Mapping Farm-to-School Networks
Implications for Research and Practice

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In this article, the contemporary Farm-to-School movement is described as a system comprised of discrete actors operating at varying levels of geographic scale, social sector, and network function. Drawing on a literature review and case study research, the authors present and analyze a Farm-to-School network in Vermont as a series of relationships between network actors predicated on the flow of financial resources, whole and processed foods, information, and regulatory authority. Furthermore, the utility for using this map to critically examine the leverage points that may drive positive change within and across the system is discussed.

KEYWORDS systems science, Vermont, classroom, cafeteria, community

INTRODUCTION

Critiques of the dominant agri-food system and discussions of the potential benefits of an alternative agri-food system have appeared in the literature for decades. Using a wide variety of terms, including sustainable agriculture, civic agriculture, and alternative agri-food supply chains, scholars have discussed a wide array of environmental and socioeconomic benefits associated with food systems, centered around premises of sustainable practices.1 Other threads of inquiry and action concern the functional relationship

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between public health, nutrition, and community food security.2–5 These lines of inquiry and practice are based on broadened participation by diverse stakeholders, closer linkages between production and consumption, and emphasis on the connections between a series of related issues of great importance including economic development, land use, and public health.3

The focus on food production and consumption as a systems construct provides researchers and practitioners alike with an opportunity to consider the relationship between food and other facets of social life and agricultural practices. Using the food system as a unit of analysis requires deeper consideration of the component parts that make up the system as well as the relationship between these parts. Viewed through a systems lens, all or part of the food system may be studied or consciously modified through a variety of programmatic and public policy interventions.

One set of programmatic and public policy interventions that has garnered a great deal of attention is the farm-to-school (FTS) movement. FTS blends the movement toward more sustainable food and agricultural practices with the expanded view that food systems are integrated with other social and policy domains, including health and education. Referred to as both the “vanguard” and “one of the most conspicuous efforts”6(p.335) to develop alternative more sustainable food systems, FTS began as early as 1997 in California and Connecticut and has drawn the attention of many scholars and practitioners in recent years. One study defined FTS as “the ability to connect schools with local and regional farmers to benefit both sets of participants.”7(p415)

FTS advocates and practitioners attempt to apply the lessons and practices of sustainable agriculture and community-based food systems to school meals, with the goal of improving both childhood nutrition and farm profitability. Yet, the literature is rife with discussion of the barriers and difficulties in fostering FTS efforts. Given the multiple stakeholders, conflicting agendas, and complicated regulations, improving school lunch has proven to be a “wicked problem.”8 Batie9 defined the challenges as dynamically complex, ill-structured, public problems,(pp1176–1177) and called for engaged scholarship that “requires both use-driven science that recognizes and addresses uncertainties and meaningful engagement of stakeholders in decision-making that propels knowledge into action”(p1181) to address this class of problems. Batie9 further discussed the shortcomings of normal linear science (including the majority of applied economics) in addressing these problems, citing ecological economics and its reliance on systems perspectives as a better candidate for addressing their complexity.

FTS is intermeshed with one of the nation’s largest and most important nutrition programs, the National School Lunch Program (NSLP). The NSLP is large: recent reports have stated that the NSLP serves meals to more than 30.5 million children each day at more than 101 000 school and child care institutions, at a cost of $9.3 billion in Fiscal Year 2008.10 The NSLP has 2
broad goals: enhancing childhood nutrition while providing market support for US agricultural products, not unlike FTS’ goals. Despite the magnitude of its budget, many find shortcomings in the performance of NSLP vis-à-vis its goals. Critiques of the nutritional value of school meals focus on their reliance on highly processed foods with concomitant high levels of sugar, fat, and sodium and inadequate fiber, as well as insufficient efforts at combating childhood obesity. Others bemoan the lack of market opportunity for small- and medium-sized farms, stating that the NSLP mainly serves as a market for a small number of very large farms, even though the majority of US farms are small.11

Placed in a systems construct, the NSLP is comprised of a complex network of federal-level agencies, large industrial farms, industrial-scale food processing plants, national distribution networks, state and local procurement systems, and virtually every public school district in the United States. FTS networks share certain parallel and nested features of the NSLP network. The networks that exist to support FTS programs utilize the same school-level institutional structures used to implement the NSLP. FTS programs feature more locally based farmers and regional distribution centers. Those FTS programs that include links to the school curriculum will also involve teachers and school administrators, bringing a range of knowledge and hands-on experiences of local farms, food-growing practices, and healthy eating habits directly to students, who are also the consumers of school lunches. The types of resources that flow between these actors include funding and a range of whole and processed foods. The relationships between these actors may also be structured by certain regulatory expectations: federal-level nutritional standards and standards for determining eligibility for free- and reduced-price lunches.

