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Jennifer Michele Muzinic

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**PRODUCER INTEREST IN A FOOD HUB: A LOOK AT ATTRIBUTES,
ADAPTATIONS AND ATTITUDE**

A Masters Thesis

Presented to

The Graduate College of
Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree
Master of Natural and Applied Science

By

Jennifer Muzinic

December 2015

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PRODUCER INTEREST IN A FOOD HUB: A LOOK AT ATTRIBUTES, ADAPTATIONS AND ATTITUDE

Missouri State University, December 2015

Master of Natural and Applied Science

Jennifer Muzinic

ABSTRACT

Demand for locally-sourced food in the United States has spurred the introduction of a number of food hubs in recent years. The objective of this study was to examine the attitudes of agricultural producers in the Missouri Ozarks towards participation in a food hub. A survey of 218 farmers was conducted to assess how likely producers were to sell into a food hub and whether those producers would be willing to alter their supply to accommodate the needs of the proposed hub. Descriptive statistics, factor analysis and regression analysis were used to uncover which variables were most likely to contribute to a producer's decision to market his or her products through a food hub. Explanatory variables examined included producer attitude, social demographics, use of technology and extension services, and farm attributes. The study found that producer willingness to participate was positively related to farmer adoption of conservation and marketing technologies as well as a producer's positive attitude towards the benefits of a food hub. Age was found to be inversely related to producer willingness to participate as well as willingness to adjust supply to meet the needs of the proposed food hub. Producer attitude towards hub benefits and adoption of sustainable crop technologies were also positively related to willingness to adjust supply. These findings suggest that agricultural producers with favorable views towards technology in general and the benefits of foods hubs in particular will be more likely to market their products through a food hub.

KEYWORDS: food hub, technology adoption, Missouri, producer attitude, producer attributes, producer participation, local food systems, local food marketing

This abstract is approved as to form and content

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Chairperson, Advisory Committee
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I dedicate this thesis to Gene Baldi III and Cheryl Muzinic. Thank you for believing.

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INTRODUCTION

Problem Statement

The 20 counties that comprise the Missouri Ozarks represent 16 percent of the state's population. The region covers nearly 20 percent of the state's land area. Yet only two of those counties have a lower percentage of people living below the poverty level than the state average. The U.S. Census Bureau estimated that 15.5 percent of Missouri's population was below the poverty level between 2009 and 2013. In the Missouri Ozarks, that percentage was 4.5 points higher, at 20 percent (U.S. Census Bureau, 2015). The installation of a food hub in the region has the potential to produce a positive impact on the economy of the Ozarks (therefore helping to increase incomes).

Producers who sell to local markets, including through food hubs, tend to report consecutive years of profit more frequently than producers engaged in conventional sales (Low et al., 2015). A 2010 study by the USDA's Economic Research Service (Martinez et al.) determined that local food systems can increase a region's employment and incomes. And a Cornell study that examined food hubs found that for every dollar demanded from food hub products, an additional sixty-three cents was generated in related products (Schmidt et al., 2011). By participating in a local food system that meets the strong demand for local-grown products, Ozarks producers may also be able to generate higher incomes for themselves and their communities.

Locally-grown food products are indeed in demand throughout the United States. In 2012, local food sales reached an estimated 6.1 billion dollars (Low et al., 2015). The National Restaurant Association predicts that locally-sourced products will continue to gain popularity with chefs and restaurant patrons during 2016 as well (National

Restaurant Association, 2015). To meet that increased demand, the number of local food marketing channels is growing. The number of farmers markets has increased by 180 percent since 2006. Food hub numbers have increased by 288 percent during the same time period (Low et al, 2015). The rapid rise in food hubs suggest that demand has grown beyond the farmers market, creating opportunity for small farmers to expand into as they grow their business (Runyon, 2015).

There is little question that more farmers are taking advantage of the popularity in locally-grown products (LGPs) by using direct marketing channels. Roughly eight percent of all farms, or 164,700 farms, are marketing locally, with approximately 70 percent utilizing only direct to consumer methods (Low et al., 2015). Direct to consumer sales grew by eight percent from 2007 to 2012, reaching \$1.3 billion dollars in 2012. Nearly 50,000 farms in the U.S. also participate in direct to restaurant sales (U.S. Department of Agriculture, 2015). While the USDA Census of Agriculture does not capture the number of producers selling into food hubs, a food hub study conducted in 2013 by Michigan State University's Center for Regional Food Systems and the Wallace Center at Winrock International found that food hubs work with an average of 80 producers and suppliers (Fisher et al., 2013). With 302 food hubs currently operating in the U.S. (Low et al., 2015), a rough estimate of the number of producers selling to hubs is 24,160.

Yet there is a lot to learn about why farmers choose to participate in new marketing channels. Food hub feasibility studies are not uncommon, although reports tend to focus on identifying consumer demand and limitations such as lack of infrastructure and compliance with government regulations. While some studies have

reached out to agricultural producers through surveys and interviews, questions were primarily related to the types and quantities of product farmers could supply.

Research Objective

This study looks at food hubs from the perspective of a new technology farmers can use to market their products. Its purpose is to understand the attitudes and attributes of producers who are likely to participate in a food hub. It examines demographic information such as farm size, farmer age and number of years farming; technologies and marketing methods already adapted; and attitude towards a hub, hub ownership and potential value-added services (such as education or group food service safety certifications) a food hub can offer to producers.

It is the intent of this research to provide information on producers in the Missouri Ozarks and their attitude towards a food hub. Individuals who are establishing a food hub in the area can utilize this information during the business planning stages. Government officials, hub managers, producers and local food advocates can use this research to make better decisions about food hubs and local food marketing. It is hoped that the intended audience for this research will gain a better understanding about producer perceptions of a food hub and the marketing challenges farmers face. It is expected that this added insight will benefit producers through added marketing, educational and training opportunities. Additionally, local food organizations such as community gardens and food policy groups may benefit from the increased knowledge of producer demographics and motivations as they prepare business plans and grant applications for their own projects.

The purpose of this thesis was achieved using data collected from 218 producers operating within a 20-county area comprising the Missouri Ozarks. The data was collected using in-person interviews, mail and online surveys through SurveyMonkey.com during a six month period beginning in November, 2014 and ending in April, 2015. The survey questionnaire included various sections including farm size, product mix, existing or future adaptation of marketing and other technologies, value-added activities, interest and attitude toward a food hub, willingness to invest time and other resources for a successful food hub and socio-demographic information. In January, 2015, a food hub workshop was conducted and attended by an estimated 50 producers. A focus group attended by 15 producers was held in April, 2015. Both the workshop and focus group added depth to the data provided by the survey responses. Additionally, a profile of the Missouri Ozarks region was constructed using secondary data from the United States Department of Agriculture (USDA) Census of Agriculture and the United States Census Bureau. The statistical analysis of the data was conducted using Statistical Package for Social Sciences (SPSS) and LIMDEP software.

Thesis Organization

This thesis is separated into five sections and two appendixes. The first chapter, the introduction, presents the problem statement, the objective of the research and the organization of the thesis. Chapter two provides the literature review of previous research, which is divided into several parts. The first part provides a background on food hubs in the U.S. It defines a food hub and discusses various models and ownership structures in operation today. The second section of the chapter examines producers who are selling to existing hubs, while a third section explores producer adoption of

technologies. Finally, the last portion of chapter two examines producer acceptance of risk.

Chapter three discusses the materials and methods used to conduct the study. It discusses the conceptual and empirical frameworks used, survey methodology and hypotheses. Chapter four discusses the study findings, including regional characteristics of the Missouri Ozarks and characteristics of producers in the region, including socio-demographic information, crops produced and producer attitude towards a proposed food hub. This chapter also includes the results from the empirical model. The final chapter, the conclusion, reviews the finding of the study, discusses its limitations and suggests future areas of research. IRB approval was obtained prior to conducting this study (Study Number 15-0163), on October 13, 2014. Appendix A documents the approval and training completed for work with human subjects. Appendix B is the survey used for the study.

REVIEW OF LITERATURE

This chapter reviews existing research on food hubs. The focus of the research was to identify the attributes of producers who are willing to participate in a food hub. Because there is little available research on the producers who sell through a food hub, the scope of the research was widened. Because food hubs are a new marketing technology, research on producer adoption of new technology was reviewed. The studies reviewed served as guidelines during the development of the survey materials and the research hypotheses.

Food Hub Background

A food hub is commonly defined as “a business or organization that actively manages the aggregation, distribution and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail and institutional demand” (Diamond & Barnham, 2012). While there are food hubs that have been in operation for more than 20 years, the majority of hubs have begun operation in the past five years (Fisher et al., 2013).

Farmers have turned to food hubs in recent years in part to meet consumer demand for local food while saving on transportation and marketing costs (Low et al., 2015). Buyers, in return, benefit from selling local goods purchased from a single seller that can offer a reliable, source-verified supply (Diamond & Barnham, 2012).

A 2013 survey of food hub managers found that most food hubs were located on the west or east coasts, and were either within or adjacent to a metropolitan area. The

proximity to an urban outlet had ramifications for profitability: hubs that weren't located in metropolitan areas reported higher reliance on grant funding (Fisher et al., 2013).

Food hubs tend to follow either for-profit, privately owned (40 percent), or nonprofit (30 percent) business models. Roughly 20 percent are cooperatives (Low et al., 2015). The 2013 survey found that a small number of food hubs (4 percent) are publicly owned (Fisher et al., 2013). The customer base for hubs can be individual consumers, businesses or institutions, or a combination of the two. About 40 percent focus on consumers, while the remaining hubs are evenly split between a business/institution or combination approach (Low et al., 2015).

Food hub employment tends to increase with the size of the hub and the hub's sales volume. The 2013 survey found that the average number of full-time workers a hub employed was 11. Hubs generating less than \$500,000 in annual sales averaged two full time staffers, and those earning between \$500,000 and \$2 million employed an average of five full time workers (Fisher et al., 2013).

