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The Local Food System Vitality Index: A pilot analysis to demonstrate a process for measuring system performance and development

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Abstract

Identifying successful development priorities for local food systems (LFSs) is a challenge for producers, LFS advocates, Extension agents, and policymakers. Consumer perceptions and preferences regarding what constitutes an active, healthy, and vibrant LFS often differ within and between diverse communities. Producers, development entities, and others would benefit from rapid assessment processes that provide detailed information on consumer preferences and

potential market opportunities within their LFS.

In this paper, we introduce the analytic possibilities of our Local Food System Vitality Index (LFSVI). Using data collected from a pilot survey in Lexington, Kentucky, we rapidly assess the performance of 20 different components of our LFS. The LFSVI differs from most other food system and quality-of-life indices by focusing on the perceptions of resident food consumers.

In our analysis, we identify that Lexington residents generally associate farmers markets, farm-to-fork restaurants, local product diversity, and retail sourcing of local food with high overall vitality of the local food system. While residents score the first three components as high performing, they perceive the retail component to be less functional. We use results such as these to compare which aspects of the LFS are valued versus which are high performing. We do this comparison across different resident food consumer segments in and between geographic locations. Throughout our analysis, we discuss how this index method is generally applicable and conducive to identifying LFS development priorities.

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Keywords

Local Food Systems, Performance Indices, Food System Vitality, Food System Development

Introduction

Local food systems (LFSs) are created through relationships between multiple individuals, institutions, and environments. The specific constellation of actors¹ shape the place-specific attributes, market channels, and culture surrounding a locality's food system (Feagan, 2007; Selfa & Qazi, 2005). While certain decision-makers have more power to shape and define how LFSs develop and change, it is critical to engage with the perceptions of diverse actors within the system. Producers, intermediaries, and buyers interact according to logics of market exchange and perceived consumer demand. Development personnel design LFS promotion strategies using success stories from other communities and discussions with stakeholders. Residents make decisions based on personal values, income, and proximity to market channels.

Because these actors engage with different components of the system, they often have divergent perspectives, perceptions, and preferences regarding what constitutes an active, healthy, and vibrant LFS. For instance, farmers markets have increased in popularity across the U.S. over the past 20 years (Low et al., 2015). Many local food advocates view farmers markets as an entry point to developing relationships between producers and consumers—and, by extension, developing local food systems (Brown & Miller, 2008). Farmers markets are undoubtedly a popular LFS venue that provides room for market transactions, the development of social bonds, and unique cultural experiences (Gillespie, Hilchey, Hinrichs, & Feenstra, 2007; Hinrichs, 2000); however, they are not sufficient to produce a sustainable, resilient LFS. In certain communities, especially rural areas, farmers markets may not have a large enough consumer base to attract or convince producers to divert resources to diversified production strategies that generally have small sales volumes (Rossi, Meyer, & Knappage, 2018). Additionally, residents in certain

areas may value different local food system components, attributes, or elements that do not cohere with national trends. In short, LFS development requires in-depth consideration of place-specific production resources and resident interests.

Our focus in this article is to introduce a methodology for quickly evaluating residents' perceptions of their LFS. Producers and LFS development stakeholders lack a systematic approach for measuring residents' perceptions of how certain inherently valued LFS aspects are performing and/or meeting expectations. These and other community decision-makers (including food councils, agricultural businesses, and local food coordinators) would benefit from a process to quickly assess how different groups of residents perceive the functioning of multiple components of their LFS. Understanding broad perspectives on LFS performance within a particular community, as well as those for smaller segments within the population, would allow for food system development that is locally specific and meets the needs of diverse groups.

In this article, we introduce the *Local Food System Vitality Index* (LFSVI). This index identifies place-specific stakeholder perceptions regarding the *performance* of different components of an LFS. Using data collected from a pilot survey of residents in Lexington, Kentucky, we illustrate how the LFSVI provides insights into how different stakeholders within and between communities differentially perceive and value certain LFS aspects. We analyze residents' perceptions of LFS component performance in different geospatial and demographic segments of the community. Using this analysis, we provide LFS decision-makers baseline information for further exploration into how capital and labor resources may be most effectively enrolled to create structurally diverse and resilient food systems that address broader community needs and aspirations.

We envision this methodology as a starting point for further inquiry and analysis and as a complement to other LFS assessment tools such as *The Economics of Local Food Systems Toolkit* (Thilmany McFadden et al., 2016). Rather than providing

¹ That is, producers, residents, distributors, processors, retail buyers, foodservice providers, LFS advocates, and other LFS participants.

estimated economic impacts of specific LFS interventions, our LFSVI identifies what aspects of an LFS may be favored by residents in different consumer segments within and between cities. As such, our analysis of Lexington is primarily used as an example of how our methodology can be employed, rather than a comprehensive analysis of the LFS. The strength of this methodology is its analytic flexibility, and we present different ways in which the performance of an LFS can be measured and benchmarked against other communities.

Background: Local Food System Performance Assessments are a Stated Need of LFS Development Entities

We developed the LFSVI to meet a recognized need for rapid performance assessment tools related to LFSs. Since LFSs in different locales have unique characteristics (Feagan, 2007; Hinrichs, 2000; Selfa & Qazi, 2005), effective LFS marketing, distribution, and development strategies should be based on place-specific characteristics. Many regional and local community economic development organizations are searching for ways to better understand these characteristics in order to set priorities that would strengthen and create economic opportunities for producers and local food businesses (Goodwin, 2013; Lamie, Dunning, Bendfeldt, Lelekacs, Velandia, & Meyer, 2013; Thilmany McFadden et al., 2016; North, Lamie, & Crosby, 2017). For instance, the USDA Southern Risk Management Education Center (SRMEC), the Southern Rural Development Center (SRDC), and Southern Sustainable Agriculture Research & Education (SARE) all have convened research and Extension professionals to help identify LFS priorities particularly for Land Grant Universities in the South (Goodwin, 2013; North et al., 2017). These entities recommend research and extension projects that assess what products, market channels, and aspects of the local food experience are valued by different consumer segments in multiple geographic locations (Palma, Morgan, & McCoy, 2013). Similarly, the USDA Agricultural Marketing

Service (AMS) has created The Economics of Local Food Systems Toolkit, which allows LFS stakeholders to quantify the impact of different local food system projects or investments (Thilmany McFadden et al., 2016).

The LFSVI addresses these needs and complements existing LFS assessment tools by providing an analytical framework to assess place-based stakeholder preferences, relationships, and values related to local food activity, marketing, and production. By understanding what aspects of an LFS residents value, producers and policymakers can prioritize the development and support of programs, strategies, infrastructure, and resources that aid the creation of more targeted expansion and development initiatives.

While our article presents data from a single pilot survey in Lexington, Kentucky, we illustrate how the LFSVI can be used generally to

1. understand potential areas of strength and weakness in an LFS that, if addressed, may enhance economic opportunities for producers and food-related businesses and
2. evaluate policies, institutions, and infrastructure that are integral to the vitality of specific local food systems.

