition and Senior Farmers' Market Nutrition Programs (FMNP), or as a dollar-for-dollar match of the shoppers' own Supplemental Nutrition Assistance Program (SNAP) spending (Karakus, MacAllum, Milfort, & Hao, 2014; Low et al., 2015).

F2S programs can also provide a market for locally grown agricultural products and have the potential to impact children's food knowledge and healthy development by linking agriculture, school

¹ WIC is the federal Special Supplemental Nutrition Program for Women, Infants, and Children.

gardens, and nutrition education et al., 2014). The 2015 USDA Farm to School Census reported that nationwide over 40% of surveyed schools participated in F2S activities, which may include buying and serving locally sourced food, tending to school gardens, and providing gardening and nutrition education. These schools represent a sizeable potential market to which local farmers could sell their produce (USDA Food and Nutrition Service, 2015). While the potential economic benefits for farmers from F2S come from local food sales, farmers may also engage with schools in other ways that can impact children and set the stage for future local food procurement, like visiting school gardens and cafeterias, hosting field trips, or providing food for taste tests (Joshi, Azuma, & Feenstra, 2008).

There is limited generalizable evidence describing the benefits of and rationale for participating in FMNI and F2S programs from the perspective of producers. Some research has explored farmer participation in local food marketing channels and their motivations to engage in civic agriculture focused on local distribution and sustainable practices (Furman, Roncoli, Nelson, & Hoogenboom, 2014; USDA NASS, 2016). One study noted the importance of nutrition incentives to sales at farmers markets (Cole et al., 2013), and another identified modest economic impacts for farmers selling in institutional markets (Sitaker, Kolodinsky, Seguin, & Pitts, 2014). Research suggests that farmers seem to value impacts on health, education and community (Conner, Sevoian, Heiss, & Berlin, 2011; Izumi, Wynne Wright, & Hamm, 2010; Lazarus, 2014); however, it is unclear how strongly these factors motivate their decision to engage in FMNI and F2S programs. Other studies have identified seasonality, consumer and school budget constraints, and imbalances between supply and demand as key barriers that prevent farmers from participating in these programs (Berkenkamp, 2012; Huff, 2015; Rosenberg, Truong, Russell, Abdul-Haqq, Gipson, & Hickson, 2013). An additional study highlighted the creative supply chain and market strategies farmers employ to lessen these barriers (Feenstra, Allen, Hardesty, Ohmart, & Perez, 2011). Overall, these studies are limited in scope and have focused primarily in the

Upper Midwest, the Northeast, and in California. More research is needed to understand the factors farmers consider when deciding whether to participate in FMNI and/or F2S programs as well as the barriers that deter nonparticipants.

Research Objective

The objective of this study was to understand the perspectives of fruit and vegetable farmers on the adoption and the impacts of FMNI and F2S programs. To do this, we developed and administered a survey to assess (1) the key factors that influence the adoption of FMNI and F2S programs; (2) their perceptions of the most significant barriers to program adoption; and (3) the influence of non-economic factors on their motivation to adopt these programs. The Diffusion of Innovations (DI) theory was used to develop a framework for understanding FMNI and F2S program adoption (Rogers, 2003).

Methods

Farmer Survey Development

The farmer survey was developed to explore the characteristics of FMNI and F2S programs that influence farmer participation as well as the perceived barriers and impacts of participation. The survey was composed of three main sections: (1) perceptions of FMNI and F2S as defined by four DI theory attributes (relative advantage, compatibility, complexity, and observability); (2) experienced or perceived barriers to program adoption; and (3) reported impacts of program adoption.

Perceptions of FMNI and F2S framed by the Diffusion of Innovations theory

First used in rural sociology in the 1940s and '50s, the DI theory has been adapted for use in many settings, including agriculture, to understand perceptions of new programs or technology and explain how innovations have spread (Hasin & Smith, 2016; Rogers, 2003; Saltiel, Bauder, & Palakovich, 1994). While multiple iterations of the DI theory exist, the four main theoretical constructs (innovation characteristics, communication channel, time, and social system) work to explain *how and why* diffusion occurs and the potential *consequences or*

outcomes of that process (Rogers, 2003).

DI offered an appropriate framework for understanding the innovation characteristics of FMNI and F2S that influenced farmers' decisions to engage with these programs. The innovation characteristics outlined by the DI theory are defined as the perceived attributes that the potential adopter understands the innovation or intervention to offer. The five perceived attributes are relative advantage, compatibility, complexity, observability, and trialability. The attributes, their definitions, and the application of these characteristics are outlined in Table 1 (Rogers, 2003).

For each of the four DI theory attributes, variables were operationalized and survey questions developed based in part on a previously validated instrument (Hasin & Smith 2016) which examined the diffusion of electronic benefits transfer (EBT) technology at farmers markets from the market manager's perspective. The questions were adapted using published research about farmer perspectives on FMNI and F2S programs (Atkinson, 2007; Pankratz, Hallfors, & Cho, 2002). Theory variables were measured using a five-point Likert scale of agreement which was coded numerically for analysis (1=strongly disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree,

5=strongly agree).