In this article we introduce a map of the range of actors that encompass both the NSLP and FTS programs. The utility of such a map is 2-fold: (1) the map provides educators, researchers, and practitioners with a mental model12 of the diversity of FTS network actors and the kind of ties that exist between them; and (2) the map provides policy makers, advocates, and practitioners with some insights into where certain “leverage points” (might exist to bring about improvements to the system.13

Specifically, this analysis attempts to answer these questions: who are the actors and stakeholders implicated in most FTS programs and how do they relate to one another? The next section of this article will review prior studies on FTS, highlighting major themes, opportunities, obstacles, and lessons learned, before turning to discussing efforts in Vermont in particular. A brief discussion of systems methodology and the methods used to create and analyze the systems map follows. The map itself is then presented, after which results are discussed in comparison to prior research. The article concludes with limitations and directions for future research.
PRIOR RESEARCH ON FARM TO SCHOOL

The growing body of literature on FTS programs across the country defines their 2 main functions generally as (1) procurement and preparation of locally produced foods for school meals and (2) experience-based educational activities addressing the agricultural, culinary, and nutritional qualities of such foods. The procurement and preparation component accomplishes 4 distinct aims. These are to (1) improve students’ nutritional intake; (2) create markets for small- and medium-sized farmers in the schools’ own communities and regions; (3) strengthen local economies by spending a greater percentage of school food services’ budgets on foods produced nearby; and (4) enhance the natural environment by supporting sustainable agricultural practices.

The experiential educational component of most FTS programs has been shown to increase students’ appreciation and preferences for healthful foods that are produced locally in an environmentally sound manner and is often portrayed as the overarching goal of FTS programs. FTS is also described as decreasing the social distancing between food production and consumption by fostering efforts which bring food to consumers with the farmer’s face or story on it. As an effort to decrease the social distancing and put the farmer’s face on the food, it is therefore not surprising that FTS is at the forefront of the United States Department of Agriculture’s (USDA) Know Your farmer Know Your Food initiative in its pursuit of broad community development goals.

Advocates believe that the combined application of both these components of FTS programs—local food procurement and experience-based education—is instrumental in encouraging students’ consumption of healthful, locally produced food. Research on school gardens demonstrates that experience-based agricultural education increases students’ willingness to eat fruits and vegetables.

Previous research on FTS has outlined a broad array of actors involved in advocacy and practice, including foodservice and other school professionals, distributors, farmers, and community partners. A broad set of potential benefits is discussed, including supporting the local economy, increasing fruit and vegetable consumption, procuring fresher produce, contributing to the wider educational mission, and enhancing overall community pride.

Barriers to FTS from schools’ perspectives fall into several categories: increased cost; ordering logistics (reliability, transaction costs); lack of handling, preparation, and storage capacity (both labor and equipment); food safety and liability; and efficiency in transport and distribution. From distributors’ standpoints, obstacles to FTS include competition from year-round production areas, existing relationships with farmers/suppliers, and the need for more local processing. Some distributors also cite consumer indifference.
and buyers’ emphasis on price, quality, and service over locally grown characteristics.\textsuperscript{16,20,24,34,37}

Barriers to local school food procurement have been identified in terms of their effects on farmers. These include the low prices that farmers generally receive from school foodservice customers, as well as an inefficient infrastructure for wholesale distribution by small- and medium-sized farms. These factors together seem to keep FTS sales from significantly augmenting the incomes of participating farmers. Smaller scale farmers often have difficulties affording liability insurance and meeting desired quantities, postharvest, and hazard analysis critical control point (HAACP) requirements.\textsuperscript{6,17,20}