Producers for Food Hubs

On average, food hubs source their products from 80 farmers. Nearly 80 percent of food hub managers consider their producers to be small or midsized farmers, defined as having gross sales under \$500,000 per year (Fisher et al., 2013). There appears to be a tendency for midsized farmers to turn to food hub sales, while smaller producers focus on direct-to-consumer sales such as farmers markets, on-farm sales and Community Supported Agriculture (CSA), which allows consumers to purchase "subscriptions" for farm products. More small farms, defined as farms with less than \$50,000 in annual

income, are engaged in direct sales than midsize (\$50,000 to \$500,000) or large farms. Midsize farms, however, generate more direct sales dollars (Martinez et al., 2010).

Some of the rationale for midsize producers to look towards food hubs as a marketing solution may be due to their role as “agriculture in the middle” farmers. These farmers may be large enough to overwhelm the direct-to-consumer market while remaining too small to capitalize on production efficiencies and the large-volume benefits afforded to large operations (Diamond & Barnham, 2012).

A feasibility study for a food hub in Central Minnesota found that very small farmers – those with \$5,000 or less in annual sales – did rely on direct-to-consumer methods for their sales, primarily through farmers markets. Yet these small producers were also attracted to the potential hub’s ability to connect them to local buyers, as well as features such as processing facilities, value-added activities and business skill development (Happy Dancing Turtle, 2012). Central Indiana farmers considering a potential food hub in their region valued a one-site drop off, which they viewed as preferable to having to manage multiple deliveries and sales. The main draw to the one-stop drop off was the ability for them to spend more time farming (Aubrey, 2012).

Producers also have preferences towards hub ownership. The Central Indiana producers did not find a cooperative approach to ownership desirable, since some farmers had experience with poor organization in the past. A farmer-owned hub was preferred strongly by one farmer in the Indiana study, while others wanted to see more logistics completed before commenting either way (Aubrey, 2012).

Roadblocks to a food hub, as perceived by Indiana producers, followed five themes: market entry/competition (is Wal-Mart a buyer or competitor); regulations compliance/cost; management costs/concerns (particularly in terms of staffing costs and

how those salaries would impact the price producers receive from the hub); production practices and crops; and consumer acceptance. The benefits producers saw were divided into categories such as local economic development; food quality (short shipping, fresher produce); positive farmer-consumer interaction (a built in way to reach consumers); and opportunity for the farmer to focus on growing (Aubrey, 2012).

Producer Adoption of Technology

The contributing factors in the decision to adopt new technology can be categorized into socio-demographics, farm attributes and the producer's attitude about the benefits of a new technology (Adesina & Zinnah, 1993). Among the socio-demographic attributes, several studies have found that older farmers tend to be less willing to utilize new technologies (Souza Monteiro & Caswell, Amponsah). However, age doesn't always play a factor: a literature review of farmers' adoption of conservation practices revealed that age is not always found to be significant. That research suggested that frequently used explanatory variables, such as age, are going to have a higher number of both positive and negative effects on the dependent variables in studies, simply because of the number of times they are used (Knowler and Bradshaw, 2007).

Education, farm size and income is positively related to adoption of some technologies, such as computer use and outside-the-farm professional services (Amponsah, 1995). Other technological adoptions, such as organic farming practices, seem to appeal to farmers with fewer acres (McEachern and Willock, 2004). Availability of extension services has been found to increase the likelihood of a farmer to adopt conservation practices (Baidu-Forson, 1999) and grow new varieties of a crop (Adesina & Zinnah, 1993).

Changes to existing business practices can often take the path of least resistance. In a 2008 study of agriculture industry members' willingness to adopt assurance programs, the researchers identified lack of incentive as a deterrent to implementation of new practices (Soderlund et al, 2008). Risk acceptance, availability of an extension agent and a percentage of already-degraded land were the three primary factors contributing to farmer adoption of soil conservation practices in Niger (Baidu-Forson, 1999).

Producer perception of the benefits of a new technology may play an even more important role in determining whether or not he or she will adopt that technology. In a study of Sierra Leone mangrove rice farmers and their willingness to plant new varieties of rice, researchers found that farm or farmer-specific attributes were less significant than whether or not farmers believed the new rice varieties would have better yields or was easier to cook. Each perceived benefit increased the likelihood of the adoption of that technology (Adesina & Zinnah, 1993).

Producer Acceptance of Risk

Agricultural production inherently involves some level of risk. Some of that risk revolves around the uncertainty of yields, both in terms of quality and quantity. Yet more risks are assumed by producers in the form of fluctuating input costs such as labor, fuel and feed, as well as the fluctuating prices for products (Schieffer, 2015). Risk tolerance varies by type of farm as well. Fresh fruit and vegetable producers assume a greater risk in terms of perishability and quality standards (Schieffer, 2015). Producers that specialize in different areas of production also have different levels of risk: row crop farmers and dairy farmers are least tolerant of risks, while fruit and vegetable crop producers tend to be more tolerant (Roe, 2015).

For producers who are primarily involved in direct-to-consumer sales, there is some level of increased risk involved in food hub participation. Producers who sell directly to consumers are able to generate retail prices. These producers are often concerned with the amount of money the food hub will retain for their administrative costs, compared to the prices passed on to farmers (Aubrey, 2012). In fact, one of the insights Matson et al. (2015) uncovered during a food hub case study review was that it is more difficult to recruit producers with established direct marketing relationships. A study by Meter and Phillips Goldenberg (2013) suggested a number of producers were wary of the risk of aggregation, particularly without purchasing commitments from buyers. Producers who rely solely on direct-to-consumer sales tend to purchase less machinery and own less land than conventional farmers, indicating a higher level of risk aversion. Additionally, they generate more of their income from marketing services performed than their conventional counterparts, which can decrease fluctuations in income (Low et al., 2015).

MODELS, MATERIALS AND METHODS

Purpose of the Study

The purpose of this study was to understand the factors contributing to producers' willingness to sell their products through a food hub. The intended audience for this research includes individuals considering establishing a food hub, hub managers, government officials, and producers. The expectation is that the audience will use the increased knowledge to help agricultural producers expand their market reach.

Conceptual Model

The framework for analyzing producers' participation in a food hub and their production adjustments to meet the requirement of the proposed hub is developed based on the technology adoption model developed by Rahm and Huffman (1986) and further developed and used by Adesina and Zinnah (1993). Producers' participation in a food hub and their production adjustment decisions can be similar to any other technology adoption, and is assumed to be based on utility maximization. The food hub can be defined as a new way to market products, or as a new technology, $j=1$, and traditional marketing of products, $j=2$.

The underlying utility function, which is non-observable, is defined by $U(R_{ji}, K_{ji})$ where the utility derived by the marketing channels, U , is the function of R and K . R is the vector of farm and farmer specific characteristics including farm size, age and experience of the farmer. K is the perceived or actual attributes associated with the adopted new marketing channels (e.g., food hub) or traditional marketing channels. Thus, the relationship between unobserved utility derived from the marketing channels is

defined to be a function of observed farm and farmer specific attributes and perceived or actual attributes of the marketing channels, and an error term having a mean value equal to 0:

$$U_{ji} = \alpha_j F_i(R_i, K_i) + e_{ji} \quad j=1,2; i=1,\dots,n \quad (1)$$

The i th producer will select the alternative if $J=1$ if $U_{1i} > U_{2i}$ or if the non-observable (latent) random variable $y^* = U_{1i} - U_{2i} > 0$. Y_i is observable and represents y^* . Y_i is equal to 1 if producers indicate a willingness to participate in a food hub and adjust production to meet the food hub requirements, and 0 if not. Y_i is the function of independent variables including farm and farmer characteristics, and the actual and perceived attributes of a food hub.

Empirical Model

A Logit model was used to estimate the probability of producers purchasing from a food hub and the probability of producers adjusting their supply to meet the needs of the proposed hub. The model was defined as:

$$Y_1 = \beta' X_i + \epsilon_i$$

The values for Y are 0 and 1. For WTP_HUB, the value 0 indicates that the surveyed producer was neutral about, not very interested or not at all interested in food hub participation. The value 1 indicates the respondent was either interested or very interested in food hub participation. For the dependent variable WTA_Supply, the value 0 indicates that the respondent was not willing to add products, grow specific products or expand production based on the food hub's needs. The value 1 specifies that the producer was willing to adjust supply to meet hub requirements. X_i is a vector of explanatory variables which is hypothesized to impact producers' decisions to participate in a food

hub or adjust supply according to hub needs. β is the vector of unknown parameters. ϵ_i is the independently and identically normally distributed error term. Limdep was used to estimate the parameters for the model, using maximum likelihood estimates.

Following the technology adoption framework, it is assumed that the producer faces a choice between a traditional (T) and a food hub (F) marketing channel. Utilities derived from these two channels are indicated by U_T and U_F , respectively. These utility levels (U_T and U_F) are not directly observable. The observable variables are the attributes of the marketing channel a ($a = T, F$) and a vector of producer and farm characteristics (x). The technology adoption model assumes the utility derived by a producer i from utilizing the marketing channel with attribute a ($a = T, F$) can be expressed as follows:

$$U_{ai} = V_{ai} + \epsilon_{ai} \quad (1)$$

where U_{ai} is the latent, unobserved utility for choice alternative a , V_{ai} is the explainable part of the latent utility that depends on the chosen channel's attribute a and the farm and farmer-specific characteristics of producer i , and ϵ_{ai} is the random or unexplainable component of the latent utility.