Barriers to and Impacts of Program Adoption

Barriers to and impacts of program participation were synthesized from previously published literature regarding FMNI and F2S programs (Bateman, Engel, & Meinen, 2014; Matts, Conner, Fisher, Tyler, & Hamm, 2015; Washington State Department of Agriculture Office of Compliance and Outreach, 2012). Barriers were ranked on a four-point scale and then coded (1=not at all a barrier, 2=minor barrier, 3=major barrier, 4=not applicable). Farmers were asked to consider how FMNI and F2S participation impacted financial factors such as income and market access by indicating the degree to which they experienced a change (1=decreased greatly, 2=decreased some, 3=stayed the same, 4=increased some, 5=increased greatly, and 6=not applicable/do not know). Impacts related to economic, social/community, and environmental factors were included in separate sections of the survey, with the goal of having respondents rank the three most important factors within each category. When ranking their top three choices within each category, respondents could also indicate if a given category, for example economic impacts, was not important to them.

Table 1. Core Innovation Characteristics in the Diffusion of Innovations Theory

Attribute	Definition	Application
Relative Advantage	Perception that the innovation is better than its predecessor.	The benefits for farmers may be related to income, market access, social status, or other factors. If a program is seen as more beneficial when compared to other market options (e.g., wholesale), the program is more likely to be adopted.
Compatibility	Perception that the innovation fits in with the potential adopters' existing values, experiences, and needs.	When a program is consistent with a farmer's business model, value system, or sociocultural view, he/she is more likely to participate.
Complexity ^a	Perceived level of difficulty to understand and use the innovation or adopt the intervention.	Programs are less likely to be adopted when they are perceived as complex to the farmer.
Observability	Degree to which results of the innovation or program use are visible to others.	If a farmer is able to observe another farmer who has chosen to participate in a program, they can observe how the program works and the benefits of use. This makes the farmer more likely to adopt, as well.
Trialability ^b (omitted)	Degree to which innovation can be tried before adopting.	If a program can be tried out before an adoption decision is made, there is a greater likelihood of adoption.

^a This attribute is the only one negatively related to adoption; therefore, some have used the term simplicity to maintain uniform directionality across all the attributes.

^b In the case of programs like farmers market nutrition incentive (FMNI) and farm-to-school (F2S) programs, try-outs are not typically possible; therefore, this concept was not included in this study.

Survey Validity and Pilot Testing

Fourteen expert reviewers provided content validity feedback on the farmer survey with five reviewers providing feedback on the FMNI section, seven on the F2S section, and two on the application of DI theory. The experts represented a variety of backgrounds, including the nonprofit sector ($n=2$), farming ($n=4$), farming trade organizations ($n=2$), government ($n=3$), agriculture education and/or training ($n=1$), and behavior change theory research ($n=2$). The majority of feedback was related to question wording and missing concepts within the impact, barriers, and program characteristics categories. Content and design issues raised by expert reviewers were addressed prior to pilot testing.

In November and December 2016, 13 farmers were asked to pilot-test the full survey. These farmers were recruited through one producer conference in New England, a state department of agriculture in New England, and regional agriculture working groups in New England and the Midwest region. Nine farmers participated in both FMNI and F2S, one in F2S only, two in FMNI only, and one in neither program. Each tester completed the survey on a Qualtrics web-based platform, either on a tablet provided to them by research staff or on their personal computer. Participants were asked to engage in a brief discussion following the completion of the survey to provide any additional feedback. Further edits were then made to the survey to clarify or remove questions that were duplicates, lacked relevance to the survey population, or were subject to substantial recall bias.

Survey Sample

The study was conducted using a cross-sectional sample of fruit and vegetable farmers in the Mid-Atlantic region during February and March 2017. The study targeted fruit and vegetable farmers because several FMNI programs are restricted to purchasing only fresh produce, and those types of local agricultural products also are most frequently purchased by schools (USDA Food and Nutrition Service, n.d., 2017). So far, there has been a lack of studies concerning FMNI and F2S programs in the Mid-Atlantic region—Pennsylvania, New Jersey, Delaware, Maryland, Virginia, West Virginia, and

the District of Columbia. To participate, farmers had to meet the following inclusion criteria. The farmer must have:

1. Produced and sold fruits or vegetables for human consumption in 2016;
2. Been an owner, co-owner, or primary decision-maker about marketing for the farm; and
3. Participated or considered participating in the FMNI and/or F2S programs at their current operation.

Farmers were recruited using a snowball sampling technique, with initial contacts at two producer conferences in the Mid-Atlantic region. Additional participants were recruited through organizations and stakeholders in the Mid-Atlantic region with access to the population of interest (e.g., state extension offices, food hubs, nonprofit and/or community organizations, regional agriculture working groups). Surveys were self-administered by respondents via Qualtrics, either by using a tablet provided by the on-site research team at conferences or by using their own personal computers. Respondents who indicated participation in FMNI and/or F2S programs were prompted to answer all three sections of the survey. Those who had considered either program but chose not to participate (i.e., non-adopters) were only asked to complete survey sections one and two. The survey also inquired about demographic, socioeconomic, and farm business information. The study was approved by the researchers' university Institutional Review Board for human subjects research.

Analysis

Means and standard deviations were calculated for each DI theory variable, and t-tests corrected for unequal variance were utilized to compare adopters and non-adopters in each program. Variables were grouped based on their connection to the four main DI theory attributes, and a summary score for each attribute was generated. Additional t-tests were conducted to compare FMNI and F2S adopters and non-adopters. Internal consistency using calculations of Cronbach's alpha were done to determine whether the variables composing each

attribute were measuring the same concept, with alphas of >0.65 being considered acceptable (Goforth, 2015). For the DI attributes related to FMNI, all alphas were >0.65. For F2S, the alphas bordered 0.65, with the attribute of complexity significantly below the cutoff at 0.47. The lower F2S alphas were likely due to the small sample of F2S respondents. Therefore, the variables were all maintained in their respective categories, acknowledging the need for larger future samples to determine reliability.