The LFSVI emerged, in part, as a response to the authors' experiences with LFS assessment requests. Over the past three years, the authors were asked to assess the performance of multiple LFSs by their mayor's office, local and state community development organizations, and other research universities. In one local food demand study, we encountered a complex set of consumer and producer preferences for improving Lexington, Kentucky's LFS (Rossi, Hyden, Woods, Davis, Brislen, & Allen, 2015).² While consumer demand was high for local food in general, growth in local markets has been slow due to (1) distribution and processing infrastructure not being oriented to local markets and (2) mismatches between producer and buyer expectations. Insights

² This Local Food Demand Assessment study was conducted separately from and prior to the development of the LFSVI. However, we revisited the results of this food demand study as a way to validate and interpret some of the quantitative results of the subsequent LFSVI survey.

generated from this food demand study were valuable for producers, the city's local food coordinator, and other stakeholders; however, the process was extremely time and resource intensive and required nearly 50 in-depth interviews. Additionally, it provided only a snapshot of the current LFS conditions as well as second-hand, mediated data on the perspectives of residents. For instance, many restaurateurs felt that their sourcing of local products was critical to attracting and maintaining loyal customers. Without understanding the degree to which general consumers (or different segments of the city) value 'restaurants sourcing local ingredients,' it is difficult to know how effective local sourcing or its promotion would be as a business strategy for restaurants. This study would have benefitted from a repeatable analytic process that quickly and directly assessed resident perceptions of the LFS performance across a wide spectrum of related markets, programs, and agencies.

By developing a rapid assessment method, we can provide a baseline of LFS dynamics over time (if the LFSVI is repeatedly used) that may subsequently inform a more efficient and directed use of interviewing and assessment resources. The LFSVI quickly provides a number of insights into the areas of the LFS that are most visible and important to everyday residents. With a baseline of stakeholder perceptions regarding the LFS, we could have narrowed our focus in our interview questions to see how residents' perceptions of their LFS correspond to perceptions of stakeholders more directly connected to flows, transactions, and changes within the LFS (e.g., producers, distributors, retailers, restaurateurs, etc.). We could have also provided resident perception data to LFS stakeholders in interviews to see whether these data matched their understanding of the LFS. By comparing stakeholder interview responses to resident consumer data generated by the LFSVI, we could have produced a deeper and richer discussion about potential obstacles to and resources for LFS development. Unfortunately, we had already conducted a number of LFS assessments before developing this LFSVI methodology. Nevertheless, we will revisit some of the key points of this assessment when presenting the results from our LFSVI.

Literature Review: Local Food Systems, Indices, and Quality of Life Measures

Indices can be tools for social engagement. They often help inform policy recommendations by providing quick information on places or phenomena of interest. This policy-oriented use of indices has recently achieved prominence in the global economic development literature (Florida, 2002; Hamilton, Helliwell, Woolcock, 2016; Morelix, Tareque, Fairlie, Russell, & Reedy, 2016; Stiglitz, Sen, & Fitoussi, 2010). In some indices, lifestyle amenities and other cultural and/or social place attributes of place are promoted to support local investment and business development initiatives (Pittman, Pittman, Phillips, & Cangelosi, 2009). The logic associated with these index approaches is that places must compete for hypermobile investment funds through strategies that simultaneously 1) enhance 'quality of life' (QOL) attributes and 2) provide infrastructures that facilitate social relationships and the rapid exchange of information (Ateljevic & Doorne, 2003; Chang & Huang, 2005; Jessop & Sum, 2000; Yeoh, 2005). Indices, rankings, and other metrics allow localities to benchmark the performance of different characteristics of place. By identifying where a locality holds a perceived advantage (or deficiency) in terms of place characteristics such as livability (*The Economist*, 2017), entrepreneurship (Morelix et al., 2016), and sustainability and/or green space (Arcadis, 2016; Siemens, 2012), local policymakers can differentiate their place from others to strategically market or improve aspects of their city or region. As such, policymakers are keenly interested in metrics that identify place attributes to leverage for economic development (Diener & Suh, 1997; Florida, 2002).

At the same time, when index approaches focus too much on QOL attributes and amenities, they privilege particular types of labor and citizens. Richard Florida's (2002) work, in particular, prioritized the 'creative class' as a driver of robust urban economic growth. Indices such as those developed by Florida were used for re-envisioning urban space and setting development priorities. These tasks were accomplished by using indicators which measured phenomena such as 'coolness,' 'talent,' and 'diversity' as predictors of (and prerequisites

for) high-tech economic development (Florida, 2002). Indeed, cities (including Lexington, KY—the focus of this case study) invited Florida to consult on or promote strategies for making places more appealing to tech-oriented investment and the creative class through modifications of urban space (Eblen, 2010).

As these amenities-oriented indices prioritize bringing diversity and technocentric forms of economic activity to cities, they outline a vision of place-based development that is only applicable to a small class of potential residents and workers. They ignore local conditions, contingencies, and resources of and for development. This type of approach also diminishes the contributions of other types of economic activity, such as food production (Krätke, 2010). Despite the popularity of the QOL-oriented index approaches for assessing development priorities, most existing indices do not consider the relative activity and vitality of LFSs. As LFSs are sites of novel social exchange and engagement (Hinrichs, 2000), their omission from QOL indicators is puzzling. Researchers and analysts have yet to develop an index that effectively measures LFS performance from diverse residential perspectives, or one which presents a quick overview of LFSs.

There are only four indices, to our knowledge, which quantify local food activity; each has limitations for providing LFS development personnel with actionable data. The Food Relocalization Index assesses production and marketing indicators in the United Kingdom (Ricketts Hein, Ilbery, & Kneafsey, 2006). The Locavore Index (Strolling of the Heifers, n.d.) and a similar index developed for Hungary (Benedek & Balázs, 2014) rely on indicators drawn from secondary data. For instance, both indices measure food activity in each state or county through LFS attributes that can be counted such as the ‘# of CSAs,’ ‘# of farmers markets,’ ‘# of certification schemes,’ and ‘# of producer entries in local food directories.’ These indices may overvalue numerous smaller-scale operations; but, more importantly, they only infer LFS performance from attribute counts. Our index directly asks residents how they view the functioning of attributes

such as CSAs, farmers markets, and certification schemes. As such, LFS vitality is not limited to countable entities. Finally, the Local Agrifood System Sustainability and Resilience Index has a unique emphasis on stakeholder relationships and system stability (Green, Worstell, & Canarios, 2017; Worstell & Green, 2017). This index provides compelling production-side portraits of LFSs by using readily accessible secondary data—an approach we find may be complementary, but not directly related to our LFSVI’s emphasis on resident perceptions of system performance and vitality.

While indices based on secondary data provide rapid assessments, most local food indices are too coarse-grained to capture novel social arrangements and preferences that would be useful for stakeholders to develop place-specific recommendations for LFS development. Additionally, certain census data (e.g., CSA numbers) may not reflect the ground-level realities or rapid changes of an LFS (Galt, 2011). Food policy activities require supplemental local data collection. For instance, our interview-based study on local food demand (Rossi et al., 2015)³ was commissioned by the city because publicly available secondary data did not provide sufficient information on LFS activity.

Our local food system vitality index addresses the limitations of more general surveys by collecting primary data directly from local residents. By engaging directly with residents, we can provide insights on how individuals and groups in varied geographic locations and subpopulations differentially value certain attributes of their LFS. We use survey responses to measure LFS vitality for 20 specific LFS components. Because our index is analytically flexible, we can evaluate which LFS components are valued by different consumer segments within and between LFSs in numerous ways. We will present, for instance, how residents (1) from locales of different sizes and (2) of different income levels differentially prioritize LFS components. It would also be possible to compare perceptions within and between zip codes, though we do not present this type of analysis in this manuscript. Understanding the heterogeneity of

³ Conducted prior to and independent of our LFSVI survey.

residential views of an LFS is critical in designing targeted investments and interventions to encourage diverse residential engagements with the food system.