In this way, producer i chooses the food hub marketing channel (attribute F), and therefore is willing to participate in a food hub or adjust supply to meet the needs of a food hub, if $U_{Fi} > U_{Ti}$. The probability that producer i is willing to participate in a food hub (or willing to adjust supply to meet the needs of a hub) is given by:

$$P_i = \text{Prob}(V_{Fi} + \epsilon_{Fi} > V_{Ti} + \epsilon_{Ti}) \\ \text{Prob}(\epsilon_{Ti} - \epsilon_{Fi} < V_{Fi} - V_{Ti}) \quad (2)$$

Describing the joint density of ϵ_a ($a = T, F$) by $f(\epsilon_a)$, the above probability is given by:

(3)

$$P_i = \int_{\epsilon} Z_i (\epsilon_{Ti} - \epsilon_{Fi} < V_{Fi} - V_{Ti}) f(\epsilon_i) d\epsilon_i$$

where Z_i is an indicator variable that equals 1 when the term inside parenthesis is true and 0 otherwise. The indicator variable Z_i will equal 1 when the utility from the food hub marketing channel is greater than the utility from other marketing channels. The assumption that each ϵ_{ai} ($a = T, F$) is identically and independently distributed as a type I extreme value (a Gumbel distribution) implies that $\epsilon_i = \epsilon_{Ti} - \epsilon_{Fi}$ follows the logistic distribution. This assumption leads to the standard logit model of discrete choice.

The relation between producers' willingness to participate in a food hub/adjust supply and producer socio-demographics, farm attributes and attitude is examined by modeling the indicator variable Z_i for the i^{th} producer as a function of his or her socioeconomic, farm attributes and attitude is as follows:

(4)

$$Z_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \dots + \beta_k X_{ik} + v_i, i = 1, 2, \dots, n$$

where:

Z_i = unobserved index level or the log odds of choice for the i^{th} producer;

x_{ij} = j^{th} attribute of the i^{th} respondent;

$\beta = (\beta_0, \beta_1, \dots, \beta_k)$ = the parameter vector to be estimated; and

v = random error term.

Using the logistic distributional assumption for the random term, the probability P_i (that the i^{th} producer will be willing to participate in a food hub or adjust supply to meet the needs of a hub) can now be expressed as:

(5)

$$P_i = F(Z_i) = F(B_0 + \sum_{j=1}^k \beta_j X_{ij}) = F(\beta X_i) = 1/[1 + \exp(-Z_i)]$$

The estimated β -coefficients of equation (5) do not directly represent the marginal effects of the independent variables on the probability P_i that the producer is willing to participate or adjust supply. In the case of a continuous explanatory variable, the marginal effect of x_j on the probability P_i is given by:

$$\partial P_i / \partial x_{ij} = [\beta_j \exp(-\beta X_i)] / [1 + \exp(-\beta X_i)]^2$$

However, if the explanatory variable is qualitative or discrete in nature, $\partial P_i / \partial x_{ij}$ does not exist. In such a case, the marginal effect of a discrete explanatory variable is obtained by evaluating P_i at alternative values of x_{ij} . The marginal effect of such a variable is:

$$\partial P_i / \partial x_{ij} = P(x_{ij} = 1) - P(x_{ij} = 0)$$

The following empirical model is used to estimate the relationship between the probability that the producer will choose to participate in a food hub and his or her socio-economic attributes, farm attributes and attitude:

$$\begin{aligned} WTP\ HUB = & \beta_0 + \beta_1 PH\ ONSITE + \beta_2 CERT + \beta_3 CROPS\ SU + \beta_4 NC\ ORG + \\ & \beta_5 EXT + \beta_6 TRADITION + \beta_7 WHOLESALE + \beta_8 NEW\ MARKET + \beta_9 HUB\ ATT + \\ & \beta_{10} EDU + \beta_{11} AGE + v \end{aligned}$$

If a producer is willing to participate in the food hub, $WTP\ HUB$ will equal 1, and it will equal 0 otherwise.

Similarly, the empirical model to estimate the relationship between producer and farm attributes and attitude and willingness to adjust supply to meet the needs of a proposed food hub is:

(9)

$$WTADJUST = \beta_0 + \beta_1 PH\ ONSITE + \beta_2 CERT + \beta_3 CROPS\ SU + \beta_4 NC\ ORG + \\ \beta_5 EXT + \beta_6 TRADITION + \beta_7 WHOLESALE + \beta_8 NEW\ MARKET + \beta_9 HUB\ ATT + \\ \beta_{10} EDU + \beta_{11} AGE + v$$

If the producer is willing to adjust supply to meet the needs of the hub, WTADJUST will equal 1 and 0 otherwise.

Population

This study examined the attributes and attitudes of producers in the Missouri Ozarks. The Missouri Ozarks is comprised of 20 counties in the southern part of the state. According to the 2012 USDA Census of Agriculture, there are 22,707 farms in the region. To reach producers in these counties, email and farm addresses were obtained from databases kept by Missouri State University's Fruit Experiment Station and the University of Missouri Extension. These lists were supplemented by obtaining information from the Missouri Department of Agriculture's website, AgriMissouri.com. Personal interviews with producers were conducted at workshops, farmers market meetings and agricultural events throughout the region. A food hub workshop held in January, 2015 and a focus group conducted in April, 2015 generated a number of survey responses and also provided additional insight into the producers' attitudes towards a proposed hub. Two-hundred and eighteen surveys were collected, achieving a confidence interval of 0.06621 at a 95 percent confidence level. The standard error is 0.03378.

Survey Design and Description

Previously published reports on the feasibility of food hubs and research on producer adaptation of technology were carefully studied to identify the information needed from the survey. Secondary data from the USDA Census of Agriculture and the US Census Bureau was used to create a profile of the 20-county region. Personal interviews with leaders in the local food industry in Southwest Missouri, including farmers market managers and food policy advocates, were conducted to gain an understanding of challenges and opportunities within the region. The steering committee for the South Central Missouri Food Hub Feasibility Study was asked to review a draft of the survey and offer suggestions. The survey questionnaire included various sections such as farm size, product mix, existing or future adaptation of marketing and other technology, distribution channels to sell the products, value-added activities, interest and attitude toward a food hub, willingness to invest time and other resources for a successful food hub, and socio-demographic information. Survey questions formats were varied based on the information required. The estimated time for completing the survey was 15 to 20 minutes.

Survey instruments were pre-tested among 20 producers at horticulture seminars in Brixey, MO and Joplin, MO. Utilizing feedback from the pre-test as well as suggestions from the steering committee members, the instrument was further improved and finalized. The survey instruments were administered through traditional personal interview and mail survey methods. An online method used SurveyMonkey.com.

Variable Definitions and Hypotheses

Surveys were entered into SPSS at Missouri State University when they were received. The study analysis is based on survey responses related to attributes, attitudes towards food hub participation and technologies put into place or being considered. Principal components factor analysis (PCA) was used to condense more than 50 farm attributes, attitudes and technologies to a smaller number of key variables. Logit models were run using Limdep software to determine the relationship between the condensed variables and the two dependent variables, willingness to participate in a food hub and willingness to adjust supply to meet the needs of the proposed food hub.

As shown in Table 1, a total of eleven variables representing farm attributes and socio-demographics of farmers was determined to impact producers' decision to sell to a food hub and/or adjust supply to accommodate the hub's needs. These variables were accountable for 70 percent and 80 percent of correct prediction, respectively.

Producer Age, Education and Use of Extension Services. Three of the variables are “stand alone” measurements of producer response to a single question: age, education and use of extension services. Age was reduced to a binary response, with 1 representing producers who are age 50 or older and 0 representing those producers younger than 50. It was hypothesized that age would be negatively related to both willingness to participate and willingness to adjust supply (Table 2).

Level of education was also converted to a binary statistic, with 1 representing producers who have had at least some college and 0 representing producers with a high school diploma or less. It was unknown how education would influence willingness to participate in a hub. Amponsah (1995) found education to be positively related to

Table 1: Descriptive Statistics of Variables Included in the Regression Models

Variable	Description of variable	Mean	Standard Deviation
WTP_HUB	1="Likely" or "Very Likely" to Participate; 0=Not willing	0.62	0.49
WTA_Supply	1=Willing to add products, grow specific products, or expand production; 0=Not willing	0.76	0.43
PH_ONSITE	Composite variable summing six postharvest activities: sorting, cooling, packing, washing, grading and labeling	1.89	2.15
CERTIFICATIONS	Composite variable comprised of five certifications: GHP, GAP, Certified Humane, Animal Welfare Approved, USDA Certified Organic	4.55	3.81
CROPS_SU	Composite variable comprised of five activities related to crop production: cover crops, IPM, extended growing season, diversified crops, no till	7.59	4.53
NC_ORG	Composite variable comprised of avoidance of synthetic fertilizers and non-certified, but practicing organic	3.50	2.23
EXTENSION	Scored frequency of extension services use	2.24	1.84
TRADITIONAL	Composite variable comprised of five marketing practices: direct to consumer (u-pick, roadside shops, etc.), farmers market, restaurant, grocery, institutions	1.38	1.38
WHOLESALE	Composite variable comprised of three marketing venues: contract marketing, distributors/wholesales, cooperatives	0.29	0.59
NEW_MARKETING	Composite variable comprised of two marketing venues: CSA and internet sales	0.44	0.68
HUB_ATT	Composite variable comprised of three attitudes towards a food hub: finding new customers, increased business income and more time farming	10.05	3.11
EDUCATION	1=More than high school education; 0=high school or less	0.81	0.40
AGE	1=50 or older; 0=younger than 50	0.67	0.47

producer adoption of computer technology. Yet producers with higher education levels also have the ability to earn higher incomes in non-farm related careers. Low et al. (2015) noted that producers with the capacity to earn more income off the farm are less likely to dedicate themselves to full time farming. The opportunity costs may discourage more educated producers from committing to food hub participation. However, it is hypothesized that education is positively related to a producer's willingness to adjust supply to meet the needs of a hub.

Table 2: Hypotheses for Variables in Producer Willingness to Participate in a Food Hub and Producer Willingness to Adjust Supply

Independent variable	Expected sign for willingness to participate	Expected sign for willingness to adjust supply
PH_ONSITE	+	+
CERTIFICATIONS	+	+
CROPS_SU	+	+
NC_ORG	+	+
EXTENSION	+	+
TRADITIONAL	+	+
WHOLESALE	+	+
NEW_MARKETING	+	+
HUB_ATTITUDE	+	+
EDU	+/-	+
AGE	-	-

Use of extension services indicates the frequency with which producers say they receive help from extension, with 0 indicating never and 5 indicating more than 1-2 times per year. Extension service use was expected to be positively related to willingness to participate in a food hub as well as willingness to adjust supply.