The barriers for FMNI, sales to schools, and other F2S activities were calculated and ranked based on the percent of respondents indicating that an item was a major barrier. To determine what respondents perceived to be the most important impacts of FMNI and F2S programs, each suggested economic, social/community, and environmental factor was reverse coded and totaled. Adopters were required to rank at least one but no more than three impacts within each category; therefore, the number of respondents for each item varied. Following the ranking, the top three factors in each category were selected based on their total score. The significance level was set at $p < 0.05$ for all analyses. All analyses were conducted using Stata SE, version 14.2 (StataCorp LLC, 2017).

Results

Descriptive Statistics

Of those who met the inclusion criteria, a total of 195 surveys were attempted. However, responses were removed if a majority of questions were left unanswered (36 responses) or there were inconsistencies in the data that suggested a fraudulent submission (4 responses), resulting in a final sample size of 155 farmers. The sample size for each survey section is noted in the tables.

Concerning the programs of interest in this study, 104 farmers responded that they currently participate in FMNI, and 42 responded that they currently participate in F2S. Twenty-nine farmers indicated current adoption of both programs. Those who never considered adoption of FMNI ($n=35$) or F2S ($n=47$) were separated from non-adopters (FMNI=38, F2S=66) and were not asked questions concerning their perceptions of program

characteristics, barriers, and impacts as they would not likely have such perceptions. Farm and farmer characteristics are shown in Table 2. All six states in the Mid-Atlantic region and the District of Columbia were represented in the sample. Based on the USDA definitions of farm size prior to the 2015 definition revisions, the majority of farmers oversaw farms that would be considered small, with 85.5% reporting annual sales below US\$250,000. Most respondents were female (57.4%), White (87.1%), and non-Hispanic (91.6%). There were few differences in farmer demographics and farm characteristics between the adopters and non-adopters in either program; however, FMNI adopters had been farming for

Table 2. Farm and Farmer Characteristics
($n=155$)

Farm Location	%
Pennsylvania	36.1
Maryland	25.8
Virginia	18.1
West Virginia	12.3
New Jersey	3.9
Delaware	1.9
Washington, DC	1.9
Farm Income, by Farm Size Category	
Small farms (<US\$250K)	85.8
Midsize farms (US\$250K–<US\$1mil)	8.4
Large farms (US\$1 mil–<US\$5 mil)	4.5
Very large farms (>US\$5 mil)	1.3
Geographic Location	
Rural	74.2
Urban	11.6
Suburban/semi-urban	14.2
Respondent Position	
Owner or Co-owner	76.1
General Non-owner Operator	10.3
Production Manager	5.2
Sales & Marketing Manager	6.5
Other, please share:	1.9
	mean (SD)
Age	42.9 (13.4)
Years farming	13.5 (11.6)

almost five years longer than non-adopters (14.8 years versus 10.0 years, $p=0.02$).

Data were also gathered about the types and duration of FMNI and F2S engagement reported by farmers to provide a sense of how program participation has changed over time (Appendix, Table A1). The largest number of farmers reported that their farm was authorized to accept WIC or Senior Farmers' Market vouchers, with 25% doing so for more than 10 years. Farmers engaging in F2S most frequently reported providing produce to schools for samples or tastings ($n=31$), with most having engaged in that practice for 1 to 3 years (51.6%).

Farmers Market Nutrition Program Results

Differences in program perception

Table 3 displays the differences between the perceptions of adopters and non-adopters regarding FMNI, all of which were significantly different except for the attribute of observability. The most substantial difference was related to the attribute of complexity, which has been reverse coded in order to provide uniform directionality across all DI factor categories. We interpret this as adopters perceiving the ease of participation to be a mean of 3.4 (out of 5) which differs significantly from non-adopters, who perceive the ease of participation to

Table 3. Diffusion of Innovation Theory Factors Influencing Farmers Market Nutrition Incentive (FMNI) Program Adoption

DI Theory Factor	Magnitude of difference in means (absolute value)	Adopters ($n=104$)	Non-adopters ($n=38$)	p -value*
		Mean value on scale (sd) ^a		
Complexity ^b	1.0	3.4 (0.84)	2.4 (0.71)	0.0000
Compatibility	0.5	4.5 (0.62)	4.0 (0.69)	0.0004
Relative Advantage	0.4	4.3 (0.68)	3.9 (0.73)	0.0015
Observability	0.1	3.6 (0.43)	3.5 (0.56)	0.5434

^a Data are presented as the overall mean score (standard deviation) on 1–5 scale where 1 is strongly disagree & 5 is strongly agree.

^b Note that the scale for the complexity category has been reversed to maintain a uniform directionality across all categories, meaning a high score equates to less complexity.