Accordingly, the economic incentives for farmers to sell directly to school foodservices appear to be relatively minor. Recent studies found that these farmers do not sell much produce to schools but that they considered these sales to be a token diversification of their ordinary markets, an outlet for products they could not sell elsewhere, and a small supplement to their incomes during the fall and winter months.\textsuperscript{6}

Several related themes run through examples of the barriers to FTS from these multiple perspectives, including a lack of funds, coordination, and capacity. The small amount of money schools can allocate to fruit and vegetable servings limits school markets’ contributions to farm income. This is compounded by schools’ preference for precut produce delivered by broadline distributors, each of whom requires a slice of this small pie, further decreasing farmers’ returns.\textsuperscript{16} From the school’s standpoint, even if local produce is cost neutral, many lunch programs require additional financial resources to fund the equipment and human resource development needed to receive, handle, prepare, and serve locally grown whole foods.

Another set of barriers includes broad lack of coordination and capacity for distributing, processing, procuring, and preparing local foods. From a distributor’s standpoint, if only a few school buyers want local produce with the farmer’s face and story on it, the transaction costs and effort of addressing the well-known logistical problems of coordinating reliable procurement are formidable in the face of limited supply capacity. Delivering precut fresh produce with the specific farm identified on it may also require coordination with processors, who would likely need to run such a product as a separate batch; furthermore, only a limited number of processors are willing to do so.\textsuperscript{35}

The literature also provides a number of key lessons and suggestions. First, there are educational and communication needs for both farmers and foodservice buyers to promote mutual understanding of the realities each faces, as well as pertinent regulations and product specifications.\textsuperscript{36,37} Strong leadership and “champions” for efforts from school service professionals, including closer relations and greater buy-in from staff, is critical in this respect.\textsuperscript{35,38} Second, channeling locally grown produce through snack,
rather than lunch, provision has advantages such as flexibility, smaller scale, and simplicity, which makes it a good candidate for pilot efforts. Finally, although several states have robust FTS programs\textsuperscript{36} integrated into their schools, Vermont’s FTS programs are especially notable for both their history and scope, characterized by well-coordinated partnerships between state government and nonprofit organizations. Vermont Food Education Every Day (VT-FEED) is a particularly prolific nonprofit, having provided technical assistance to more than one third of Vermont’s 300 schools over 10 years. The state government is also an active promoter of FTS: since 2007 the Vermont Agency of Agriculture, Food, and Markets (VAAFM) has administered a competitive grant program for schools planning and implementing FTS programs. Because they are so well established, FTS programs in Vermont may offer useful context and insights to researchers and practitioners developing programming elsewhere, though it is important to note that the state’s small size and lack of large urban areas set it apart from many others and so may limit the external validity of findings.

A hallmark of VT-FEED’s efforts is the integration of efforts among 3 dimensions, as described by their 3 C’s model: Community, Classroom, and Cafeteria. Community in this context can include a broad array of stakeholders including farmers, parents, and citizens. VT-FEED’s efforts recognize the value of positive mutual reinforcement—positive feedback loops—which accompanies efforts linking these 3 aspects of FTS. Links between (1) classroom and cafeteria and (2) classroom and local community farmers can foster experiential learning opportunities central to FTS, creating and reinforcing good eating habits and lifelong demand for healthful, locally grown foods. Classroom–parent and cafeteria–parent links can further reinforce good eating habits and increase school meal participation and revenue. Marketing of the school foodservice’s (cafeteria’s) local procurement efforts (and the concomitant health/nutrition and community economic benefits to the broader citizen community) can foster support and stakeholder buy-in for policies and practices that favor FTS. Vermont FEED, with its 3 C’s model, also facilitates coordination and increases capacity by providing technical assistance, sharing best practices and educational resources for both food-service workers and students, as well as providing some financial assistance for the implementation of FTS efforts.

GOVERNANCE NETWORK METHODOLOGY

We have noted how FTS programs are comprised of a diverse array of organizational and individual actors. The unique characteristics that FTS programs bring to the more established, institutionally based NSLP, which has traditionally driven school lunch provision, are the added actors that find new roles in this system. These actors range from regional nonprofit
organizations such as VT-FEED, to local farmers, to the teachers who work to integrate local food systems into their curriculum.