Methods

The LFSVI represents the vitality of a local food system through the evaluation and perception of resident food consumers. Recognizing place-specific LFS characteristics is critical to the growth of local food marketing activities (Goodwin, 2013; North et al., 2017; Palma et al., 2013). We engaged in a series of resident focus groups in the Lexington, Kentucky, area to identify important components in residents' overall assessments of their LFS. Lexington was chosen because the authors had experience conducting research in this city and the surrounding regions. These experiences provided context for evaluating the LFSVI in its development. The components identified by focus group participants were refined down to 20 distinct measures. These measures are organized in three broad groups—food market performance, community engagement performance, and local food promotion performance. These 20 components became the foundation of a pilot survey instrument to assess resident perceptions about the performance each of these LFS components.

We sent a blended mail and web-based survey to a randomized sample of 1,500 Lexington residents via the residential property transaction database in the Spring of 2017. This database contained the addresses of property transactions conducted between 2012 and 2017. Prior to random selection, individuals were segmented by property value within each zip code. We sought equal representation across zip codes and property values. We received approximately 300 paper surveys from respondents. Fifty respondents chose to take the online version of the survey provided in the original mailing. Each participant was asked to evaluate 20 LFS components in Lexington for performance on a 5-point Likert scale. The question was stated as follows: "How would you rate the following aspects of the local food scene in Lexington? Feel free to select 'don't know' if you

don't feel comfortable answering." Figure 1 presents the questions relating to individual component performance.

Residents rated these same 20 LFS components and overall vitality for a second community—the place they lived prior to Lexington if they moved to the city after 2006. Component scores for the previous communities became the base against which we compared Lexington's component scores in our index methodology. Respondents were subsequently asked to assess the overall "vitality of Lexington's local food scene" (Figure 2).

We deliberately targeted addresses with recent changes in ownership to oversample individuals that may have moved to Lexington from other communities. This approach provides a larger sample of individuals with previous community evaluations to serve as a baseline to index and contextualize Lexington LFS component scores. This sampling approach does limit our ability to generalize perceptions of LFS performance for all residents (see demographics in Figure 3). Lexington is a rapidly growing city (10% increase in population from 2010-2017) that draws in residents from around the state and country. It is also home to a land grant university, a large research hospital, and several large national and global companies. It also has internationally regarded equine and bourbon industries and is considered one of the highest educated cities in the United States.⁴ As such, many survey participants had a recent previous community of LFS reference. One-third of these respondents moved to Lexington from other communities in Kentucky within the past 10 years. Survey participants were predominantly degree-holding, middle class, women with a medium to strong interest in local food systems. Our sampling focus on more recent arrivals to the city provides insights into which LFS components are valued by individuals that have detailed experiences of how these components perform in different geographic contexts.

Many respondents (37%), however, are long-term Lexington residents and were not asked to evaluate a previous community. The LFSVI can be

⁴ Ranked 13th in 2014 census for percentage of population with at least a bachelor's degree (40%).

Figure 1. Individual LFS Component Rating Questions

How would you rate the functioning of the following aspects of your local food scene?						
	Very Poor	Poor	Avg.	Good	Excellent	Don't Know
Element	1	2	3	4	5	0
FOOD MARKET PERFORMANCE						
Farmers markets quality	0	0	0	0	0	0
Retail cooperative food stores offer food from local farms	0	0	0	0	0	0
Grocery stores offer food from local farms	0	0	0	0	0	0
Restaurants serve local food	0	0	0	0	0	0
Community supported agriculture (CSA) program quality	0	0	0	0	0	0
Schools engage with local farms	0	0	0	0	0	0
Food trucks use local ingredients	0	0	0	0	0	0
COMMUNITY ENGAGEMENT PERFORMANCE						
Low-income neighborhoods have access to fresh food	0	0	0	0	0	0
Community food festivals	0	0	0	0	0	0
Food banks are accessible and offer fresh food	0	0	0	0	0	0
On-farm events	0	0	0	0	0	0
Community gardens	0	0	0	0	0	0
Cooking, food preservation, and consumer education programs	0	0	0	0	0	0
LOCAL FOOD PROMOTION PERFORMANCE						
Label that identifies locally grown or raised items	0	0	0	0	0	0
Overall diversity of local food items	0	0	0	0	0	0
Microbreweries and distilleries promote local food	0	0	0	0	0	0
Local government support of the food scene	0	0	0	0	0	0
Local food is competitively priced	0	0	0	0	0	0
Private investment in local food businesses	0	0	0	0	0	0

Figure 2. Overall LFS Rating Question

Rate the vitality of your local food scene. Vitality is defined as 'the strength and activeness of the local food scene.'					
My community's local food scene is.....	Extremely Poor (1)	Poor (2)	Average (3)	Good (4)	Excellent (5)
	○	○	○	○	○

adjusted to view different resident segments in aggregate, in discrete units, or in a weighted model. While we decided to oversample recent arrivals, our dataset still provides insights on numerous subpopulations, including long-time residents. In future surveys, we will randomize mailings for all

residences and possibly oversample lower-income residents to ensure a more representative sample. A variety of oversampling approaches can be justified in cases where the preferences of a particular segment of the community need to be better understood or are otherwise difficult to access.

Analysis

This survey approach yielded a rich dataset. Below is a discussion of the analytic approaches we used

Figure 3. Respondent Demographic Information

	<i>N</i>		<i>N</i>	%
Male (%)	116	33%	Education	346
Age (years)	348	39	High school diploma	23
Household Income (US\$)	329	100,000	2 year degree	30
<50K	64	20%	4 year degree	103
50–99K	130	38%	Graduate or professional degree	190
<100K	135	42%		
LFS Interest	350		No Previous Community	131
Weak/Moderate	196	56%	Previous Community	224
Strong	154	44%	under 50K	101
			50–300K	65
			over 300	58

to make sense of these responses. Our first analytic approach was to examine the mean performance of each component for Lexington residents, regardless of income, zip code, or experience with a previous community. Mean component performance scores provide a general overview of how residents feel the system is performing overall and with respect to each of the 20 components. We removed 'Don't Know' responses from these means as we only wanted to account for the perceptions of individuals who knew enough about each component to evaluate it. The number of individuals who evaluated each component, however, provides insights into how visible each component is within the LFS.

Our second approach was to index these mean scores against the performance scores of residents' previous communities. While there are multiple ways to approach benchmarking, we chose to analyze how resident perceptions of performance are influenced by experiences with different local food systems. For this analysis, we developed index scores by dividing the mean of each component in Lexington by the corresponding component mean for the previous cities and then multiplied by 100. Scores higher than 100 represent areas where Lexington outperforms residents' previous communities. When baselining the Lexington score, we only included the resident evaluations of previous communities for individuals who moved to Lexington in the past five years.

This indexing approach also works when individuals are grouped according to demographic and

geographic differences. For instance, one could consider all of the Lexington residents recently moving from a large city, a small city, and a rural area as separate groups. We index the means of these individuals against their evaluations of their previous community.

The indexing approach is flexible and can yield comparisons of LFS component performance among different geographic and demographic groups. In future analyses, if we (and others) survey enough cities and regions, comparisons between places and resident groups with similar characteristics will be possible. In this way, we could compare Lexington, for example, to a place with a similar demographic composition in the same geographic region to better approximate relative performance. For this analysis, we chose to use the previous community scores from residents as an index baseline because we had an interest in how recent arrivals to Lexington contextualized LFS performance. Many other strategies are possible depending on the goals of the user. For index comparisons between subpopulations, we compared means for statistical significance by using a combination of ANOVA and Tukey Tests. The Tukey Test is an initial stage post-hoc multiple means test to determine which means are statistically different from each other at a 95% confidence level.