* p -values in bold show statistical significance at <0.05

Table 4. Top Five Reported Barriers and Perceived Barriers of Farmers Market Nutrition Incentive (FMNI) Program Adoption^a

	Major barrier	Minor barrier	Not at all
Adopters ($n=104$)			
Customers can't afford the prices I have to charge	24.0	51.0	20.2
Volume needs of FMNI markets are too small	15.5	27.2	42.7
Marketing of the FMNI program by market manager or FMNI program leader is not adequate	15.4	33.7	41.4
Customer interest in the produce I sell	14.4	49.0	34.6
Logistics of transporting product to FMNI market locations	6.7	14.4	69.2
Non-adopters ($n=38$)			
Paperwork required to participate in FMNI programs	47.4	44.7	2.6
Availability of training about FMNI program	44.7	44.7	5.3
Receiving prompt payment	31.6	31.6	26.3
Establishing/maintaining farmers' market or FMNI program relationships	29.0	42.1	15.8
The marketing of the FMNI program by market manager or FMNI program leader is not adequate	29.0	23.7	29.0

^a Data are presented as % of respondents identifying each factor as a barrier. Responses are ranked based on the top five most reported major barriers for adopters and non-adopters within each category. Rows may not add up to 100% because the "not applicable" category is not shown here.

be a mean of 2.4. Tables A2 and A3 (Appendix) present the detailed comparison of the individual variables composing the four DI theory attributes. As expected, FMNI program adopters showed significantly more favorable perceptions of program characteristics than FMNI non-adopters.

Barriers to participation

Table 4 presents differences in the top five reported barriers to participation in FMNI stratified by adopters and non-adopters. Both FMNI adopters and non-adopters saw the marketing of the program to be a concern. Just over 15% of adopters and 29% of non-adopters perceived marketing to be a major barrier. Otherwise, perceptions of top barriers differed between the two groups. Adopters largely cited customer and market characteristics as key barriers, while non-adopters were concerned more with program logistics. Overall, non-adopters saw more barriers to program engagement than adopters.

Impacts of participation

Sixty-four percent of FMNI adopters reported that, overall, farm income increased some or greatly as a result of participation. They also reported that the types of markets accessed were either the same or slightly more varied and diverse than before

program adoption. As a part of their overall farm sales, FMNI adopters also observed increases in the percent of sales from farmers markets and farm stands (55%). When asked which category of impacts were most important to them, 74% of FMNI farmers ranked social/community impacts highest, with economic and environmental impacts being of lesser importance. Table 5 further illustrates the top three most important impacts within each category. For 44.2% of FMNI famers, helping to feed low-income individuals was the most important social/community impact. Twenty-one percent of FMNI farmers indicated that economic factors were not a motivation for them. Overall, environmental factors were of lower importance to adopters in both programs.

Farm to School Program Results

Differences in program perception

Only perceptions of relative advantage and observability significantly differed between F2S adopters and non-adopters (Table 6). For example, adopters perceived F2S to be advantageous with a mean score of 4 (out of 5), while the mean score for non-adopters was 3.5. Program perceptions tended to be similar between adopters and non-adopters among individual questions, especially

Table 5. Impacts of Farmers Market Nutrition Incentive (FMNI) Program Participation (n=104)^a

Category of Impact	% ranking as top impact category	within category, % ranking as...		
		1st	2nd	3rd
Social/community Impacts	74.0			
Helps to feed low-income individuals		44.2	22.1	9.6
Positively impacts the nutrition & health of the community		19.2	47.1	14.4
Raises public awareness about food & farming		9.6	11.5	27.9
Economic Impacts	23.1			
Increases my sales at existing markets		47.1	14.4	6.7
Allows me to charge a fair price, since low income shoppers have help buying my produce		17.3	28.9	13.5
Not motivated by economic factors		21.2	2.9	9.6
Environmental Impacts	1.9			
Have customers that value more sustainable growing practices		38.5	17.3	3.9
Not motivated by environmental factors		33.7	1.9	1.9
Help me to keep my land in farming instead of another use		17.3	11.5	9.6

^a Represented here are the top three most important factors by category. They are listed largest to smallest in terms of the total number of respondents ranking each factor in their top three choices of impacts.

Table 6. Diffusion of Innovation Theory Factors Influencing Farm-to-School (F2S) Program Adoption

DI Theory Factor	Magnitude of difference in means (absolute value)	Adopters (n=42)	Non-adopters (n=66)	p-value*
		Mean value on scale (sd) ^a		
Relative Advantage	0.5	4.0 (0.14)	3.5 (0.11)	0.0118
Observability	0.4	3.2 (0.11)	2.8 (0.09)	0.0068
Complexity*	0.3	2.9 (0.11)	2.6 (0.11)	0.1059
Compatibility	0.1	3.9 (0.07)	3.8 (0.07)	0.1333

^a Data are presented as the overall mean score (standard deviation) on 1–5 scale where 1 is strongly disagree and 5 is strongly agree.
^b Note that the scale for the complexity category has been reversed to maintain a uniform directionality across all categories, meaning a high score equates to less complexity.
 * p-values in bold show statistical significance at <0.05

Table 7. Top Five Reported Barriers/Perceived Barriers of Farm-to-School (F2S) Program Adoption^a