In reality, NSLP and FTS programs form the basis of a complex network of actors ranging from the federal level pride to the household level. We characterize these networks as one form of “governance network” that exists to carry out one or more policy function. In this case, the National School Lunch Program exists as a governance network to implement federal-level policies oriented toward providing all children with nutritionally sound lunches throughout all public schools in the nation. Governance network analysis uses a basic network heuristic comprised of “nodes” and “ties.” The nodes in the school lunch network are comprised of a variety of actors. These actors possess certain kinds of characteristics that, in the case of this analysis, are narrowed down to the actors’ level of geographic scale and social sector (government, nonprofit, or for-profit businesses such as farms and food distributors). After conducting a detailed review of the literature, which was summarized earlier in this article, as well as having undertaken a series of case studies of FTS programs operating within Vermont, a set of actors was identified that populate the network.

Governance network analysis is also predicated on the nature of the ties that exist between nodes in the network. The kind of ties found between actors within school lunch programs were identified through our literature review and case studies analysis. It was determined that the kind of ties that exist between actors in this network could be characterized as being related to the flow of financial resources, the flow of food (distinguished as both whole foods and processed foods), the flow of information, and the flow of regulatory and legal authority.

Because much of the analytical literature about FTS programs is based in the social sciences, the map of the school food system developed here places actors and institutions as its “elements,” according to Meadows’ systems terminology. In this way it depicts major actors who might meaningfully influence some aspect of these initiatives. The map relies on the above-detailed definition of FTS programs as initiatives consisting of school- or district-level activities that encompass one or both of the basic FTS components: (1) local food procurement and (2) agriculture, food, and nutrition education. These components are the means through which FTS practitioners work to achieve various aims.

The map places each actor or institution geographically according to its degree of “localness.” Additionally, it codes actors’ and institutions’ centrality to the general set of activities that constitute a local FTS program per se as being either “core” or “peripheral.” These 2 understandings of actors’ and institutions’ relationships to one another are important because individual FTS programs usually operate at the local (community, school, or district) level and illustrate FTS programs as (tactical) subsystems embedded within the broader (structural) system of school food procurement.
Localness is significant to FTS programs because it best enables the transparent, often face-to-face relationships between producers and consumers that facilitate the incorporation of social, environmental, equity, and health issues into food procurement as well as consumption. According to Meadows, "(i)n hierarchical systems relationships within each subsystem are denser and stronger than relationships between subsystems. Everything is connected to everything else, but not equally strongly" (italics in original). Therefore, the core of each FTS program consists most tangibly of local-level actors, who interact most directly with one another and less directly with actors and institutions at state and national levels.

Students are generally considered to be a focus of FTS programs, although some authors have asserted that these initiatives have overarching goals of effecting changes in the broader food system, which encompasses all of the actors in the diagram as well as non-actor elements outside the scope of the diagram, such as the environment, culture, agriculture, etc. Beyond students, the other actors who most often make up the core of a local FTS program per se include teachers, school foodservice directors and staff, farmers, and parents, occasionally with meaningful, direct involvement from other interested members of the school or local community, from food distributors, and from state-level nonprofit organizations or universities.

One characteristic that the map cannot easily represent in 2 dimensions is the fact that, in reality, there may be greater or fewer numbers of any given type of actor than another. This is especially important when considering how FTS programs are represented in the map. As Schafft et al. noted, these initiatives differ greatly from place to place, according to local needs and interests. For example, there are almost certainly more students involved in FTS programs than there are teachers and probably more teachers involved than farmers. And, of course, there is only one USDA. For this reason, a 2-dimensional map is misleading about one very distinctive characteristic of FTS programs: their variation.

The other actors in the diagram influence FTS programs less directly, but no less importantly, by determining a regulatory environment, exchanging food commodities as tangentially associated actors in the broader economy, providing financial resources, or promulgating information or knowledge relevant to the initiative’s activities or to the core actors’ understandings of food, agriculture, consumption, etc. The role that these actors play in a map of a FTS program is most analogous to Kloppenburg et al.’s concept of “structure,” a term that Meadows also used to introduce the external influences on individual elements within systems. In this sense, these other actors—especially those at the national level—carry much of the power to determine the systemic status quo that actors in FTS programs strive to change. This is an important characteristic of the federal government’s regulatory capacities within the broader system of school food procurement.
ANALYSIS

The next section presents a level-by-level explication of each actor’s or institution’s relationships with the others in the context of a “typical” FTS program. It should be noted that FTS as it is represented here is nested within the broader NSLP school lunch program. In this sense, the diagram (Figure 1) represents a FTS program of high complexity, to account for as many possibilities as might exist. In reality, FTS programs may consist of a subset of the actors and relationships depicted here or may include varying degrees of these actors’ involvement. But the value of such a comprehensive map is as an aid to envisioning what might happen—either to FTS programs themselves or to the broader system—as a result of certain changes to the system aimed at further promoting or institutionalizing the aims or components of FTS programs.