We used a third type of analysis, ordered logistic regression, to understand the relationship of each component to overall vitality. We regressed each score of overall vitality for Lexington against

each of the 20 individual component ratings. We also included demographic variables including sex (binary), age (continuous: years), income (continuous: log of thousands of dollars), and interest in local food (ordinal: 1–5 Likert scale, where 1 and 2=low interest, 3 and 4=medium interest, and 5=high interest). Regressions help illustrate which individual components consistently explain ratings of overall vitality. We interpret statistically significant components as critical to how Lexington residents view their food system. We present these results alongside index data because an interpretation of component performance requires the consideration of absolute (mean), comparative

(index), and contextual (regression) performance.

As with the index approach, we ran ordered logistic regressions on subgroups of Lexington residents based on their previous community, their age, their interest in local food, and their income. By segmenting the analysis in both index and regressions, we provide details into how different residents in the city perceive LFS performance and value specific components.

Results

In this section, we present the component performance data from a few different perspectives. Table 1 provides an overview of the general

Table 1. Lexington Resident Perceptions of Local Food Systems (LFS) Component Performance

	Previous Communities			Lexington				OLR
Components	N	Mean	Std. Dev.	N	Mean	Std. Dev.	Index	p>z
Market Channel Performance								
Farmers Market***	110	3.75	1.29	333	4.16	0.81	111	.000
CSAs	65	3.22	1.40	221	4.00	0.83	124	.191
Coop Grocery	95	3.20	1.30	310	3.91	0.80	122	.307
Food Truck	71	3.00	1.46	199	3.79	0.84	126	.591
Restaurants***	109	3.22	1.28	320	3.79	0.91	118	.003
Retail***	113	3.08	1.22	345	3.50	0.95	114	.011
Ethnic Markets	78	2.99	1.46	173	3.21	1.04	107	.154
Farm to School	81	2.75	1.25	144	3.03	1.17	110	.318
Community Measures Performance								
Food Festivals*	115	3.24	1.32	312	3.59	0.94	111	.062
On-farm Events	93	2.95	1.29	232	3.33	0.97	113	.930
Food Education	100	2.69	1.11	237	3.22	0.94	120	.603
Food Banks	85	2.98	1.16	186	3.19	1.07	107	.433
Community Gardens	102	2.68	1.25	265	3.12	1.03	117	.141
Low Inc. Comm.	91	2.60	1.20	229	2.72	1.02	104	.357
Local Food Promotion Performance								
Breweries Promote LFS*	91	3.15	1.48	291	4.08	0.98	129	.088
Local Food Label	115	3.13	1.26	320	3.93	3.06	126	.367
Local Product Diversity***	117	3.34	1.36	323	3.62	0.99	108	.001
Govt. Support of LFS	81	3.14	1.32	222	3.49	1.01	111	.375
Private Investment in LFS	66	3.11	1.31	168	3.47	1.07	112	.551
Price Competitive	105	3.30	1.13	314	3.40	0.92	103	.807
N=306								
Overall Vitality	125	3.44		354	3.89		113	Prob>chi2 =.000

Note: ***, **, and * represent component significance at the 99%, 95%, and 90% level in ordered logistic regressions (OLR) (see OLR p>z column). For performance scores, 'Don't Know' results were removed. As such, the N differs for each component.

performance of each component within Lexington's system. The first broad column to consider is the one that contains Lexington component means (third from the right). This provides a decontextualized snapshot of how residents feel individual components are performing on a 1–5 Likert scale. A score above or below three indicates whether a component scores above or below average respectively for respondents.

We deliberately left the definition of and criteria for evaluating 'performance' up to the respondent. This approach allows each resident to evaluate each component in reference to a constellation of other components—i.e., in reference to a system of relationships. The explanation for why 'farmers market quality' scores comparatively higher on average in Lexington than 'food banks are accessible and offer fresh food,' for example, requires more inquiry at a local level. The performance scores, however, when presented alongside other contextualizing data, give insights into the broader system perceptions and patterns.

For instance, the 'Previous Communities' column in Table 1 presents performance scores of a previous community for residents who moved to Lexington within the past five years (third from the left). The index score shows how each Lexington component mean is shaped by experiences with a previous community. Our contention is that new residents' experiences with previous LFSs influence their perceptions of Lexington LFS performance. Previous community experiences serve as a baseline to standardize the Lexington component performance. Index scores above and below 100 represent higher and lower performance respectively compared to the previous community baseline.

Finally, we indicate which component means are significant independent variables in ordered logistic regression analyses of overall system vitality. We place asterisks next to these significant component means in Table 1. Since the overall vitality score (i.e., the overall system performance)

is considered in relation to all individual components (as well as demographic indicators), these regression results provide a contextualization of each component in relation to the overall system. We interpret statistical significance as an indicator of the relative importance of that component to the respondents' understandings of the LFS.⁵ We give the performance of these significant components more consideration since they partly explain perceptions of overall vitality. Taken together, these different analyses (mean performance, index, and regression) provide a nuanced and contextualized portrait of the performance of different components according to diverse individuals with complex understandings of their LFS. Full regression results for the survey population are presented in the Appendix.

General Performance Evaluations

From this data, we have a few takeaways. First, for the general respondent, farmers markets have the highest mean performance score (4.2) and the most overall ratings (N=333). The high number of responses for this component shows that residents have knowledge about how the farmers markets in Lexington perform. If a respondent does not feel comfortable assessing a component, they would select 'Don't Know,'⁶ and we would remove this data point from the analysis. Farmers markets are quite visible in the food scene and well regarded. While performing better on average than previous communities' farmers markets, the index score is not dramatically higher. This may indicate that farmers markets are performing well in Lexington, but they may not constitute a distinguishing feature compared to others LFSs.

However, this component's significance in regression models illustrates that farmers markets are critical to respondents' overall evaluations of LFS performance, whereas other highly regarded components, such as local food labels (3.9), are not predictive of overall vitality (i.e., they are not significant in OLR models). The city government and/or LFS development entities might recommend continued or expanded support for farmers

⁵ Components that are significant in the OLR models are indicated in tables in the form of asterisks.

⁶ 'Don't Know' responses were removed from this part of the analysis thereby resulting in decreases in overall N.

markets⁷ but look for other lower performing elements in which to invest or intervene.

'CSA program quality' also scored well in general (4.0) and was one of the higher scoring components in relation to participants' previous communities (index=124). Despite there being only five CSA farms offering over 50 shares each in the Lexington area, this market channel has received positive attention recently.⁸ The city government, local university, and other employer organizations have recently started offering cost offsets for CSAs to their employees. While these scores suggest a compelling story to tell about Lexington's CSAs, this component was not significant in OLR models. CSAs' lack of significance in OLR models could be explained by their relative newness as a market channel in Lexington. CSAs are currently high performing, yet not completely integral to the overall perception of an LFS. We require further research to understand why CSAs are rated as such, and how this score (and significance level) are changing over time. This data is a starting point for further inquiries.

'Breweries/distilleries promote local food' scored highest on the index (129) as well as in its general performance score (4.1). Additionally, it is significant (at the 90% level) in the logistic regression model of overall vitality scores. A large number of residents also showed enough knowledge about brewery activities to rate this element ($N=291$). Together, breweries/distilleries score well in the absolute (mean performance), comparative (index), and contextual (regression) metrics in our model.