Potential Barriers to F2S Sales	Major barrier	Minor barrier	Not at all
Adopters (n=42)			
Schools lack the capacity to do scratch cooking or serve fresh food (e.g., staff skills, equipment, space)	52.4	16.7	11.9
School(s) offer low purchase price and/or have food budget constraints	40.5	31.0	14.3
Lack of investment from the food service director or manager to engage in farm to school sales and activities	35.7	28.6	16.7
Contract/bidding process that is required by school district(s)	33.3	26.2	9.5
Volume needs of schools are too large	28.6	21.4	31.0
Non-adopters (n=66)			
Schools lack the capacity to do scratch cooking or serve fresh food (e.g., staff skills, equipment, space)	52.3	20.0	9.2
Volume needs of schools are too large	50.8	21.5	15.4
Contract/bidding process that is required by school district(s)	50.8	18.5	7.7
Lack of knowledge about which schools are interested in buying directly from farms	50.8	26.2	10.8
Seasonality of my products don't match with school year	49.2	24.6	10.8
Potential Barriers to Other F2S Activities			
Adopters (n=42)			
Logistical challenges in coordinating visits to classrooms or cafeterias	19.1	40.5	16.7
The time involved in visiting classrooms or cafeterias	19.1	28.6	28.6
The time involved in hosting field trips at my farm	11.9	31.0	31.0
The cost of bring students to my farm for field trips	11.9	23.8	33.3
Logistical challenges in coordinating field trips to my farm	9.5	31.0	35.7
Non-adopters (n=66)			
The cost of bring students to my farm for field trips	21.5	20.0	33.9
Logistical challenges in coordinating visits to classrooms or cafeterias	18.5	33.9	26.2
Logistical challenges in coordinating field trips to my farm	15.6	28.1	32.8
The time involved in hosting field trips at my farm	15.6	28.1	34.4
The time involved in visiting classrooms or cafeterias	9.2	35.4	32.3

^a Data are presented as % of respondents identifying each factor as a barrier. Responses are ranked based on the top five most reported major barriers for adopters and non-adopters within each category. Rows may not add up to 100% because the "not applicable" category is not shown here.

those related to the attributes of complexity and compatibility; however the reliability of the complexity measure (as indicated by Cronbach's alpha) was marginal (Appendix Tables A2 and A3).

Barriers to participation

Both F2S adopters and non-adopters ranked the limited capacity of schools to cook from scratch as the most substantial barrier to engagement in F2S sales (Table 7), with approximately 52% of respondents in each group ranking it as a major barrier. Issues with contract and/or bidding processes and the large volume needs of schools were also in the top five for both groups. The remaining barriers differed between the two, with adopters experiencing challenges with school budget constraints and a lack of investment by food service leadership. Major challenges related to other F2S activities were reported less frequently than with F2S sales. For both sets of F2S barriers, non-adopters generally ranked items as major barriers more often than adopters.

Impacts of participation

Fifty percent of F2S adopters reported overall farm income increasing some or greatly as a result of participation. The variety of markets accessed was perceived to be the same or slightly higher than before program adoption. F2S adopters largely

reported no changes to the variety of products they sell. Seventy-nine percent of adopters ranked social/community impacts of highest importance, followed by economic and environmental impacts (Table 8). Specifically, teaching kids about farming and food production was cited as the most important social/community impact. Thirty-one percent of F2S adopters were not motivated by economic factors, and environmental factors were also of lower importance overall.

Discussion

With the goal of more deeply understanding the adoption, barriers, and impacts of FMNI and F2S programs, our survey of Mid-Atlantic fruit and vegetable farmers uniquely captured the perspectives of both program adopters and non-adopters. Our results indicate that adopters of both FMNI and F2S perceive the programs to be more advantageous than non-adopters, specifically related to the potential social impact and market opportunities provided by these programs. However, adopters and non-adopters differed in their perceptions of program characteristics and perceived barriers to adoption in ways that likely impact the decision to participate in FMNI and F2S programs. The most frequently reported barriers concerned issues with product pricing, customer engagement, program logistics, and administration.

Table 8. Impacts of Farm-to-School (F2S) Program Participation (n=42)^a

Category of Impact	% ranking as top impact category	within category, % ranking as...		
		1st	2nd	3rd
Social/community Impacts	78.6			
Teach kids about farming and how food grows		33.3	23.8	21.4
Positively impact the nutrition & health of kids		21.4	23.8	21.4
Help build relationships between me and nearby communities		23.8	11.9	19.1
Economic Impacts	21.4			
Not motivated by economic factors.		31.0	2.4	0.0
Help to build my future customer base		11.9	16.7	7.1
Provide me with large volume orders		14.3	11.9	4.8
Environmental Impacts	0.0			
Teach kids about environmental issues and sustainable farming		69.1	4.8	2.4
Keeps "seconds" or lower grade produce from being wasted		7.1	16.7	4.8
Support lower transportation emissions by keeping my distribution local		2.4	16.7	9.5

^a Represented here are the top three most important factors by category. They are listed largest to smallest in terms of the total number of respondents ranking each factor in their top three choices of impacts.

Social/community impacts were a clear motivating factor for farmers, with approximately 75% of respondents ranking those impacts as most important in deciding whether or not to participate.

FMNI Program Perceptions and Barriers

The DI theory framework helped to illuminate certain differences in program perceptions that may lead to program adoption. We found that FMNI adopters perceived the program to be less complex, more advantageous, and more compatible with their business model and values than non-adopters. Even with these differences, we still found that non-adopters appreciate the role of FMNI in community food systems to the same degree as adopters and find value in supporting food access for low-income communities. The more substantial differences were related to perceptions of the program structure and logistics, encompassed by the attributes of relative advantage and compatibility. The differences between FMNI adopters and non-adopters indicate that once farmers participate in the program, they no longer view issues like payment, program procedures, and the fit of the program into their business model as concerns. Outreach to potential participants by FMNI sponsoring agencies and farmers markets could more explicitly highlight that logistical aspects of the program are not as burdensome as they may seem. Furthermore, outreach could also highlight that support is available at the state and local level to navigate program administration.