Home

The home is the most local level relevant to a FTS program because it is where students generally spend most of their time, consume many of their daily calories, adopt many of their cultural and nutritional sensibilities regarding food, or gain the resources from parents (either food-in-kind, money, or free/reduced-price meal status) that condition their consumption of food at school. Active parents may also help initiate or participate in FTS activities at the school level. In addition, students may bring home knowledge and preferences that they gain in FTS programs, thereby changing their families’ food consumption, though their preferences may also be influenced at the home level by national-level food manufacturers’ advertising and merchandising for (often less-healthful) products. Lastly, because students consume appreciable proportions of their daily food intake at the school level, healthful and educational school food programs contribute to low-income households’ food security.

School

The school is perhaps the most salient level of localness because it is the level at which students participate in FTS programs. This participation falls generally along the lines of the 2 primary components of FTS: (1) local food procurement (consumption) and (2) food, agriculture, and nutrition education (learning).

Students bring food, lunch/breakfast money, or free/reduced-price lunch eligibility to their school cafeterias, which, together with students’ food preferences, create students’ food demand. The foodservice staff, in turn, prepares, serves, and sells food that they believe the students will
consume, based on the preferences conveyed by the students and on their professional training. These resources (i.e., meal payments) allow the school foodservice to purchase the food, equipment, and labor that they use.

Students’ participation in school meal programs also provides the basis on which federal and state governments fund foodservices. These funds
are usually channeled through a state-level agency, such as Vermont’s Department of Children and Families (DCF). School foodservice directors use these funds to purchase food, most commonly from food distribution companies and from the USDA commodities program, which is also coordinated in-state by the state-level agency.\textsuperscript{45} Many school foodservice directors involved in FTS programs conscientiously purchase locally produced food, either through food distribution companies or directly from farmers.\textsuperscript{6} In some FTS programs, school foodservice staff members act as educators, conveying information to students about the origins or other qualities of the food they serve at school or facilitating lessons on food, nutrition, or agriculture\textsuperscript{14} and creating “trickle-down” excitement and pride, which encourages students to try novel items.\textsuperscript{46}

Teachers are the other core actor at the school level and are responsible for many of the educational facets of FTS programs. They may take students on field trips to farms or invite farmers to speak to students at school, facilitating meaningful direct interaction between students and the producers of their food. Teachers involved in FTS programs may also spearhead school garden projects and carry out classroom-based lessons on agriculture, food, and nutrition.\textsuperscript{47}

Students can have strong influences on their peers’ food preferences and choices, as Bissonnette and Contento\textsuperscript{40} demonstrated. This creates an impetus for FTS programs to engage all students within a school and, as Izumi et al\textsuperscript{46} put it, frame healthful, locally produced food as “cool food.”\textsuperscript{p89} This appreciation of the “bottom-up” dynamics of the spread of healthy food habits is important to note and suggests the opportunities that exist to employ social network analysis and computer simulation modeling approaches such as agent-based models to study these emergent qualities.

Two nonindividual elements warrant consideration at the school level. The first is the school wellness policy, which the Child Nutrition Act, via the USDA, requires all schools participating in federal meal programs to formulate and adopt.\textsuperscript{48} Any of the aforementioned school-level actors, with the addition of school nurses and principals, as well as district-level boards and superintendents, might play a role in designing policies and practices that promote students’ physical and nutritional wellness. Authors and practitioners identify benefits of coordinating the planning of school wellness policies with FTS programs.\textsuperscript{23,24}