Postharvest Activities and Marketing Distribution Channels. Producers were also asked whether their farms took part in eight post-harvest activities: they were able to indicate either yes (1) or no (0) on the survey. Factor analysis indicated that six of these activities were highly correlated with each other: sorting, cooling, washing, labeling, packing and grading. The responses to these activities were combined to create a single, scored variable, PH_ONSITE, which has a maximum score of six. The PH_ONSITE variable was expected to have a positive relationship to both dependent variables.

Producers were asked if they utilized (1) or did not utilize (0) eleven marketing channels. Factor analysis helped to condense these variables to five distinct groups. TRADITIONAL marketing outlets include direct to consumer venues such as u-pick or roadside stands, farmers market, restaurants, grocery stores, and institutions such as schools or hospitals. The maximum value for this score is five. Because a producer who received a high score in this area would be participating in a number of marketing channels already, it was expected that the TRADITIONAL variable would have a positive relationship with willingness to participate and willingness to adjust supply.

WHOLESALE marketing outlets (maximum score 3) include contract marketing, distributors/wholesalers and local or regional marketing cooperatives. NEW_MARKETING consists of sales through Community Supported Agriculture (CSA) models and internet sales, generating a maximum score of 2. Both WHOLESALE and

NEW_MARKETING were hypothesized to be positively related to the dependent variables, for the same reason given for the TRADITIONAL hypothesis.

Producer Use of Technologies. Producers were also asked about their current use of 18 technologies related to sustainable farming and certifications. Producers could indicate the practices did not apply to their farm (0), that they were not interested in adopting such practices (1), whether they were considering adopting the practice (2) and whether they currently use the practice (3). Using factor analysis, four distinct groups were identified. CERTIFICATIONS is a score (maximum value 15) of producer preference/adoption of five certifications: Good Handling Practices, Good Agricultural Practices, Certified Humane, Animal Welfare Approved and USDA Certified Organic. CROPS_SU is a scored measurement (maximum value 15) of consideration/adoption of cover crops, integrated pest management, extended growing season (greenhouse/high tunnels), diversified product offerings and no-till. NC_ORG is a score (maximum value 6) of avoidance of synthetic fertilizers and non-certified, practicing organic.

LIVESTOCK_SU is a scored variable (maximum value of 15) of rotational grazing, grass fed and finished, antibiotic-free, free range/pasture raised and selection of crops/animal breeds adapted to site and soil conditions. It could be argued that each of these variables is comprised of new technologies already adopted or viewed favorably by producers. For this reason, all three were expected to have positive relationships to the willingness to participate in a food hub and adjust supply to meet the proposed hub's needs.

Producer Attitude Towards a Food Hub. HUB_ATT is also a scored variable (maximum value 15). Producers were asked to what extent they agreed with three statements, with 1 representing strong disagreement and 5 representing strong agreement.

The three statements were related to how strongly a farmer felt that participating in a food hub would benefit his or her business, by expanding marketing reach and finding new customers; by increasing business income; and by allowing farmers to concentrate more of their time on farming. HUB_ATT was expected to have a positive relationship to willingness to participate in a food hub and the willingness to adjust supply to meet the needs of the hub.

RESULTS

Regional Characteristics

The Missouri Ozarks region is a twenty-county area consisting of Barry, Cedar, Christian, Dade, Dallas, Douglas, Greene, Hickory, Howell, Laclede, Lawrence, Ozark, Polk, Ripley, Shannon, Stone, Taney, Texas, Webster and Wright counties. The 2014 population of the region was 955,677. (U.S. Census Bureau, 2015) While the region's population is only 16 percent of the state's total population, it makes up for nearly 20 percent of its land area: the area encompasses 13,152 square miles. (U.S. Census Bureau, 2015)

The region has 22,707 farms covering 4.85 million acres. The average farm size is 231 acres, while the median farm size is 117 acres. Most of the regions farms (nearly 16,000) are larger than 50 acres. Approximately 30 percent of the region's farms are fewer than 50 acres. Seventy-four percent (16,712 farms) reported sales less than 25,000 dollars in 2012. The majority of those farms (9,488) had sales of less than 5,000 dollars. (U.S. Department of Agriculture, 2015)

Farmers in the Missouri Ozarks work with challenges in terms of land and seasonality. The land has a number of steep slopes and rocky (cherty limestone) soils. Slopes tend to be heavily forested, with farmers planting small fields and pasture on more even grounds. Frigipan can prevent roots from reaching their optimal depth. (Soil Survey Staff, 1979) Winter temperatures prevent a year-round growing season. The majority of the counties are in planting Zone 6b, which has average extreme minimum temperatures between -5 and 0. Portions of Christian, Cedar, Dallas, Greene, Laclede, Polk, Texas, Webster and Wright counties fall within planting Zone 6a, which has

average extreme minimum temperatures between -10 and -5 degrees Fahrenheit.

(Planthardiness.ars.usda.gov, 2015) A number of farmers within the region extend the planting season by using high tunnels.

Producer Characteristics

Producers in the Missouri Ozarks tend to be older, with many years of farming experience. Nearly 70 percent of the producers who responded to the survey were 50 years or older. Less than 10 percent were younger than 30 years. Nearly half of these producers (45.8 percent) have been farming for more than 15 years. Yet a number of survey respondents began production relatively recently: 27 percent reported fewer than five years of farming experience.

The farm size distribution in the study area was skewed towards medium and small farms. Thirty-eight percent of producers had farms with fewer than 10 acres. Roughly 19 percent reported farms with between 10 and 60 acres. A little more than 13 percent of the respondents reported to have more than 300 acres of farm size.

Approximately 44 percent of such farms were located in Texas and Wright counties.

Thirty-six percent of the respondents reported farming using garden plots, suggesting a number of the farmers were small lifestyle or hobby farmers. Among them, nearly 30 percent reported growing in an area less than 400 square foot. In addition, 17 percent of the respondents had adopted extended growing operations by using a high tunnel or greenhouse. Almost 75 percent of those operations had fewer than 1500 square feet of high tunnel or greenhouse.

As depicted in Table 3, the gross annual income from farming reported by the respondents were consistent with the size of the farming operation discussed above.

Nearly 40 percent of the producers reported gross annual farm sales below \$5,000. While the number of producers in this range appears to be large, it is consistent with findings from the 2012 census of agriculture: 42 percent of producers in the Ozarks reported incomes of \$5,000 or less to the census. (U.S. Department of Agriculture, 2015) Only about 24 percent of the producers reported more than \$40,000 annual gross income with 7.6 percent at more than \$100,000. While self-reported income is usually underreported in many surveys, the reported income from farms suggest that for the majority of the Ozarks producers, farm income serves as a supplement to the overall household income. This is consistent with cross-tabulation results between farm income and the survey question “Do you consider yourself a full time farmer?” Among the producers with annual farm incomes of less than \$5,000, nearly 80 percent responded that they were not full time farmers. Sixty-three percent of producers reporting farm incomes between \$5,000 and \$20,000 did not consider themselves full time farmers.

Roughly 35 percent of the respondents were female. The respondents were ethnically skewed with 95 percent of them self-reporting as white Caucasian, a close representation of rural Missouri. One-quarter of the respondents received some college, earned a high school diploma or less of education. Thirty one percent reported earning a college degree. More than 18 percent held a master’s degree or higher level of education. This is higher than the regional average: According to U.S. Census Bureau (2015) statistics, only sixteen percent of persons aged 25 or older in the region held bachelor’s degrees or achieved higher levels of education. As has been found in other surveys, more educated respondents are more likely agree to fill out the surveys compared to less educated ones.

Table 3: Frequency of Annual Gross Farm Income (N = 211)

Annual gross farm income	Valid Percent
Less than \$5,000	39.3
\$5,000 to 20,000	28.4
\$20,000 to 40,000	8.5
\$40,000 to 50,000	4.3
\$50,000 to 100,000	11.8
More than \$100,000	7.6
Total	100

Producer Participation in Post-Harvest Activities and Marketing. Producers were asked about nine well defined types of post-harvest activities performed by them including washing, cooling sorting, grading, packing, labeling, trimming (cutting), and slaughter. The degree of post-harvest activities was determined using a score variable that represented the number of post-harvest activities performed by producers out of the nine activities. There were four degrees of post-harvest activities: none performed; low level (1 to 3 types); mid-level (4 to 6 types); and high level (7 to 9 types). A little more than a third of the producers (36 percent) did not perform any post-harvest activity. Fifty-five percent performed some type of such activities with nearly nine percent performing at the highest level of post-harvest activities.

Producers were asked whether they were currently performing or were considering performing a number of sustainable farming practices often preferred by the buyers of local food products. These activities included no till, use of compost, organic farming, and integrated pest management. The list included 10 such practices. A variable

to represent the level of sustainable practices was created based on the number of such practices currently performed or intended to be performed in the future. There were four degrees of sustainable practices: none performed; low level (1 to 4 types); mid-level (5 to 7 types); and high level (8 to 10 types). Only 7.3 percent of the producers did not perform any sustainable practices. More than 31 percent reported that they were either currently practicing or intend to practice a high level of sustainable practices.

The producers were also asked whether they were currently performing or were considering performing a number of marketing programs including grass fed/finished, antibiotic free, free range/pasture raised, animal welfare approved, certified humane, good handling certified (GHP), good agricultural practices (GAP) certified, and extended growing season. These programs are often preferred by the buyers of local food products. The list included eight such programs. A variable to represent the level of marketing programs was created based on the number of such programs currently adopted or intended to be adopted in the future. There were four levels of marketing programs: no program; low level (1 to 2 types); moderate-level (3 to 6 types); and high level (7 to 8 types). Only 15.6 percent of the producers did not adopt any of the marketing programs on the list. More than 17 percent reported that they were either currently adopting or intend to adopt a high level of marketing programs. More than 65 percent of the producers had adopted or intend to adopt either low or moderate levels of marketing programs.