Due to its high performance along different measures, it is possible to theorize whether breweries are a distinguishing feature of Lexington's LFS. According to other studies by the authors, chefs and restaurant owners link increased consumer awareness of local food to the emergence of the city's microbreweries (Rossi et al., 2015).

Lexington opened its first brewery only six years ago. Since then, five more breweries and one cidery have opened. Most breweries partnered with food trucks and nearby restaurants rather than offering their own menu. At the same time, food-related businesses emerged in the same areas.

One brewery property, for example, was established at the site of an old bread factory. Throughout its existence, it has focused on community engagement and promoting local food. This property, called the Breadbox, has a number of food-related enterprises. It has a business that uses aquaculture techniques to simultaneously produce tilapia and microgreens, a fish and chips restaurant, and a certified kitchen for processing donated and/or gleaned seconds (i.e., edible produce that doesn't meet the aesthetic conventions of retailers) to help address the area's food insecurity. Additionally, the brewery holds a mini farmers market on-site, serves as a CSA pickup location, and holds local food events. While the brewery phenomenon is new in Lexington, the city has seen continued integration and cross-promotion with local food. A few other breweries have seen similar relationships develop.

Further, Central Kentucky's bourbon industry has played an important role in the development of the LFS in terms of creating an association between the region and craft processes. Distilleries are a popular draw for tourists. Bourbon, as an agricultural product, is an example of *terroir*—an association between the region, its environment, cultural know-how, and distinct consumable products (Bowen, 2010). This association has extended to food with distilleries also promoting regional cuisine and local products. As such, distilleries and breweries both seem to support LFS development in this community. While it is not possible to make this claim from the index data alone, the LFSVI provides a place to start determining the components that have a virtuous effect on LFS development and resilience.

⁷ The city has four farmers market locations (two separate market organizations): two in the center of the city, and two on the south side. The north side has no formal market, but is served by a community garden nonprofit and an innovative sliding-scale CSA project. Support for different components within the city is spatially heterogeneous. Authors compare spatial differences in component function in Table 7.

⁸ The current CSA share count for the central Kentucky region in 2018 is around 800. Many individuals share or split their shares with others. There is also considerable turnover every year in shareholders. Based on these numbers, we expect that survey respondents who rated the CSA component in our survey ($N=221$) likely participated in this market channel at some point in the past few years.

As these brewery/distillery resonances with local food are recent, and as our survey may have oversampled those predisposed to having a strong interest in this component, we intend to repeat this survey after a few years to see how within-Lexington scores of each component change, especially with broader representation of respondents. Repeatability and flexibility are strengths of the LFSVI methodology; it also allows for different benchmarking and sampling strategies, as discussed. For instance, if we were to conduct a larger national survey of places, or many intensive surveys of individual towns or cities, we could aggregate the component scores of small cities (i.e., 100–500K people) in the Southeast to provide a more contemporary comparison of brewery/distillery performance (as well as that of other components).⁹ In its current form, we must recognize the temporal limitations of using a previous community score as a benchmark, but we also argue that comparison to previous experiences allows respondents to better evaluate their experience in Lexington.

The local food label, as noted in Table 1, has a high overall index score (126), and scored well in general for Lexington (3.93). Residents may have provided such a score due to their strong awareness of the KY Proud logo. Around 69% of Kentuckians are familiar with the label (Think New, 2016). This logo indicates a product that is grown or processed in Kentucky. The label also finds middle ground between University of Louisville 'Cardinal Red' and the University of Kentucky 'Wildcat Blue.' It also may be that restaurants, stores, etc. are identifying farm sources on menus and labels. At the same time, this component was not significant in ordered logistic regressions (OLRs), so it is not a consistent predictor of overall vitality for the general resident. While the regression data may make this component less suitable for understanding overall system function, the index and mean data still give insights into how this component functions in other contexts. Again, this index gives us a good starting point for more detailed inquiries.

Retail sourcing of local products was extremely

important in the OLRs, but only moderately above average in the mean scores (3.50). We know from other research projects that Kentucky has few producers that reach wholesale levels of production (Brislen, Rossi, & Stancil, 2016; Rossi et al., 2018). As such, we interpret these data as indicating consumer interest in local food in retail settings, but, the data indicate an underperformance on the part of retail outlets. These data suggest that there is unmet consumer demand in the retail sector; more investment and research on how to address this issue is important.

As mentioned above, this particular data point, when combined with further inquiries, may lead decision-makers to consider different strategies for improving farmers' access to wholesale markets. This access can be improved, for example, through aggregation or collective marketing strategies. In the process of deciding a particular course of action, decision-makers may employ the *Local Food Economics Toolkit* or another assessment method to identify economic and social impacts. The LFSVI complements other development approaches.

What is most compelling from our pilot index and OLR observations is that they align well with the results from other studies we have conducted—especially the local food demand study requested by Lexington's local food coordinator (Rossi et al., 2015). In that study, respondents indicated that restaurants sourcing locally, the emergence of breweries, and farmers markets were the three main drivers of the LFS. Each of these components scored highly in resident evaluations (in our index methodology) and was significant in OLRs of overall vitality. Our current index, however, points to components beyond those mentioned in our assessment that could aid LFS development decisions. Further, the LFSVI provided a more efficient approach to gathering LFS performance data compared to the food demand study that required 50 hour-long interviews.

Lexington Component Performance: Long-time Residents Compared to Recent Arrivals

While the data presented in Table 1 identify general perceptions of Lexington's food scene, the LFSVI

⁹ We are currently involved in a multistate project to create a larger baseline for indexing.

is useful for understanding how different groups of residents within the city (and between cities) evaluate LFS components. In the following section, we illustrate how perceptions of Lexington's LFS relate to individuals' experiences with previous communities.

We begin with Lexington residents who have been in the city for at least 10 years (Table 2). Of the 131 individuals from this group, many of them did not know enough about components such as CSAs, farm-to-school programs, food banks, and food trucks to evaluate their performance. Additionally, this group scored these LFS aspects much lower than all other groups. Long-term residents, then, were the least engaged group in terms of evaluating Lexington. Nevertheless, there are some important insights gained from their responses.

In OLRs of overall vitality for this group, a few components were significant to overall vitality scores, and thus more likely to be associated with this group's vision of a high-performing LFS. These components include consumer food education, food festivals, local product diversity, retail, and restaurants sourcing local. Because the first element performs below average (2.92), long-time residents may find food education (e.g., cooking, preserving, and gardening) programs important but in need of further investment, development, or diversification. Similarly, longer-term residents have an interest in finding local foods in retail spaces, yet this component has a mediocre mean performance. Based on this data, LFS development stakeholders might consider developing strategies for increasing wholesale level production among

Kentucky farmers.

Breweries and farmers markets scored the highest of all elements while farm-to-school and low-income food access scored the lowest. Many of the performance ratings are similar to the unsegmented means in Table 1, but components that are significant to overall vitality in OLRs differ. The differences in the components that are significant in OLRs indicate different priorities for resident segments within the LFS. Higher component ratings are associated with an increased likelihood of rating overall vitality higher. As we discuss throughout this section, the LFSVI can produce performance ratings for different subpopulations within the city.

When the long-time resident group is compared to residents who recently moved to the city from different locations, a few interesting patterns emerge. The most obvious pattern here is that Lexington's performance inversely relates to the size of a resident's previous community (Table 3).