The second nonindividual element is the stock of resources—usually financial—that enable FTS activities as diverse as field trips, school gardens, and purchases of food or resources not covered by school foodservices’ ordinary budgets. Actors at the school level who are most involved in the FTS programming, likely teachers or foodservice staff, usually manage these resources. Funding for school-level FTS activities usually comes from private sources such as fundraisers at the local level or grants from nonprofit
organizations and foundations but can also come from state-level agencies of agriculture or health.\textsuperscript{11}

School District/Supervisory Union

Though FTS programs are organized primarily at the school level, actors at the district level may sometimes play important roles. This is especially relevant when school foodservices operate at the district level and, as a result, a director may make food procurement decisions and staff may prepare food for multiple schools in a centrally located kitchen. Sometimes district-level foodservice management is more suited to purchasing local foods from distributors that can meet its larger scale demand than it is to purchasing directly from small- or medium-size farms that may intermittently supply smaller quantities. Also, schools or districts may contract with private foodservice management companies instead of directly employing foodservice staff.\textsuperscript{21,24,38}

School boards and the superintendents whom they hire may influence the regulatory environment under which school foodservices operate, especially regarding the use of equipment and school-owned facilities, in addition to oversight of budgets, but foodservices generally must secure their own set of resources without much contribution from district funds.\textsuperscript{36} Actors at the district level may regulate FTS-related curriculum or policies that govern other aspects of the school food environment, such as competitive food sales on school grounds.\textsuperscript{48}

Community/Regional

One critical group of FTS actors at the community level is farmers, who often participate in both the local procurement and educational components of the programs. There are multiple ways in which they can participate in the former. The most straightforward—and perhaps the most epitomized—are farmers’ sales of whole or on-farm-processed foods directly to school foodservices. They can also pay processing enterprises to add value to their whole products or sell to distribution companies who aggregate it with food purchased from other farmers and wholesalers. Farmers participate in the educational components of FTS programs whenever they interact directly with students—hosting field trips to their farms, visiting schools’ lunchrooms and classrooms, or helping with school garden projects. Farmers’ production practices are subject to scrutiny and regulation at the state level, especially by agencies of agriculture, from which farmers may also receive useful information and technical assistance.

Other community members can have effects on FTS programs in their capacities as electors of school board representatives and funders of local schools through property taxes (though these funds rarely contribute to
school food budgets). They also constitute the retail customer base of farmers in the community who participate in FTS programs.

State

In the private sector, the state level represents a scope of localness that is greater than the community level but still smaller than the national level. The primary private FTS actors at the state level are food processing and distribution companies. The processors directly relevant to FTS programs are mostly small- or medium-scale businesses that work directly with farmers to add value to whole products. With the appropriate infrastructure, farmers may be able to do some light processing or value-adding (cooking, etc) on-farm, but in many cases it is more cost-effective for farms to contract with processors that specialize in these sorts of transformations. Therefore, coordination with these businesses is often critical to FTS success.

Similarly, though individual farms may be able to sell products directly to school foodservices, high transaction costs relative to low prices may make it more efficient to arrange for transportation with an in-state food distribution company or occasionally through a cooperative of farms that share relevant resources. Most distribution companies also deal in wholesale products sourced from producers across the nation, however, so it is not always possible to maintain transparency regarding the source of local foods for FTS programs, an attribute that many FTS actors consider to be important.6,20

Other prominent private FTS actors at the state level include non-profit organizations and foundations that may facilitate local initiatives by providing information, technical support, resources, or occasionally even management of particular aspects of a program, such as curriculum design or local food sourcing or aggregation. These nonprofits sometimes finance their activities on a fee-for-service basis but also through grants. Other FTS-specializing nonprofits may focus on regions within states, such as Green Mountain Farm to School in northern Vermont and Upper Valley Farm to School in central-eastern Vermont.

State governmental agencies can also influence the viability of FTS programs. Such influence often takes the form of regulation, as when departments of education impose standards that may complement or compete with FTS educational curricula, when departments of health or agriculture regulate processors’ and farmers’ production and direct sales practices, or when state-level agencies designated by the USDA administer the federally mandated school food commodities programs. But states’ influence in FTS programs can also take the form of hands-on advocacy. State borders are convenient, highly visible parameters for defining the localness of food as well as economy, and thus it is often politically and financially advantageous for states to promote food commerce within their own boundaries.
Examples of states’ promotion of FTS programs include the competitive grant program established by Vermont’s legislature and administered by VAAFM, Cornell University Extension’s technical support program for FTS, as well as the Minnesota Department of Health’s awards of Statewide Health Improvement Program grant funding to FTS programs. Other universities offer various departmental programs that promote FTS through more formal research agendas or other outreach programs.\textsuperscript{49,50} Citizens at the state level ultimately influence public support of FTS through their election of public servants and remittance of taxes.