Producer Use of Marketing Channels. The distribution channel used by producers to sell their products were divided into various categories and types: 1) direct to consumer, including U-pick, roadside, own shops, etc., farmers market, community supported agriculture (CSA), and internet sales; 2) farm to retailer including restaurant

and caterers, and grocery stores; 3) contract marketing; 4) direct to distributors or wholesalers; 5) direct to institutions such as hospitals and school systems; 6) direct to local or regional marketing cooperatives; 7) direct to food hubs; and 8) others. Nearly 70 percent of the producers surveyed used one or more types of direct to consumer marketing channels. Slightly more than 27 percent of the producers sold directly to retailers using one or both route. Very few producers sold through contract marketing (6 percent); distributors and wholesalers (11 percent); schools and hospitals (4.1 percent); and local and regional marketing cooperatives (11.9 percent). Less than one percent (0.9 percent, or two producers) reported selling through a food hub. This is not unexpected, as there were only two known food hubs in the region at the time: both were in the start-up phases. Other channels including produce auctions, stockyards, and special events were used by approximately 12 percent of the producers. Five and a half percent of the producers wrote in livestock auctions or sale barns under “other.”

Agricultural Products

The survey categorized agricultural products into three groups, namely fresh vegetables and melons; fresh fruits; tree nuts; and livestock and livestock products. These groups are similar to the ones defined in the USDA Census of Agriculture. The survey was relatively successful in eliciting types of products but not as successful in the quantity of products produced by survey respondents.

Fresh Fruit, Vegetable and Nut Production. Nearly 45 percent of the producers reported that they earned farm income from commercially grown fruits, vegetables, and nuts. Among them, 10.1 percent reported that 100 percent of their income was from

fruits, vegetables, and nuts. The results suggest that a vast majority of the producers in the study area combined fruit and vegetables with livestock products in their product mix.

More than 35 percent of the producers surveyed grew one or more types of fresh vegetables. Approximately 20 percent of the producers produced and sold five or more types of fresh vegetables. Table 4 reports the types of fresh vegetables grown in the study area and the percentage of producers growing them. Tomatoes were the most popularly grown followed by cucumbers, peppers, beans and squash. Other vegetables not shown in the table included greens including lettuce, okra and pumpkins. A small percentage of producers (4.2 percent) were highly diversified with nine or more types of fresh vegetables grown and sold.

Table 4: Frequency of Vegetables and Melons Sold (Top 10)

Products	Frequencies	Percentages
Tomatoes	67	30.7%
Cucumbers	54	24.8%
Peppers	48	22.0%
Beans	44	20.2%
Squash	42	19.3%
Melons	30	13.8%
Potatoes	29	13.3%
Sweet corn	22	10.1%
Garlic	21	9.6%
Mushrooms	5	2.3%

Nearly nine percent of the producers surveyed grew one or more types of fresh fruits. Very few producers (.9 percent) produced and sold four or more types of fresh fruits. Table 5 reports the types of fresh fruits and tree nuts grown in the study area and the percentage of producers growing them. Blackberries were the most popularly grown fruits followed by apples, grapes, and peaches. Other fruits not shown in the table included Asian pears, apricots, blueberries, raspberries, and elderberries. Walnuts were the most popularly grown tree nuts followed by pecans. Other tree nuts not shown in the table included hazelnuts and almonds.

Table 5: Frequency of Fresh Fruits and Tree Nuts Sold

Products	Frequencies	Percentages
Blackberries	17	7.8%
Walnuts	13	6.0%
Apples	10	4.6%
Grapes	7	3.2%
Peaches	6	2.8%
Pecans	3	1.4%

Livestock and Livestock Products. Nearly 70 percent of the producers reported that they earned farm income from commercially produced livestock and livestock products. Among them, 24.1 percent reported that 100 percent of their income was attributed to livestock and livestock products. The results suggests that while a vast majority of the producers in the study area combine fruit and vegetables with livestock

products in their product mix, producers in the study are more dependent on livestock products than on fresh vegetables, fruits and nuts for their livelihood.

While nearly 62 percent of the producers raised one or more types of livestock species, this sector is the least diversified. More than one third (34.9 percent) of the producers specialized in only one type of livestock; namely beef. Less than 15 percent of the producers diversified in three or more products. Table 6 reports the types of livestock or livestock products produced in the study area and the percentage of producers producing them. Beef was the most popularly raised livestock for commercial purpose followed by poultry (eggs and chicken), hogs and pigs, goats and fluid milk. Other livestock not shown in the table included buffalo, and breeding dogs.

Livestock Processing. Slightly more than 30 percent of the livestock producers had livestock (excluding poultry) processed for meat sales. Beef was the primary livestock processed for meat sales followed by hogs/pigs and lamb/goats. In the preceding year of the survey, 70 percent of the producers processed less than 10 animals for meat sales. Typically, producers had either one or two animals processed at one time.

Close to 82 percent of the producers processing livestock for meat sales reported to have travelled less than 50 miles for the processing services. More than 80 percent of the producers using processing facilities indicated they were either satisfied or highly satisfied with the meat processors. Only 8.8 percent of the poultry producers reported to have processed poultry for meat sales. Approximately 70 percent of them reported processing more than 100 birds at a time. On farm processing was reported by 40 percent of the producers. Twenty percent of the poultry processors reported that they used processing plants more than 100 miles from their production site. Roughly 70 percent of producers using outside processors for processing the poultry said they were

Table 6: Frequency of Livestock and Livestock Products Raised (Top 10)

Products	Frequencies	Percentages
Beef	95	46.1%
Eggs	42	20.4%
Chickens	24	11.7%
Hogs/Pigs	23	11.2%
Goats	20	9.7%
Milk	16	7.8%
Bees/Honey	15	7.2%
Sheep/Lamb	11	5.3%
Turkey	7	3.4%
Cheese	5	2.4%

satisfied or highly satisfied with the services they received. Among those producers using meat processors for livestock and poultry, 35 percent used USDA inspected processing facilities; 30.8 percent used Missouri inspected facilities, and 13.7 percent used custom exempt facilities.

Processor Attributes. Producers using meat processing facilities were asked to rate selected attributes of a meat processing facilities from “not important” to “very important.” Quality of service received greatest percentage of “somewhat important” and “very important” ratings by the largest number of producers, followed by reputation, food safety certification and communications and relationships. Flexibility of the processors

was rated “somewhat important” and “very important” among the fewest number of producers using the facilities.

Producer Attitude Towards a Food Hub

The main objective of the study was to evaluate the attitude of producers in the 20-county region toward a food hub. A food hub was defined in the survey instrument in the following way: “A food hub brings together products from a number of local farms and offers services which may include cooling, storage, marketing and distribution, washing, grading, sorting, packing or repacking, packaging and labeling.”

The level of interest toward a food hub was measured by asking the question, “If a local Food Hub, as described above, were reasonably accessible and offered a fair price, how would you describe your level of interest in selling your food products through the hub?” Five levels of interest were indicated by selecting “very interested” through “not at all interested.” The results were further collapsed into two groups, “interested” and “not interested.” More than two thirds (67.5 percent) of the producers were either “interested” or “very interested” in having a food hub as defined above.

Food Hub Features and Services Preferred by Producers. A regional food hub could also offer a variety of other services to help local growers improve their business, increase sales, and strengthen the local food system. Producers were asked to rate their level of interest in a number of additional hub activities, as reported in Table 7. Producers were most interested in connecting to new buyers through the proposed hub: 76.4 percent said they were “interested” or “very interested” in this hub feature. Assistance with receiving food safety certifications (67.7 percent) and receiving education in business

skills (63.2 percent) were the next most desired hub features. Producers were least interested in getting help with harvest labor (39 percent) through the proposed food hub.

Table 7: Frequency of Producer Interest in Additional Services a Food Hub Can Provide

Services	Percent not interested	Percent interested
Connecting to new buyers	23.6	76.4
Participating in education on food preservation, cooking, nutrition, etc.	40.5	59.5
Receiving assistance obtaining food certifications	32.3	67.7
Commercial kitchen	51.3	48.7
Meat processing	46.6	53.5
Receiving business education	36.8	63.3
Harvest labor	61.0	39.0

Producers were also asked which ownership structure would make them more likely to participate in selling produce and livestock through a local food hub. A five point scale ranging from “very likely” to “not likely at all” was used. The results were further collapsed into two categories, “likely” and “not likely.” A cooperative structure was most preferred (62.4 percent), followed by grower-owned (61.2 percent). Only 43.6 percent of producers indicated they would be likely to participate if they were able to be a part owner or investor in the hub.

Producers' Stake in the Proposed Food Hub. Producers were also asked if they were willing to alter their supply, obtain certifications or dedicate a specified amount of time to meet the needs of the proposed food hub. While nearly 84 percent of the producers who responded to the question “Would you be willing to obtain food safety/Good Agriculture Practices certification if it were required?” said they would obtain certifications, more than half (57.6 percent) said they would only do so if there were no cost. Approximately 19 percent of respondents indicated they would be willing to pay less than \$500 annually. Interestingly, nearly six percent of the producers who responded to the question already had certifications.

Producers were also asked how much of a time commitment they would be willing to make to meet food safety/tracking requirements of food hub operations (in terms of training hours, record keeping, inspections, etc.). A little more than 80 percent of the respondents were willing to commit some hours per year. Slightly more than 75 percent of the producers were willing to add products, grow specific products, or expand production based on the food hub needs.

Confidence in the Proposed Food Hub. Producer confidence in the ability of the food hub to help their business operations was measured by asking them to respond to a number of statements using a five point scale ranging from “strongly disagree” to “strongly agree”. The results were further condensed into “agree” and “disagree.” Most of the producers believed that food hub will help them expand their market reach and increase their business income. Fewer (36.6 percent) believed that participation in a hub would allow them to spend more time farming.