Table 2. Long-time Resident Perceptions of Lexington's LFS

Components	Lexington with No Previous Community		
	N	Mean	Std. Dev.
Market Channel Performance			
Farmers Market	127	4.14	0.85
Coop Grocery	113	3.71	0.86
Retail	127	3.03	0.94
Restaurants	118	3.36	0.88
CSAs	83	3.76	0.88
Farm to School	56	2.38	0.93
Food Truck	73	3.49	0.87
Ethnic Markets	64	2.78	0.98
Community Measures Performance			
Low Income Food Access	97	2.42	1.00
Food Education**	103	2.92	0.91
Community Gardens	109	2.83	0.96
Food Festivals**	119	3.26	0.92
Food Banks	73	2.75	0.89
On-farm Events	101	3.05	0.85
Local Food Promotion Performance			
Local Product Diversity*	110	3.42	0.84
Local Food Label***	112	3.54	1.00
Price Competitive	112	3.12	0.91
Breweries Promote LFS	101	3.86	0.91
Govt. Support of LFS	90	3.21	0.93
Private Investment in LFS	68	3.12	0.95
Overall Vitality	131	3.72	

***, **, and * represent component significance at the 99%, 95%, and 90% level in ordered logistic regressions. Full regression results not shown for this segment.

The overall vitality of Lexington shifts between 4.11 (when residents come from rural communities), 3.92 (when residents come from small cities), and 3.82 (when residents come from large cities).

Critically, though, overall vitality ratings are all higher for these segments than for residents who have lived in Lexington for at least 10 years (3.72). We used post-hoc ANOVA techniques (Tukey Tests) to test the differences in means between groups. We found that overall vitality means are significantly different only between the smaller previous community and long-term resident groups. This statistical relationship is consistent for most of the components (small previous community residents are different from long-term residents). In some components, the medium and large previous community segments are also statistically different from and higher scoring than the long-term residents. A few notable components that exhibit this pattern are the retail, farm-to-school, and food banks components.

Residents moving from medium-sized cities (same size class as Lexington) had the highest scores for food trucks, community gardens, and private investment in the LFS. These scores had varying levels of statistical difference from the other resident categories; however, in each case, the scores were statistically higher than the long-term resident group. Finally, residents moving from

large cities rated the local food label and CSAs¹⁰ highest among the groups.

Together, these data illustrate that residents' perceptions of what works well in Lexington's LFS are shaped in part by their previous experiences. If residents recently moved to the city from another place, they are more likely to have a favorable view of each element compared to those who have been in the city for longer than 10 years. As such, long-term residents may be too embedded in food-related behavior patterns to see the more subtle evolution of the system. Or they have more

Table 3. Resident Perceptions of Lexington Based on Previous Community Size

	Lexington Index Summary: Previous Community Size			
	Small <50K	Medium 50–300K	Large >300K	LT Res.
Population <i>N</i>	96	64	58	131
Farmers Market	4.29	4.08	4.00	4.14
Coop Grocery	4.08 ^a	3.95 ^{a,b}	3.94 ^{a,b}	3.71 ^b
Retail	3.84 ^a	3.67 ^a	3.65 ^a	3.03 ^b
Restaurants	4.04 ^a	4.07 ^a	3.90 ^a	3.36 ^b
CSAs	4.14 ^a	4.08 ^{a,b}	4.15 ^a	3.76 ^b
Farm to School	3.44 ^a	3.43 ^a	3.43 ^a	2.38 ^b
Food Truck	3.93 ^{a,b}	4.24 ^a	3.65 ^{b,c}	3.49 ^c
Ethnic Markets	3.59 ^a	3.43 ^a	3.2 ^{a,b}	2.78 ^b
Low Income Food Access	3.03 ^a	2.95 ^a	2.73 ^{a,b}	2.42 ^b
Food Education	3.60 ^a	3.28 ^{a,b}	3.32 ^a	2.92 ^b
Community Gardens	3.29 ^a	3.52 ^a	3.12 ^{a,b}	2.83 ^b
Food Festivals	3.94 ^a	3.77 ^{a,b}	3.48 ^{b,c}	3.26 ^c
Food Banks	3.53 ^a	3.39 ^a	3.35 ^a	2.75 ^b
On-farm Events	3.53 ^a	3.60 ^a	3.52 ^a	3.05 ^b
Local Product Diversity	3.84 ^a	3.68 ^b	3.60 ^b	3.42 ^b
Local Food Label	3.91 ^a	3.75 ^{a,b}	4.07 ^a	3.54 ^b
Price Competitive	3.61 ^a	3.53 ^a	3.50 ^a	3.12 ^b
Breweries Promote LFS	4.29 ^a	4.15 ^{a,b}	4.14 ^{a,b}	3.86 ^b
Government Support of LFS	3.58 ^{a,b}	3.79 ^a	3.74 ^a	3.21 ^b
Private Investment in LFS	3.54 ^{a,b}	4.12 ^a	3.63 ^{a,b}	3.12 ^b
Overall Vitality	4.11 ^a	3.92 ^{a,b}	3.82 ^{a,b}	3.72 ^b

The superscripts represent whether a group mean is statistically the same or different from the other groups at a >95% confidence level. For instance, if 3 groups are 'a' and the last is 'b' that means all of the 'a' means are statistically the same as each other, but different from 'b' using Tukey Tests (Post-Hoc ANOVA).

¹⁰ This score is not statistically different than those of small and medium previous community residents.

nuanced understandings of the positive and negative aspects of each of these elements. More recent arrivals to Lexington may be more willing to explore different food system options as they adjust to their move. They may also be seeking experiences that align with their previous place of residence.

Revisiting components significant in OLR¹¹ from Table 2, food festivals, local retail, restaurants serving local products, and consumer food education programs were all critical to long-term residents' understanding of overall food vitality. A takeaway from Tables 2 and 3, then, is that LFS stakeholders should consider strategies and

programs to better market, educate, and engage long-term residents of Lexington in the LFS. The local food coordinator or community organization could draw from this data to focus on strengthening or diversifying these components to focus on long-term residents.

Lexington Component Performance: Previous Community Comparison

In this section, we delve deeper into how Lexington's performance scores from respondents coming from a previous community compare to the performance of that previous community. In Table 1, we presented an aggregate of all Lexington

scores indexed by all previous community scores. In Table 4, we index the mean Lexington component scores for each resident segment against ratings of their previous community in. To construct the index baseline, we only included the previous community scores from individuals who moved to Lexington within the past five years.¹² This approach gives a sense of how previous community experiences impact the perception of Lexington.

In the previous section, we noted that Lexington scores comparatively high among individuals coming from small towns compared to the other groups. When comparing Lexington to their previous community, individuals coming from smaller towns generally have the highest index scores among groups (Table 4). Lexington likely has a larger number of local food-oriented market channels, social institutions, and resources compared to smaller communities. As 60% of individuals in this segment came to Lexington from other small towns in Kentucky, these results are not surprising. In other projects, we have identified an interest in local food among rural Kentucky residents; but, inadequate distribution and/or processing infrastructure, supply, and market

Table 4. Index Scores based on Previous Community Size

	Small	Med	Large
Population	<50K	50–300K	>300K
<i>N</i>	46	39	40
Farmers Market	137	103	95
Coop Grocery	163	108	112
Retail	144	113	108
Restaurants	163	115	107
CSAs	169	114	114
Farm to School	156	111	113
Food Truck	202	144	98
Ethnic Markets	176	116	86
Low Income Food Access	132	111	96
Food Education	161	112	109
Community Gardens	169	115	101
Food Festivals	168	106	90
Food Banks	153	107	96
On-farm Events	142	116	106
Local Product Diversity	151	105	89
Local Food Label	149	123	110
Price Competitive	130	103	94
Breweries Promote LFS	200	131	105
Govt. Support of LFS	149	118	100
Private Investment in LFS	173	117	96
Overall Vitality	152	105	95

¹¹ A component's significance to overall vitality is represented as asterisks. Full analysis not shown.