These differences in program perception also relate to the perceived barriers to FMNI participation. There was a general consensus that market managers could improve the advertising of the FMNI programs. Successful pilot projects and a recent USDA Food and Nutrition Service study (Karakus et al., 2014; Low et al., 2015) found that low-income survey respondents were 40 times more likely to shop at farmers markets if they had knowledge of these markets providing incentives for SNAP participants. With this in mind, improved marketing of the program could help mitigate affordability issues and increase farmer revenue. Other barriers experienced by FMNI adopters were related to customer budgets, the preference for certain food items, the volume

needs of the market, and the logistics of transport to market locations. To address cost issues, some farmers and markets have established “pay-what-you-can” or sliding scale models. Others have chosen to host a CSA pick-up site at lower income markets to help to create more efficient food distribution. While more difficult to coordinate, assessing the community’s food preferences in order to shift growing practices, offering cooking demonstrations, and providing taste tests may be additional ways to increase the sale of produce items.

For non-adopters, perceived barriers relate mostly to issues of start-up and program logistics. Knowing that these issues are not relevant for adopters, it is essential that recruitment efforts clearly explain the logistical ease of the program and that trainings provided by state and local level program administrators are accessible to potential adopters. FMNI program sponsoring agencies could further improve their reach through the development of recruitment partnerships with new farmer training programs, state extension offices, and other groups focused on market access for small to midsize producers.

F2S Program Perceptions and Barriers

Similar to FMNI respondents, all F2S respondents viewed school-based local agriculture programs as valuable within community food systems and prioritize providing food to local school children. Not surprisingly, F2S adopters perceive the program to be more advantageous and a better fit with their business model than non-adopters, which may explain in part their decision to participate. However, it is notable that program complexity and logistics are a concern regardless of participation status. While this may not be surprising, more research with a larger sample of farmers participating in F2S programs may be needed to understand why some farmers choose to engage despite knowing about these challenges while others do not. While difficult to execute, there is still room to improve the technical and logistical support available to farmers interested in engaging with schools. These improvements include assistance with building relationships with potential school partners, navigating the contracting and bidding process, and

managing produce deliveries. The provision and marketing of this additional support could help shift the mindset of those who have chosen not to participate.

Regarding F2S sales, both adopters and non-adopters saw the lack of capacity of schools to scratch cook or serve freshly prepared food (compared to serving frozen, heat-and-serve meals) as the biggest barrier. This is not a new concern, as many school districts have shifted away from scratch cooking since the early 1980s. At that time, large-scale budget cuts forced schools to reduce spending on food and labor while also increasing business. This often meant serving quick, “kid-friendly” meals like pizza and fries that required less skill, thus saving money and staff time (Poppendieck, 2011). Partially in response to the lack of scratch cooking capacity and other F2S barriers, federal-level support for F2S was formally established in the 2010 Healthy Hunger Free Kids Act. This legislation created a USDA F2S program to fund training and technical assistance for key program stakeholders through a competitive grant program. Additional initiatives at the federal, state, and local levels have even been put into place to help districts procure kitchen equipment to process and store fresh food, which might include items like large-capacity food processors, knife sets, cutting boards, and additional refrigeration space (The Pew Charitable Trusts, 2013; USDA Food and Nutrition Service, 2014). Efforts have also been made to provide culinary training and professional development for food service staff (Cohen, Richardson, Cluggish, Parker, Catalano, & Rimm, 2015; Dill, 2017; Stephens & Byker Shanks, 2015). Despite these advancements, there is still a need to invest in school and kitchen infrastructure upgrades and more widespread food service staff training to support a shift towards more scratch cooking in school meal programs.

Other barriers cited by both F2S adopters and non-adopters included the burdensome contract and bidding process and the fact that school volume needs may exceed farmers’ capacity. To help better understand procurement issues, a pilot project within the 2014 farm bill created more flexibility for eight states to use geographic preference to purchase unprocessed, local fruits

and vegetables using USDA dollars slated to school meal purchases (Low et al., 2015). Geographic preference is a strategy used by school districts during contracting and bidding processes that allows local producers to receive “preference points” when their proposal is being weighed against other, non-local producers (USDA Farm to School Program, 2014). States and localities have also passed legislation making it easier for school districts to give preference to local food producers when making purchases (Low et al., 2015). Additionally, it is becoming more common for school districts and external partners to engage in collective bidding processes and coordinate bulk food purchases in order to lessen these as challenges (Conner, Nowak, Berkenkamp, Feenstra, Van Soelen Kim, Liquori, & Hamm, 2011). Matching programs and technology platforms have been successful at better synchronizing school supply with farmer demand, which may be a barrier that aggregators can help address. Geographic preference policies and other types of logistical support await further evaluation regarding their effectiveness in increasing farmer participation in F2S programs. If successful, these strategies could offer support to allow these programs to expand.

Lastly, it is noteworthy that fewer logistical and financial barriers are present when considering other F2S activities beyond sales, such as engaging in classroom and cafeteria visits and hosting field trips. These activities may not have a significant financial impact for farmers in the short term, but may influence children’s future food purchasing decisions. For farmers interested in engaging with schools for the first time, these activities present low hanging fruit that may assist them in developing relationships with food service staff and gaining a greater understanding for school food demands, while potentially leading to more in-depth involvement in F2S activities and sales.