Farm Income

One variable that was removed from the logit model is still important enough to warrant further analysis: annual gross farm income. When the regression model was run alongside the independent variable EDUCATION, it was determined that the two variables were highly correlated with each other. To analyze the impact of farm income on the independent variables within the regression model, a binary variable was created. Farms with incomes of less than \$20,000 per year were given a 0 value and farm incomes of \$20,000 or more were given a 1 value. A mean value of 0.3223 indicates most of the farms represented through the survey (n=211) are generating less than \$20,000 per year. This variable was compared to the independent variables using ANOVA. Eight variables were found to be significant at a level of at least 10 percent, as shown in Table 8.

The NC_ORG score (F-Statistic = 11.08) suggests that farms with annual incomes lower than \$20,000 tend to target more organic practices. The two variables comprising the NC_ORG score, non-certified, practicing organic and avoidance of synthetic fertilizers are both statistically significant when an ANOVA means comparison is run against farm income. One reason for this may be because the farms that generate less income are likely to be smaller in terms of acreage and production as well, making organic practices more manageable. Additionally, smaller producers may also be marketing through direct to consumer venues, such as farmers markets, where they can communicate their practices directly to customers who likely value such methods.

Producers with farms generating more than \$20,000 in annual income tend to use extension services more frequently (F-value = 7.75). This may be because smaller producers are less likely to seek out help from extension. It's also possible that extension services are geared towards larger scale production and production methods, although

Table 8: Mean Comparison of Farm Incomes, Farm attributes, Socio-Demographics and Attitude

Variables	Income < \$20,000	Income > \$20,000	F-Statistic
NC_ORG	3.86	2.79	11.08**
Non-certified, practicing organic	1.99	1.36	11.03**
Avoid synthetic fertilizers	2.16	1.58	11.98**
Percent of farm income from livestock	35.45	66.39	24.73**
EXTENSION	1.99	2.74	7.75**
TRADITIONAL	1.27	1.60	2.68*
WHOLESALE	0.23	0.44	5.91**
NEW_MARKETING	0.39	0.54	2.36
Increased income	3.37	3.63	2.67*

**Less than five percent significant; * less than 10 percent significant

further research would be needed to determine the validity of such a statement. It does appear to be true that smaller producers perceive themselves to be in need of the educational resources needed to increase the scale of their businesses. Throughout the study, a number of small producers stressed that extension staff and offices were over-worked and did not have enough time or resources to do an adequate job of assisting specialty crop producers.

Farm income is also significant in terms of types of marketing outlets used by producers. Producers with farms generating more than \$20,000 per year appear to utilize a larger number of outlets: the larger earners held higher scores when analyzing

TRADITIONAL (mean score of 1.60 compared to 1.27), WHOLESALE (mean score 0.44 compared to 0.23) and NEW_MARKETING (mean score 0.54 compared to 0.39) variables. Few producers of any size were using the CSA and internet sales measured in NEW_MARKETING: Sixty-six percent of respondents weren't using either method. Twenty-three percent of producers were engaged in one of the two practices and 10.6 percent were doing both. While this scored variable was not significant at a 10 percent level, it came close with a p-value of 0.13. It is worth noting that in both instances (utilization of one or both practices), those producers with larger farm incomes were more likely to be selling through the NEW_MARKETING outlets.

While HUB_ATT scores were not statistically significant when compared to farm incomes, one of the variables making up the score was: the belief that a food hub can help farms increase their incomes. Again, producers with larger farm incomes were more likely to believe that the hub could help increase their incomes. (Mean score of 3.63 compared to 3.37.) This may be because larger farmers have some experience selling at wholesale prices, and while smaller farmers focus on earning retail and farmers-market level prices by selling direct to consumers. Existing studies show that receiving less than retail price is typically a concern for small farmers who sell primarily at farmers markets.

Regression Model Results

Willingness to Participate in a Food Hub. The logit model used to estimate the factors influencing a farmer's decision to participate in a food hub explains 70.8 percent of the variance in the dependent variable. A McFadden R^2 of 0.16 suggests the goodness of fit of the model is acceptable. Eleven variables were used in the regression: three are

significant at less than five percent and two are significant at less than 15 percent. (Table 9)

The CROPS_SU variable ($p\text{-value} = 0.13$) indicates that producers who are using sustainable growing practices are willing to sell to a food hub. Among those producers, the probability of hub participation increased by 1.7 percent for every additional score representing the use of sustainable growing practices, including no till and crop rotation. Results related to the variable NC_ORG ($p\text{-value} = 0.04$) are even more telling. The more likely producers are to avoid synthetic fertilizers and consider their farms an organic practice, the probability of participating in a hub is higher. The probability increases by 3.9 percent for every additional inclination toward organic practice. This aligns with the makeup of many of the food hubs operating today. A 2013 survey of existing food hubs indicates that growing methods which can be broadly categorized as sustainable are preferred by hub managers, and in some cases, they are even required: chemical-free (24 percent) is among the most prevalent requirements; while the most preferred methods include use of an integrated pest management system (75 percent) and non-certified, but practicing organic (73 percent). (Fisher et al., 2013)

Estimates for the NEW_MARKETING score ($p\text{-value} = 0.11$) suggest that producers who sell through new marketing channels, including CSA or online, are more likely to participate in a food hub. For every additional use of such new marketing channels, the probability of participation in a food hub increases by 10 percent. Both marketing outlets demonstrate a willingness to grow sales beyond the farmers market: In this sense, a progression from farmers market to NEW_MARKETING venues to food hub sales seems a natural fit.

Table 9: Results of Logit Model to Analyze Producer Willingness to Participate

	Model coefficients on willingness to participate in a food hub		Marginal effects of independent variables on willingness to participate in a food hub		
			Marginal		
Variable	Coefficient	p-value	effect	p-value	
Constant	-1.398	0.11	-0.291	0.11	
PH_ONSIT	-0.058	0.58	-0.012	0.58	
CERTIFICATIONS	-0.003	0.96	-0.000	0.96	
CROPS_SU	0.089	0.13	0.017	0.13	
NC_ORG	0.186	0.04	0.039	0.04**	
EXTENSION	0.085	0.41	0.018	0.41	
TRADITIONAL	0.105	0.51	0.022	0.51	
WHOLESALE	0.438	0.22	0.091	0.22	
NEW_MARKETING	0.475	0.11	0.099	0.11	
HUB_ATT	0.157	0.02	0.033	0.02**	
EDU	-0.616	0.19	-0.117	0.15	
AGE_B	-1.074	0.01	-0.205	0.00***	
LOG LIKELIHOOD (LL)	-98.57				
RESTRCTED LL	-117.98		Predicted		
McFadden Pseudo R-squared	0.16	Actual	0	1	Total
Chi squared	38.82 (P-Value:0.00)	0	25.000	37	62.000
Degrees of freedom	11	1	17.000	106	123.000
% correct prediction	70.81		42	143	185.000
McFadden R2	0.16				

***Less than one percent significant; **Less than five percent significant

HUB_ATT demonstrates that producers with a positive attitude towards the benefits of a food hub are more likely to participate in a food hub. The scored value, which rates how strongly a producer feels about how hub participation can impact his or her farm income, expand market reach and allow for less time marketing and more time on the farm, is significant at less than 5 percent ($p\text{-value} = 0.02$). The score has a maximum value of 15: for each additional score point representing hub attitude, the probability of hub participation increases by 3.3 percent.

Producer age is a significant predictor of hub participation ($p\text{-value} = 0.01$). Producers who are younger than 50 have a 20 percent higher probability of selling through a hub compared to those who are 50 years or older. This is consistent with findings related to technology adoption: Both Monteiro and Caswell and Amponsah found that older farmers are less willing to put new technology into practice on their farms.

Willingness to Adjust Supply. While the dependent variable WTP_Hub gauges a producer's willingness to participate in a food hub, WTA_Supply is a measurement of how much a producer is willing to change his or her existing practices to accommodate the business needs of a food hub. In this sense, it can be seen as a measurement of risk acceptance. Baidu-Forson found that risk acceptance was one of three determining factors in a farmer's decision to adopt soil conservation practices. (Baidu-Forson, 1999) Here, when WTA_Supply is used as a dependent variable, it's apparent that technologies already adopted and attitude towards a hub's benefits are correlated to a producer's willingness to take on some level of risk to participate in a food hub.

The same eleven variables included in the WTP_Hub model were used in the WTA_Supply regression. The variables explain 80 percent of the variability in

WTA_Supply. A McFadden R^2 score of 0.25 indicates this is a robust model for cross-sectional data. Three of the independent variables are significant at less than five percent, while one is significant at 12 percent.

As shown in Table 10, producers who rated higher CROPS_SU scores tend to be more willing to take the risk of adjusting supply to meet food hub requirements (p-value = 0.01). For every additional score point in CROPS_SU, the probability a producer will adjust supply increases by 2.6 percent. Similarly, those producers who rate higher scores in NEW_MARKETING are also more willing to adjust supply (p-value = 0.02). For each additional score point in NEW_MARKETING, the probability of WTA_SUPPLY increases by 1.5 percent. This appears consistent with the concept that those who have already adopted technologies are more willing to adopt new technologies. HUB_ATT is highly significant in a producer's willingness to adjust supply for the hub (p-value = 0.00). As the HUB_ATT score attitude increases one point, willingness to add products, grow specific products or expand production based on hub requirements increases by 3.9 percent.

The producer's age also plays a role in his or her decision to take the risk of adjusting supply to meet a hub's needs (p-value = 0.12). Older producers are less likely to be willing to change their production habits. Producers younger than 50 years have a 10 percent higher probability of supply adjustment than their older colleagues.