National

At the national level, FTS actors can again be divided into private and governmental sectors. The private actors are the often-large-scale farmers, distributors, and processors, and other food manufacturers that anonymously produce and handle the vast majority of the food that enters the school food system but are also the companies that brand and sell it. The food manufacturing industry invests large sums of money in advertising campaigns aimed at children, and these undoubtedly play a significant role in forming students’ food preferences. It also influences practices of agencies such as the Food and Drug Administration (FDA) and USDA through its lobbying clout.\textsuperscript{41} There are also a small number of national-level nonprofit organizations and foundations (most prominently the National Farm to School Network [NFTSN]) that support FTS programs. The NFTSN mainly helps to raise awareness and share information and acts as a nexus around which local-level initiatives can interact directly with one another.

The federal government–level actors that have direct relevance to FTS programs are few but tremendously influential. The USDA enforces nutritional guidelines for school meals, administers congressionally appropriated funding for school food programs and directs the associated commodity procurement programs, and is now beginning to develop and promote technical assistance resources for FTS programs. Congress is responsible for legislation—the Child Nutrition Act and the Richard B. Russell National School Lunch Act—that determines standards for school meal programs and, until 2008, did not permit local geographical preferences in school food procurement.\textsuperscript{51} The Department of Defense is an unlikely but powerful player in school food procurement, using its large purchasing power to command low fresh fruit and vegetable prices for public institutions, including schools in many states. The Centers for Disease Control and Prevention (CDC) have given congressional testimony in support of FTS programs’ health-promoting practices, and certain states have directed funds from this agency toward FTS programs. The FDA regulates food manufacturers’ advertising practices.
In addition to negotiating, vetoing, or approving school food–related legislation that congress passes, the current administration has a high degree of relevance to the general aims of FTS. Michelle Obama is the public face of initiatives to promote children’s physical activity and preferences for healthful foods, especially fresh fruits and vegetables. Citizen taxpayers, but also corporations associated with the food industry, ultimately influence the political feasibility of FTS-related policy at the federal level.

**DISCUSSION**

As shown above, school foodservices in general, and FTS in particular, have many stakeholders on many geographic levels. Better understanding of the connections between actors and of the resource flows between and among levels can inform efforts to address many of the barriers (funding, coordination and capacity) and act upon lessons learned from prior FTS research. By describing and analyzing FTS as a network comprised of actors and ties, we may be able to identify where in the system particular challenges and opportunities for programmatic development and research exist. Addressing the funding barrier to FTS requires increased money from state or federal governments. Of particular benefit to FTS efforts would be allocations specifically targeted for purchase of locally grown fruits and vegetables. Increased funding for snack programs (suggested as effective means to foster pilot efforts due to their greater flexibility) is another important funding priority.36

Increasing coordination and capacity requires increased flow of knowledge as well as funding. Greater cooperation among nonprofits in efforts to work with school wellness committees, for example, can enhance educational efforts for students through continuously evolving and improving curricula, guided by dissemination of evaluation and research results. Nonprofits and wellness committees can also lead the charge for efforts to educate parents and citizens on the broad benefits of FTS, creating political support and momentum. This sort of support would also help to encourage development and mentoring of local FTS champions. These efforts would be further enhanced by increased 2-way flows of information between state- and national-level nonprofits (eg, VT-FEED and NFTSN), which would facilitate learning and improvement of efforts and materials.

Increasing coordination and capacity may require increased funding as well, to nonprofits for education, to schools for investment in equipment and human resource training, and to farms, local aggregators, and small-scale processors for low-interest loans, training programs, and/or feasibility studies. Such studies could test emerging models and then replicate and scale up successful efforts in order to develop infrastructure and expertise to overcome coordination and capacity gaps.
Increased funding for FTS efforts would come primarily from public sources, requiring changes in regulatory flow. Regulatory flow also starts with voting taxpayers, who condition the political environment necessary for congress to appropriate more resources for school meal programs. This regulatory flow would extend through congress to the USDA, which would oversee the distribution of the increased resources to relevant state office, to school food services, and then to students. Thus, through tracing interdependent regulatory and financial flows in the map, it is possible to see how a change in a flow at one point in the map depends on changes in other, related flows.