Impacts of FMNI and F2S Participation

When considering the impact of FMNI and F2S programs within the local food movement, often the selling point for participation is diversified market opportunities for farmers and increased revenue. However, we found that farmers report being most driven by the urge to support their

community. Not only are farmers socially motivated, but social/community impacts were ranked as overwhelmingly more important than either economic or environmental impacts for both FMNI and F2S respondents. In fact, a substantial portion of respondents indicated that economic impacts were not ranked in their top three. Of course, it is still important to highlight the economic impacts of these programs in conjunction with the social impacts, as it is essential that engagement in FMNI and F2S is profitable for farmers. Respondents indicated that both programs helped to increase overall farm income, which is key to the long-term retention of farmers within these programs. Lastly, environmental factors were of tangential importance to farmers when thinking about the overall impacts of FMNI and F2S. In addition, there may be differences in how farmers rank environmental impacts based on their choice of farming practices (i.e. organic, certified naturally grown). More research is needed to explore that potential distinction.

Strengths and Limitations

A major strength of this study was the use of the DI theory as a framework for understanding the adoption of FMNI and F2S programs. The DI theory suggests that, as information about an innovation is communicated over time among members of a social system, adoption of the innovation will occur in waves. Innovations that require new technology, are complex, or are composed of a cluster of components tend to take longer to adopt (Rogers, 2003). Understanding these elements within the context of FMNI and F2S programs helps to illuminate how the adoption of each program has occurred. While this study provides a very preliminary glimpse at the timeline by which FMNI and F2S program adoption has occurred, more research is needed to understand how those who adopted in the first wave differ from those at later phases of adoption. In the future, measuring the communication channel and social system supporting program adoption will further enhance these research findings. Unfortunately, the cross-sectional and largely retrospective nature of this study limited our ability to collect those data. Another strength of this study was the inclusion of

both program adopters and non-adopters, allowing us to uniquely capture the perspectives of those who have considered participation but chose not to engage. The insights of non-adopters are key when strategizing about recruitment and retention of future program participants. Limitations did include the small sample size and the possible sampling error (e.g., selection bias) resulting from the snowball sample. Due to the sampling strategy and geographic constraints on the study population, the results may not be representative of produce farmers throughout the Mid-Atlantic or the broader United States, and generalizability is limited. Lastly, there may be instances where recall bias was a factor, especially for farmers who were asked to recall the factors that influenced decisions they made years ago.

Implications

Knowing that FMNI and F2S programs strive to alleviate local food system inequities and provide more diversified markets for farmers, the findings from this study can improve program design and implementation and aid in recruiting additional FMNI and F2S adopters. FMNI and F2S sponsoring organizations may find success developing recruitment and technical assistance partnerships with more traditional agricultural agencies, like the Farm Bureau, state extension, and offices of rural development, agricultural marketing, as well as family and small farms. With their broader stakeholder base and existing infrastructure, these types of agencies would help to reach farmers that may not have considered FMNI or F2S and could provide a stronger foundation for program delivery.

This study also provides evidence about the importance of programs like FMNI and F2S for America's farmers. Legislative and funding support is essential to ensure that these programs continue successfully in the 2018 farm bill. Efforts should focus on maintaining the Food Insecurity Nutrition Incentive Grant Program, the Farmers Market and Local Food Promotion Program, Specialty Crop Block Grants, Community Food Projects, and the Senior Farmers Market Nutrition Program. Additionally, strengthening state and local contracting and bidding policies to minimize local food

procurement barriers and supporting an increase in school meal reimbursement amounts would enhance the ability of schools to buy from local farms. Building on the results of this and prior studies, future research related to FMNI and F2S programs is needed to capture longitudinal impacts on the local economy, child and community health outcomes, and community food security. 

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Appendix

Table A1. Length of Participation by Program

Farm Nutrition Incentive Program Activities	<i>N</i>	1 to <3 yrs	3 to <5 yrs	5 to <10 yrs	>10 yrs
My farm is authorized to accept WIC or Senior Farmers' Market vouchers (FMNP).	83	22.89%	31.33%	20.48%	25.30%
Through the farmers' market management, my farm accepts WIC or Senior Farmers' Market vouchers (FMNP).	62	24.19	24.19	25.81	25.81
Through the farmers' market management where I sell, SNAP/EBT shoppers spending is matched.	52	36.54	30.77	28.85	3.85
My farm accepts vouchers or matches SNAP spending for Community Supported Agriculture (CSA) bundles.	21	38.10	52.38	9.52	0.00
My farm sells box/bundle of produce delivered directly to low income or senior shoppers (i.e., as a part of the Commodity Supplemental Food Program).	15	46.67	33.33	13.33	6.67
Farm to School Activities	<i>N</i>	1 to <3 yrs	3 to <5 yrs	5 to <10 yrs	>10 yrs
Provided produce to a school for samples or tastings	31	51.61%	22.58%	12.90%	12.9%
Hosted a school group at your farm	29	37.93	13.79	31.03	17.24
Was a guest speaker in a classroom or at educational event at a school	28	39.29	25.00	25.00	10.71
Worked with a school food service director or farm to school program lead to plan for future sales	23	69.57	13.04	13.04	4.35
Sold one or more types of vegetables directly to one or more schools	22	54.55	27.27	18.18	0.00
Provided a school with marketing or promotional materials about your farm	21	57.14	4.76	28.57	9.52
Sold one or more types of fruit directly to one or more schools	18	44.44	39.89	5.56	11.11
Attended a school meal as a guest	15	66.67	13.33	13.33	6.67
Attended a National Farm to School Month event at a school or in community	14	64.29	14.29	14.29	7.14
Sold other products (e.g. meat, eggs, dairy) directly to one or more schools	5	80.00	0.00	20.00	0.00
Other	5	40.00	20.00	40.00	0.00

Note: Data are presented as the % of farmers engaging in each activity for the designated number of years.