Table 10: Results of Logit Model to Analyze Producer Willingness to Adjust Supply

	Model coefficients on willingness to adjust production		Marginal effects of independent variables on production adjustment		
Variable	Coefficient	p-value	effect	p-value	
Constant	-2.793	0.01	-0.403	0.01	
PH_ONSIT	-0.068	0.62	-0.010	0.62	
CERTIFICATIONS	-0.023	0.72	-0.003	0.72	
CROPS_SU	0.180	0.01	0.026	0.01**	
NC_ORG	0.078	0.46	0.011	0.46	
EXTENSION	-0.124	0.33	-0.018	0.32	
TRADITIONAL	0.180	0.36	0.026	0.36	
WHOLESALE	-0.322	0.39	-0.046	0.39	
NEW_MARKETING	1.029	0.02	0.149	0.01**	
HUB_ATT	0.272	0.00	0.039	0.00***	
EDUCATION	0.324	0.54	0.050	0.56	
AGE	-0.815	0.12	-0.107	0.08*	
LOG LIKELIHOOD (LL)	-70.19				
RESTRCTED LL	-93.60		Predicted		
McFadden Pseudo R ²	0.25	Actual	0	1	Total
	46.82 (P-				
Chi squared	Value:0.00)	0	19.000	23	42.000
Degrees of freedom	11	1	10.000	113	123.000
% correct prediction	80		29	136	165.000
McFadden R2	0.25				

***Less than one percent significant; **Less than five percent significant; *Less than one percent significant

CONCLUSION

Food hubs are quickly becoming a new marketing channel for producers who want to take advantage of the growing demand for locally-sourced foods. The producers who are willing to adapt new technologies share a number of traits with the producers who are willing to sell through a food hub.

Producer Characteristics

In general, the producers in the Missouri Ozarks tend to be older, Caucasian and male. They tend to operate small to medium-sized farms, most of which generate less than \$20,000 in annual gross farm sales, suggesting many of these farms are lifestyle or hobby farms. Slightly more than half of Ozarks producers consider themselves part-time farmers. The producers who responded to the survey tend to be more educated than the overall population of the region: more than 80 percent have at least some college, and nearly 20 percent have a master's degree or higher.

The majority of producers raise livestock and sell livestock products such as beef, poultry (eggs and chicken), dairy, honey and pork. The primary livestock product sold by the region's farmers is beef. Slightly less than half of producers in the Ozarks grow fruits, vegetables and nuts. These producers tend to be more diversified, both growing more varieties of vegetables, fruits or nuts, as well as producing some livestock products. Roughly one-third of producers reported growing using garden plots. About 20 percent of producers extended their growing season with high tunnels or greenhouses.

Ozarks producers utilize a number of marketing channels, including farmers markets, CSAs, u-pick or roadside stands, direct to grocery stores and restaurants,

institutions and wholesalers. Sales to food hubs are extremely rare, though this can likely be attributed to the fact that two small food hubs were only beginning to take form during the time of this study. Choice of marketing channels does appear to have an impact on farm income: producers who participated in more marketing channels tended to have higher farm incomes.

Producer Willingness to Participate Results

In general, most producers would be willing to sell their products to a food hub if it were reasonably accessible and offered a fair price. Those producers in the Missouri Ozarks who are willing to participate in a food hub tended to be younger than 50 years of age and had a positive attitude towards a food hub's ability to benefit their business. This suggests that a food hub should focus on educating producers about the benefits of food hub participation during recruitment.

Producers in the region who were willing to participate in a hub were also more likely to score higher on the NC_ORG variable, which indicates producers were either considering or practicing non-certified, organic production methods and avoidance of synthetic fertilizers or pesticides. These practices are also highly desired by consumers and food hub managers. There may be opportunity for a hub in the region to focus on such growing practices.

Factors that do not appear to influence willingness to participate in a food hub include use of extension services, whether a producer has or is favorable towards certifications, the number of post-harvest activities a producer performs on site, level of education and the types of marketing channels a producer chooses to participate in.

Producer Willingness to Adjust Supply Results

Most producers in the region say that they would be willing to add products, grow specific products or expand their production based on the requirements of the proposed hub. Those producers who were most likely to adjust supply for a hub were younger than 50 years of age and believed that a food hub could benefit their business through increased income, expanded market reach and the ability to spend more time farming. The producers who were willing to adjust their supply had also adopted or were considering adopting new sustainable technologies such as no till, crop rotation and diversification of crops. Again, this indicates that there are producers in the region who would be willing to supply to a hub that focuses on sustainably-grown products. It may also be that those who have already adopted new technologies are more willing to adopt other technologies. Producers who are willing to adjust their supply also were more likely to sell through the newer marketing channels, CSA and internet.

The factors that do not appear to influence a producer's willingness to adjust supply to meet the needs of a hub include performance of post-harvest activities, certifications, non-certified but practicing organic, use of extension services, use of traditional or wholesale marketing channels and education.

Limitations and Future Study

This study, like many others, could be improved upon with repetition. It did have some limitations, including a relatively small sample size. Not all producers were willing to take 15 minutes to complete the survey. The sample was also more of a convenience sample than a true random sample. The study relied heavily on distribution through farmers market managers, producer-oriented events and mailing/email lists from

organizations that frequently hosted educational events for producers. It can be said, however, that when the data generated through the survey was compared with the USDA Census of Agriculture data, the results were reasonably similar. Finally, as it has been previously noted, there were no established food hubs operating at the time of the study: the willingness to participate and adjust supply, therefore, is hypothetical and not actual.

Future research may be able to capture differences between those producers who say they are willing to participate in a food hub and those who are actually participating. Additional topics to focus on include differences between urban and rural producers and their attitudes towards food hub participation, as well as added examination of use of extension services among producers with farms generating less than \$20,000 in annual incomes.

Concluding Remarks

The conclusion of the research presented in this thesis is that producers in the Ozarks are willing to participate in a food hub and adjust their supply to meet the needs of a proposed hub. The establishment of a food hub has the potential to positive impact producers' incomes as well as the economy (including employment and incomes) of the region as a whole. The results of this thesis are that producers are interested in taking advantage of the added benefits this new marketing channel would bring.

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APPENDICES

Appendix A – Human Subjects IRB Completion Report

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM) COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

• **Name:** Jennifer Muzinic (ID: 4290023)
• **Email:** Muzinic1@live.MissouriState.edu
• **Institution Affiliation:** Missouri State University (ID: 750)
• **Institution Unit:** Agriculture
• **Phone:** 417-766-1550

• **Curriculum Group:** Human Research
• **Course Learner Group:** Social & Behavioral Research
• **Stage:** Stage 1 - Basic Course

• **Report ID:** 13698120
• **Completion Date:** 09/07/2014
• **Expiration Date:** 09/06/2017
• **Minimum Passing:** 80
• **Reported Score:** 98

REQUIRED AND ELECTIVE MODULES ONLY

	DATE COMPLETED
Belmont Report and CITI Course Introduction (ID: 1127)	09/07/14
History and Ethical Principles - SBE (ID: 490)	09/07/14
The Federal Regulations - SBE (ID: 502)	09/07/14
Assessing Risk - SBE (ID: 503)	09/07/14
Informed Consent - SBE (ID: 504)	09/07/14
Privacy and Confidentiality - SBE (ID: 505)	09/07/14
Research with Prisoners - SBE (ID: 506)	09/07/14
Research with Children - SBE (ID: 507)	09/07/14
Research in Public Elementary and Secondary Schools - SBE (ID: 508)	09/07/14
International Research - SBE (ID: 509)	09/07/14
Internet-Based Research - SBE (ID: 510)	09/07/14
Avoiding Group Harms - U.S. Research Perspectives (ID: 14080)	09/07/14
Research and HIPAA Privacy Protections (ID: 14)	09/07/14
Vulnerable Subjects - Research Involving Workers/Employees (ID: 483)	09/07/14
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	09/07/14
Missouri State University (ID: 1169)	09/07/14

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing Institution identified above or have been a paid Independent Learner.

CITI Program
Email: citisupport@miami.edu
Phone: 305-243-7970
Web: <https://www.citi-program.org>

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

• **Name:** Jennifer Muzinic (ID: 4290023)
 • **Email:** Muzinic1@live.MissouriState.edu
 • **Institution Affiliation:** Missouri State University (ID: 750)
 • **Institution Unit:** Agriculture
 • **Phone:** 417-766-1550

• **Curriculum Group:** Human Research
 • **Course Learner Group:** Social & Behavioral Research
 • **Stage:** Stage 1 - Basic Course

• **Report ID:** 13698120
 • **Report Date:** 11/16/2015
 • **Current Score**:** 98

REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES	MOST RECENT
History and Ethical Principles - SBE (ID: 490)	09/07/14
Belmont Report and CITI Course Introduction (ID: 1127)	09/07/14
The Federal Regulations - SBE (ID: 502)	09/07/14
Assessing Risk - SBE (ID: 503)	09/07/14
Informed Consent - SBE (ID: 504)	09/07/14
Privacy and Confidentiality - SBE (ID: 505)	09/07/14
Research with Prisoners - SBE (ID: 506)	09/07/14
Research with Children - SBE (ID: 507)	09/07/14
Research in Public Elementary and Secondary Schools - SBE (ID: 508)	09/07/14
International Research - SBE (ID: 509)	09/07/14
Internet-Based Research - SBE (ID: 510)	09/07/14
Research and HIPAA Privacy Protections (ID: 14)	09/07/14
Vulnerable Subjects - Research Involving Workers/Employees (ID: 483)	09/07/14
Conflicts of Interest in Research Involving Human Subjects (ID: 488)	09/07/14
Missouri State University (ID: 1169)	09/07/14
Avoiding Group Harms - U.S. Research Perspectives (ID: 14080)	09/07/14

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing Institution identified above or have been a paid Independent Learner.

CITI Program
 Email: citisupport@miami.edu
 Phone: 305-243-7970
 Web: <https://www.citi-program.org>

To: Arbindra Rimal
Agriculture - SPFD
[901 S. National Ave. Springfield MO 65897-0027](#)

From: MSU IRB

Date: 10/23/2014

RE: Notice of IRB Exemption

Exemption Category: 2.Survey, interview, public observation

Study #: 15-0163

Study Title: Feasibility Study of a Food Hub

This submission has been reviewed by the Missouri State University IRB and was determined to be exempt from further review according to the regulatory category cited above under 45 CFR 46.101(b).