¹² Residents that moved to Lexington in the past 5–10 years were included in the **Lexington performance score** for their associated previous community subgroup (i.e., small community, small city, large city), but these individuals were not included in the **previous community scores**.

opportunities makes it difficult to serve existing consumer demand for local food (Rossi et al., 2018; Brislen et al., 2016). Additionally, while LFS components such as food trucks, breweries, and food festivals all exist in these rural locations, they are not as widespread. The existence and concentration of these opportunities is part of Lexington's regional drawing power. At the same time, individuals in rural locations may have different ways of conceptualizing local food that differ from the components we have included in the LFSVI. In future iterations of this index, we may rework existing components to include aspects related to hunting, informal food exchange, gardening, and farm stands.

Lexington residents moving from similar-sized (medium population) cities also scored most components in Lexington favorably compared to their previous location; though, their scores were not as dramatic. In particular, breweries and food trucks again scored high on the index. In the small community segment, the high index scores are likely a product of the sparsity of such components in rural locations. In the medium-sized previous community, however, the same trend is evident. These two components perform better in Lexington than in comparable communities. As such, these index scores raise the question of why these components are so visible in Lexington. With more in-depth assessment, Lexington could provide lessons for others medium-sized cities looking to use components such as breweries and food trucks for local food promotion.

Residents with experience in larger cities may be more accustomed to an expanded set of LFS elements that do not exist in Lexington. This would explain index scores below 100 in comparison to their previous city and their overall low scores. Breweries and food trucks are slightly above or below the index score of 100 for this segment. These scores are not surprising; breweries and food trucks are more of a phenomenon in larger cities with longer histories. Lexington's recent adoption of these channels may explain the comparatively lower rating.

At the same time, as noted in Table 3, means for this group's component performance in Lexington are generally higher than for long-time

residents. Recent arrivals from large cities appear to value CSA programs in the region as well as the local-food label and co-op grocery stores. Additionally, the farm-to-school component scores high on the index. These index scores suggest that Lexington provides more opportunities to form producer-to-consumer relationships and/or opportunities to identify the provenance of food produced in the region. It is possible then that Lexington and similar-sized cities are large enough to provide robust local food market channels, but small enough to allow for greater confidence and transparency in the production and sourcing practices of 'local' foods.

Understanding these residential perception differences can be useful in LFS development. For instance, if Lexington is outperforming similar-sized cities along many elements, civic leaders and businesses (e.g., chambers of commerce, tourism boards, etc.) can highlight examples of these elements in their recruitment efforts. By having thriving farmers markets, CSAs, restaurants, breweries, and food festivals, Lexington may appeal to individuals deciding whether to relocate to the area. These scores may indicate that the city has many food-based amenities that are valued by potential residents. If important components score lower in Lexington, leaders can look to other similar-sized cities with a positive reputation to gain ideas for improving the LFS.

If LFS development personnel are interested in pulling in residents from larger cities, they might focus on improving elements that are regarded as statistically important in regressions (i.e., tied to overall vitality ratings), but which are underperforming compared to larger cities. Food festivals are one notable example where index scores are low (90), even though they are still rated better than average overall (3.48 and 3.60 respectively). Many other analytic options exist, such as segmenting residential perspectives by previous community region (e.g., Midwest, Pacific Northwest, Southeast, etc.) or by zip codes within a city. This analytic flexibility provides index users with a myriad of potential stories and perspectives.

Analysis of Broader Consumer Segments in the City
In addition to comparing mean scores among

different groups within the city, we use ordered logistic regressions to understand how different consumer segments within the city perceive component performance. The OLR approach identifies which LFS components are statistically related to residents' understandings of overall vitality. As discussed, we regressed overall vitality against the mean scores of each of the 20 LFS components for all respondents. In this analysis, we only considered the Lexington performance scores. The OLR approach, however, allows us to conduct an analysis for different resident segments within the city. For instance, we ran separate OLRs for individuals who previously lived in small, medium, and large communities to see what LFS components were

more likely to explain or predict the overall vitality ratings of Lexington. We also segmented Lexington residents by the following categories: interest in local food, income, and age. We present results from these segments below in Table 5, though many other segments are possible.

First, we used previous community size to segment our survey results. While we presented the mean performance of these segments in Table 3, we did not discuss the OLR results in depth. Mean performance gives a sense of absolute function, while OLR results provide information on which components are statistically and consistently tied to overall vitality ratings. For individuals coming from small towns, the only significant component in

Table 5. Logistic Regression Results by Resident Segment

LFS Components	Previous City Size			Interest in Local Food			Income (US\$)				Age		
	<50K	50–300K	>300K	Low	Medium	High	<50	50–100	100–150	>150	<31	31–46	>46
Market Channel Performance													
Farmers Market		***		***		***		**	***		***	***	*
Coop Grocery					***		**					*	
Retail				*	**		***			***	*		***
Restaurants					***	**		***	*		***	*	
CSAs				*	**	**				*			
Farm to School									**				
Food Truck	**												
Ethnic Markets													
Community Measures Performance													
Low-income Community												*	
Food Education			***					**		***			
Community Gardens									**	**		**	
Food Festivals			***	**	***	*			***				
Food Banks	**	**								**		*	*
On-farm Events							**	*	*				
Local Food Promotion Performance													
Local Product Diversity	*			***	***	*	***		**		***	**	
Local Food Label	*	*					*						
Price Competitive		**			***				**				**
Breweries Promote LFS		**						**	*		**		
Government Support of LFS					**		*		*				
Private Investment in LFS	**												
N	91	57	51	73	100	133	59	126	66	76	115	112	82

***, **, and * represent component significance at the 99%, 95%, and 90% level in ordered logistic regressions.

OLRs of overall vitality was food trucks. Individuals from smaller communities rated most of the 20 components higher on average than individuals from medium and large cities, and their index scores were quite high when rating components against their previous community (see Tables 2 and 3). This regression model, however, shows that scores for each component varied between individual residents in the segment; only the food truck component was consistently rated in the same way in terms of its contribution to overall vitality. The statistical relationship between food trucks and overall vitality scoring indicates that this component is critical to the small previous community segment's perceptions of overall vitality.

For residents moving to Lexington from similar-sized cities, farmers markets, local product diversity, local food labels, and private investment in the LFS are all elements that predict overall vitality ratings. These components are critical to this segment's understanding of the parts of an LFS that should be strong. Residents in this category scored all of these elements above 3.5 for means and over 110 for indexes (see Tables 2 and 3). As such, Lexington is viewed as functioning well compared to previous cities with respect to these elements.

Finally, for residents from large cities, food festivals, food banks, local food labels, and price competitiveness all factor into their view of LFS vitality. Of these elements, only the food label element scored above 100 on the index and each of these elements had mean scores around 3.5. Although residents gave rather consistent scores to these components with respect to overall vitality, their scores are rather mediocre.