Table A2. Components of Diffusion of Innovation Theory Score, Factors Influencing Farmers Market Nutrition Incentive (FMNI) Adopters and Non-Adopters

DI Theory Factor	Magnitude of difference in means (in absolute value)	Adopters (n=104)	Non-adopters (n=38)	<i>p</i> -value
		Mean value on scale (sd) ^a		
Compatibility				
Accepting FMNI would fit in with my system for collecting payment	1.3	4.2 (1.04)	2.9 (1.23)	0.0000
Selling at markets with an FMNI program could fit easily into a farm's business plan	0.6	4.4 (0.82)	3.9 (1.21)	0.0094
I value helping lower income shoppers get local fruits and vegetables	0.0	4.8 (0.60)	4.8 (0.62)	0.7369
FMNI programs are an important part of the local food movement	0.1	4.5 (0.74)	4.4 (0.95)	0.4925
Relative Advantage				
Benefits of participating in FMNI programs outweigh the challenges	0.9	4.4 (0.85)	3.5 (1.11)	0.0000
FMNI would increase the sales of farmers who participate	0.6	4.4 (0.82)	3.8 (0.96)	0.0025
FMNI programs would bring more customers to the farmers' market	0.4	4.3 (0.83)	3.9 (1.02)	0.0464
FMNI would help farmers reach neighborhoods or markets that they might not have before	0.1	4.3 (0.85)	4.4 (0.64)	0.6117
Complexity				
Getting reimbursed as a part of the FMNI program could require too many steps ^b	1.3	2.4 (1.12)	3.7 (0.90)	0.0000
Information about FMNI programs is easy to understand	1.1	3.9 (1.02)	2.8 (1.15)	0.0000
Process of participating in FMNI (paperwork, accounting, labor, etc.) would take more time and effort ^b	0.7	3.4 (1.16)	4.0 (0.82)	0.0004
Observability				
Other farmers had experienced problems when participating in FMNI programs ^b	0.6	2.8 (0.95)	3.4 (0.75)	0.0003
Customers seemed satisfied with the FMNI program	0.5	4.2 (0.76)	3.7 (0.96)	0.0048
Other farmers and vendors seem satisfied with the FMNI program	0.3	3.7 (0.84)	3.5 (0.95)	0.1468

^a Data are presented as the overall mean score (standard deviation) on 1–5 scale where 1 is strongly disagree and 5 is strongly agree.

^b Reverse coded for the overall average DI theory component score in Table 3.

p-values in bold show statistical significance at <0.05

Table A3. Components of Diffusion of Innovation Theory Score, Factors Influencing Farm to School (F2S) Program Adopters and Non-Adopters

DI Theory Factor	Magnitude of difference in means (absolute value)	Adopters (n=42)	Non-adopters (n=66)	p-value
		Mean value on scale (sd) ^a		
Relative Advantage				
Benefits of participating in F2S programs would outweigh the challenges	0.8	3.9 (1.09)	3.1 (1.22)	0.0004
F2S programs diversify farmers' economic opportunities	0.1	4.0 (0.95)	4.0 (0.90)	0.7073
Compatibility				
Selling to a school or schools can fit easily into the business plan for a farm	0.6	3.7 (1.16)	3.1 (1.31)	0.0137
F2S programs are an important part of the local food movement	0.4	4.6 (0.59)	4.2 (1.06)	0.0187
Selling to a school or schools would require more effort than selling to other types of markets	0.3	4.1 (0.99)	3.7 (1.29)	0.1297
I highly value helping children access local foods (such as local fruits and vegetables)	0.1	4.7 (0.68)	4.6 (0.80)	0.4916
I highly value teaching kids about farms and the job of farmers	0.0	4.7 (0.74)	4.7 (0.70)	0.9042
Complexity				
Information would be easily available explaining how to contact schools about working together	0.3	3.2 (1.13)	2.9 (1.38)	0.164
There would be adequate step-by-step instructions on how to participate in a F2S program	0.3	3.4 (1.13)	3.1 (1.27)	0.171
Process of participating in F2S (paperwork, accounting, labor, etc.) would take more time and effort ^b	0.1	4.0 (1.01)	4.1 (0.92)	0.6392
Observability				
Schools seemed satisfied with the F2S program	0.6	3.6 (1.01)	3.1 (0.85)	0.0021
Other farmers seemed satisfied when selling to schools or doing F2S activities	0.4	3.3 (1.00)	2.9 (0.97)	0.0433
Other farmers had experienced problems when working with schools ^b	0.2	3.3 (0.68)	3.5 (0.81)	0.2284

^a Data are presented as the overall mean score (standard deviation) on 1–5 scale where 1 is strongly disagree and 5 is strongly agree.

^b Reverse coded for the overall average DI theory component score in Table 6.

p-values in bold show statistical significance at <0.05