Conceptualizing other, more qualitative, changes to flows requires bringing somewhat greater imagination to the map, though this process of understanding works much in the same way. It is possible to imagine an increased flow of whole food from local farmers to school food services as resulting in student consumption of more nutritious foods prepared on site, because such an increase is likely to include more fresh, less-processed fruits and vegetables.17

The idea that specific flows in the map are related to other flows, both immediate and distant, can be explained through the concept of leverage points. Meadows described leverage points as “places in the system where a small change could lead to a large shift in behavior,”13(p145) provided that the change is made in the appropriate direction. Croom30 suggested that FTS programs’ agriculture and nutrition education components are leverage points that can shift students’ preferences in favor of fresh fruits and vegetables, thereby changing school food procurement practices through their increased demand of healthful foods. It is easy to trace on the map how such a shift would occur: teachers, farmers, and school foodservice professionals would implement experiential educational activities such as field trips, cooking classes, or school gardens (represented by the flows of information from these actors to students). This education would occur in the context of the school foodservice providing locally sourced, healthful foods to students. If education were effective in changing the students’ preferences, they would demand more of this food, transmitting this demand to the school foodservice via informational and financial flows. In turn, the school foodservice would purchase more of this food from farmers with the resources gained from students’ increased participation in the school lunch program as well as with the knowledge that the students were willing to eat this food.

But the map also demonstrates that change through a seemingly promising leverage point such as experiential education most likely requires change at other points in the system in order to be effective. For example, the foodservice staff might need training in order to know how to store, prepare, or serve new types of locally produced foods. Such training would be represented as informational flows to the foodservice. An especially knowledgeable foodservice director might be able to provide this training to his or
her staff, but more likely the training would have to be funded or mandated by political-regulatory actors such as the USDA (which would, in turn, need to realign its policies and resources in order to develop such programming) or by state-level nonprofit organizations specializing in technical assistance for FTS programs (which would, in turn, need resources, either in the form of external grants or payment by the school). From another perspective, education to change students’ preferences might compete with advertising by food manufacturers, unless the FDA enforced stronger regulations, which would in turn depend on a favorable political-legislative environment. Food manufacturers would almost certainly utilize financial and informational flows to oppose such legislation.41

CONCLUSIONS

Farm-to-school programs use local food procurement and experiential education to better achieve the stated goals of the NSLP, namely, childhood nutrition and farm viability. This article uses a systems and governance network analysis to map out the connections flows of resources among FTS stakeholders at various functional and geographic levels. The results of this map are compared to key barriers and lessons learned from prior FTS research in order to suggest important initiatives, policies, and leverage points needed to foster FTS programs’ ability to contribute to food and farming goals. Though it is beyond the map’s scope to identify all of the changes necessary to generate greater support for FTS programs, it illustrates the relevance and connections that actors and institutions at multiple scales have to local-level FTS programs. Therefore, the map’s value lies in contextualizing and informing specific discussions about developments in FTS research and policy. In this role, we hope that the map will promote more holistically conceived policymaking and more interdisciplinary research that would catalyze greater support for FTS programs from influential actors and institutions within the system. Its comprehensive scope can be used to facilitate identification of other actors, institutions, or flows that are relevant to, but not accounted for, in particular approaches. This is important when action, policymaking, and research are often conducted with a narrow conception of the problem.

FTS partnerships and mechanisms are topics ripe for continuing research. Efforts to identify effective procurement and experiential learning practices are needed, particularly in the area of overarching keys to success among heterogeneous school programs. It is also necessary to trace the impacts that these practices and public policies have on nutrition and procurement outcomes. Finally, better understanding of the concrete impacts FTS programs have on public health, farm viability, and community development would further improve FTS efforts and strengthen public
support. We hope that this article highlights the importance of a systems approach and motivates further inquiry into FTS, given its broad community development potential.

REFERENCES


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