Taken together, the regressions provide a starting point for telling a story about how individuals moving to Lexington from other locations disproportionately value different aspects of their new LFS. Knowing what components appeal to individuals from different locations (and combining these observations with index data like that presented in Tables 2 and 3) can inform strategies for promoting or investing in certain aspects of a food system that are broadly appealing to potential recruits.

A more compelling approach, perhaps, is to

examine the city based on individual interest in the local food scene (1–5 scale). We aggregated answers as follows: low interest (1 and 2), medium interest (3 and 4), and high interest (5). In this instance, we find it useful to examine what the medium interest individuals feel is important to LFS function. This group is most likely to exhibit growth in engagement with the LFS if certain changes occur. By improving LFS aspects that are important to them, a city might improve its overall LFS by including a broader resident base.

Medium-interest residents score retail, restaurants, food festivals, local product diversity, and price competitiveness consistently with respect to overall functioning. Farmers markets, though scoring high across all resident categories, are not statistically significant for the medium interest group. Retail and price elements are significant, but they receive lower scores. Taken together, these data suggest that farmers markets are performing well for all groups, but that more gains in LFS activity (through the medium interest LFS residents) would come from improving retail sourcing of local food products. Because Kentucky has infrastructural and supply deficiencies that limit the expansion of local food in the region at the wholesale level (Brislen et al., 2016; Rossi et al., 2018), LFS policymakers and NGOs can use LFSVI data to argue for and fund programs (e.g., subsidized greenhouses for season extension) to facilitate wholesale production.

Income segments provide different analytic opportunities. From the OLR data, a few observations are prominent. Both low- and high-income individuals are interested in local food in retail settings. The expansion of wholesale-level production for retail is an opportunity to make local foods more accessible to others beyond the core local food consumer groups. Retailers and institutions (e.g., schools, state parks, etc.) in Kentucky, especially in rural locations, consistently point to local products as an important area of customer interest; but, they note that local producers cannot consistently produce enough volume to satisfy demand (Brislen et al., 2016; Rossi et al., 2018). Based on existing knowledge of place-specific issues, LFS development personnel could use this data to suggest investments in (1) production equipment and training, (2) aggregation points, (3) distributors

dedicated to LFSs, or (4) lobbying governments to provide tax rebates or other incentives for producers to sell within the state.

Finally, regressions by age segments show that younger residents value farmers markets and retail; generation x/y residents have more varied priorities including community gardens and breweries; and respondents older than 45 years old place importance on local retail sourcing and price competitiveness. All of these data indicate heterogeneity of the resident food consumer within a city, while also showing measurable patterns of component affinity. Local food coordinators and LFS development personnel can use this data for various marketing and consumer education initiatives.

Conclusion


The local food system vitality index is a novel analytic process for understanding the performance of specific components of an LFS. It provides a rapid assessment of the LFS landscape and can be used by stakeholders to support arguments regarding local development priorities. In Lexington, this initial pilot survey provided us with a rich data set on residential perceptions of the LFS. It also confirmed many observations from in-depth interviews with stakeholders regarding the strengths and weaknesses of Lexington's LFS. This LFSVI also provides stakeholders with data to identify or justify development priorities. For instance, the analysis of survey data indicated that the retail market channel is statistically associated with respondents' perceptions of overall vitality and thus constitutes an important part of the system in general. Yet, it is underperforming according to mean performance scores. Local food coordinators or agriculture development organizations can point to this data to set priorities for strengthening relations between producers, distributors, and retailers.

Beyond this general approach, the LFSVI is a flexible process that can take into account the perceptions of individuals in different socioeconomic and geographic circumstances. While our pilot survey oversampled recent arrivals in the city, the sampling approach and analysis of data can be modified according to the assessor's needs and

according to different local contingencies. As such, the LFSVI can address market-oriented, social, and infrastructural aspects of what makes different LFSs vibrant and resilient.

In the future, we envision the LFSVI to be used by stakeholders in different locations to assess their own LFSs. We recognize that the 20 LFS components we used may not be the most optimal for many places; we expect to revise the survey tool as we get information and feedback from other locales, researchers, and stakeholders. It would be possible to have both a standardized set of LFS components to measure and compare across LFSs and a set of components designed to capture site-specific contingencies in different localities.

We expect that this approach will be straightforward enough to allow LFS development personnel to repeat performance evaluations every two to three years to measure the impact of different investments on LFS component performance. These iterative measurements would allow stakeholders to observe perceptual changes in the local food landscape.

Our long-term goal is to create a large database of observations from multiple LFS and to index certain locations against others with similar demographic, geographic, and size characteristics. Additionally, we would like to be able to pool data across LFSs to segment resident component priorities. For instance, this analysis would be similar to the one outlined in Table 5, but it would include pooled observations from across the country. It would then be possible to develop a typology of LFS priorities for different resident segments and regions. This data would be akin to traditional census data of element counts (i.e., # of farmers markets, CSAs, etc.) and could be analyzed as such; however, the data would represent a more intangible aspect of LFS dynamics. The direct input on LFS activity by residents is the novelty of this approach, especially in comparison to existing food-related and QOL indices. The LFSVI is more directly conducive to formulating system interventions than other index-based analytic approaches, and we look forward to working through its practical development and implementation. 

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Appendix. Ordered Logistic Regression Output for All Lexington Residents

	Coef.	Std. Err.	z	P>z	Mrgnl. Eff. dy/dx
Market Channel Performance					
Farmers Market***	0.412	0.117	3.510	0.000	-0.001
Coop Grocery	-0.104	0.102	-1.020	0.307	0.000
Retail **	0.365	0.143	2.550	0.011	-0.001
Restaurants***	0.345	0.114	3.020	0.003	-0.001
CSAs	-0.093	0.071	-1.310	0.191	0.000
Farm to School	0.090	0.090	1.000	0.318	0.000
Food Truck	-0.041	0.076	-0.540	0.591	0.000
Ethnic Markets	-0.112	0.079	-1.430	0.154	0.000
Community Measures Performance					
Low Inc. Comm.	-0.084	0.092	-0.920	0.357	0.000
Food Education	0.044	0.085	0.520	0.603	0.000
Community Gardens	0.139	0.094	1.470	0.141	0.000
Food Festivals*	0.183	0.098	1.860	0.062	-0.001
Food Banks	0.064	0.081	0.780	0.433	0.000
On-farm Events	-0.008	0.085	-0.090	0.930	0.000
Local Food Promotion Performance					
Local Product Diversity***	0.402	0.120	3.340	0.001	-0.001
Local Food Label	0.110	0.122	0.900	0.367	0.000
Price Competitive	0.030	0.122	0.240	0.807	0.000
Breweries Promote LFS*	-0.173	0.101	-1.710	0.088	0.001
Govt. Support of LFS	-0.078	0.088	-0.890	0.375	0.000
Private Investment in LFS	-0.047	0.078	-0.600	0.551	0.000
Demographic Variables					
Sex.F	-0.307	0.269	-1.140	0.254	0.001
Age	0.008	0.011	0.790	0.429	0.000
income (log)	0.138	0.184	0.750	0.453	0.000
LFS Interest - Medium	0.384	0.343	1.120	0.264	-0.001
LFS Interest - High	0.271	0.339	0.800	0.424	-0.001
				N	306
Pseudo R2	0.174			LR chi2(28)	114.7
Log likelihood	-272.1			Prob > chi2	0.000

Note: ***, **, and * represent component significance at the 99%, 95%, and 90% level in ordered logistic regressions.