Study Description: The study will assess the capacity of Southwest Missouri region comprising 9 counties to support a local food hub including Douglas, Howell, Ozark, Texas, Oregon, Shannon, Ripley, Webster and Wright. A food hub, in this case, is defined as a centrally located facility that has a management structure to facilitate the aggregation, storage, processing, and distribution of locally produced (produced within the region) food products. This study will also estimate direct, indirect, and induced effects of economic stimulus through the proposed food hub in the form of income, employment and value added generation.

Investigator's Responsibilities:

If your study protocol changes in such a way that exempt status would no longer apply, you should contact the above IRB before making the changes.

1. Name the county where your farm and business operation is located _____
2. How long have you been farming? _____ years
3. Land in production in 2014? (complete the ones that are appropriate to your business)
 - a. _____ Acres
 - b. _____ Sq. ft. (garden plots)
 - c. _____ Sq. ft. (high tunnel/greenhouse)
4. Fallow acres that could be put into production? _____ acres
5. Number of staff in your business operation including yourself, spouse, children, and hired workers?

Full time: _____; Part-time: _____; Seasonal: _____; Volunteers: _____
6. Do you consider yourself a fulltime farmer?
☐ Yes ☐ No
7. Is someone in your operation, such as a spouse or child, interested in continuing the business when you retire?
☐ Yes ☐ No
8. Annual Gross Farm Income (select the one that applies to your farm):

☐ Less than \$5,000 ☐ \$5,000-\$9,999 ☐ \$10,000-\$19,999 ☐ \$20,000-\$29,999 ☐ \$30,000-\$39,999 ☐ \$40,000-\$49,999 ☐ \$50,000-\$59,999 ☐ \$60,000-\$69,999 ☐ \$70,000-\$79,999 ☐ \$80,000-\$89,999 ☐ \$90,000-\$99,999 ☐ \$100,000-\$149,999 ☐ \$150,000-\$199,999 ☐ \$200,000-\$249,999 ☐ \$250,000-\$299,999 ☐ \$300,000-\$349,999 ☐ \$350,000-\$399,999 ☐ \$400,000-\$449,999 ☐ \$450,000-\$499,999 ☐ \$500,000-\$549,999 ☐ \$550,000-\$599,999 ☐ \$600,000-\$649,999 ☐ \$650,000-\$699,999 ☐ \$700,000-\$749,999 ☐ \$750,000-\$799,999 ☐ \$800,000-\$849,999 ☐ \$850,000-\$899,999 ☐ \$900,000-\$949,999 ☐ \$950,000-\$999,999 ☐ \$1,000,000 or more

[illegible]

- | Pre-harvest Activities | | |
|---|------------------------------|-----------------------------|
| Washing | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Cooling | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Sorting | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Grading | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Packing | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Labeling | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Value added processing including trimming, cutting, freezing, canning | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| Slaughter | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Pre-harvest Activities		
Other (Specify)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

10. Do you use the following practices on your farm:

		This does not apply to my farm	I am not interested in this practice	I am considering this practice	I currently use this practice
10.1	Cover crops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.2	Selection of crops/animal breeds adapted to your site and soil conditions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.3	Diversified product offerings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.4	No till	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.5	Use of compost, manures and green manures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.6	Avoidance of synthetic fertilizers and pesticides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.7	Rotational grazing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.8	Grass fed and finished	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.9	Antibiotic free	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.10	Free range/pasture raised	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.11	USDA Certified Organic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.12	Animal Welfare Approved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.13	Non-certified, but practicing organic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.14	Certified Humane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.15	Good Handling Practices Certified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.16	Good Agricultural Practices Certified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.17	Integrated pest management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10.18	Extended growing season (greenhouse/high tunnels)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. How often do you get help from extension services?

Never	Every few years	Every other year	Yearly	1-2 times per year	More than 1-2 times per year
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Have you sold agricultural products through the following market channels?

	Marketing Channel		
12.1	Direct to consumer (u-pick, roadside, own shops, etc.)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.2	Farmers market	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.3	Direct to consumers (CSA)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.4	Restaurant/caterer	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.5	Internet sales	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.6	Grocery stores	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.7	Contract marketing	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.8	Food hubs	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.9	Distributors/wholesalers	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.10	Institutions (schools/hospitals)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.11	Local/regional marketing coops	<input type="checkbox"/> Yes	<input type="checkbox"/> No
12.12	Other (specify):	<input type="checkbox"/> Yes	<input type="checkbox"/> No

13. Percentage of gross farm income from fresh vegetables, fruits, and nuts:

0 %	1 to 24%	25 to 49%	50-74%	75-99%	100%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you checked '0 %' above, then go to Question 17.

Product Mix: fresh vegetables, fruits and nuts

14. Have you grown the following **fresh vegetables** for commercial purposes?

Fresh Vegetables and Melons	Product grown for commercial purposes		Quantity made available for sale (based on the estimates for year grown recently)	Unit
Sweet Corn	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Tomatoes	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Melons	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Beans	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Cucumbers	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Potatoes	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Mushroom	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Peppers	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Garlic	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Squash/zucchini	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Others (specify)				

15. Have you grown the following **fresh fruits** for commercial purposes?

Fresh Fruits	Product grown for commercial purposes		Quantity made available for sale (based on the estimates for year grown recently)	Unit
Apples	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Peaches	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Blackberries	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Grapes	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Others (specify)				

16. Have you grown the following **tree nuts** for commercial purposes?

Products	Product grown for commercial purposes		Quantity made available for sale (based on the estimates for year grown recently)	Unit
Nuts				
Walnuts	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Pecans	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Others (specify)	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds

17. Percentage of gross farm income from livestock and livestock products including beef, poultry, eggs, milk and dairy products:

0 %	1 to 24%	25 to 49%	50-74%	75-99%	100%
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you checked '0 %' above, then go to Question 30.

Product Mix: livestock and livestock products

18. Have you raised/produced the following **livestock and livestock products** for the commercial purposes?

Livestock and livestock products	Product grown for commercial purposes		Quantity made available for sale (based on the estimates for year grown recently)	Unit
Fluid Milk	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Gallons

Livestock and livestock products	Product grown for commercial purposes		Quantity made available for sale (based on the estimates for year grown recently)	Unit
Cheese	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Pounds
Yogurt	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Gallons
Eggs	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Dozen
Beef Cattle	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Hogs and pigs	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Sheep/Lamb	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Goat	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Chicken	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Ducks	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Turkey	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Quail	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Pheasant	<input type="checkbox"/> Yes	<input type="checkbox"/> No		Number
Beekeeping/Honey	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
Others (Specify):				

19. Do you have your livestock processed for meat sales (excluding poultry)?
☐ Yes ☐ No

If you checked 'No' above, then go to Question 25.

If yes, what type of livestock (e.g., beef, goat, pork, etc.)? _____

20. How many animals were processed for meat sales in 2013 (Select what applies to you)?

Less than 10	10 to 30	30-40	40-50	More than 50
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21. How many are slaughtered at one time? _____

22. What is the one way distance to cattle and other livestock processing plants you often use (in miles)?

Less than 10	10 to 20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	More than 100

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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23. What is the name(s) of the processing plant(s) you use?

24. Tell us the level of satisfaction with livestock processors that you use based on your past experience (select one):

Highly satisfied	Satisfied	Somewhat satisfied	Somewhat dissatisfied	Dissatisfied	Highly dissatisfied
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

25. Have you processed poultry for meat sales in 2013?

☐ Yes

☐ No

If checked 'No' above, then go to Question 28.

If yes, how many birds were processed for meat sales in 2013? (select one):

Less than 100	100 to 200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000	More than 1000
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

26. What is the one way distance to processing plants you often use (in miles)? (select one):

On-farm processing only	Less than 10	10 to 20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	More than 100
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

27. Tell us the level of satisfaction with poultry processors that you use based on your past experience (select one):

Highly satisfied	Satisfied	Somewhat satisfied	Somewhat dissatisfied	Dissatisfied	Highly dissatisfied
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

28. What type of processing facilities have you used in the past?

Custom Exempt	MO State Inspected	USDA Inspected	Not Applicable
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

29. Rate the importance of the following processor attributes:

	Processor attributes	Very important	Somewhat important	Neutral	Somewhat unimportant	Not important at all
31.1	Cost of service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.2	Quality of services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.3	Reputation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.4	Proximity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.5	Flexibility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.6	Communications and Relationships	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.8	Food safety certification	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.9	The processor offers meat cuts my customers require	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Food Hub

A food hub brings together products from a number of local farms and offers services which may include cooling, storage, marketing and distribution, washing, grading, sorting, packing or repacking, packaging and labeling.

30. If a local Food Hub, as described above, were reasonably accessible and offered a fair price, how would you describe your level of interest in selling your food products through the hub?

Very Interested	Interested	Neutral	Not Very Interested	Not At All Interested
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

31. A local Food Hub could also offer a variety of other services to help local growers improve their business, increase sales, and strengthen the local food system. Which of the following additional Hub activities would you be most interested in? (Select all that apply.)

		Very Interested	Interested	Neutral	Not very Interested	Not At all Interested
31.1	Using Commercial Kitchen and other facilities to process or add value to your products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.2	Establishing Processing Facilities for meat products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.3	Receiving education in key business skills including marketing, financial	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

		Very Interested	Interested	Neutral	Not very Interested	Not At all Interested
	management, etc.					
31.4	Connecting to new local buyers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.5	Participating or leading educational activities in food preservation, cooking, nutrition, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.6	Assistance in achieving food safety and other certifications required by buyers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31.7	Harvest labor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

32. What would make you more likely to participate in selling produce and livestock through a local Food Hub?

		Very Likely	Likely	Neutral	Not very Likely	Not At all Likely
32.1	If Hub were grower-owned	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.2	If Hub were owned by local residents/business	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.3	If Hub were a grower owned cooperative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.4	If you were offered the opportunity to become an investor in or a part owner of the Hub	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.5	If you were able to sell your produce or livestock through the Hub	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32.6	If the hub was a nonprofit organization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Food Hub Attitudes

33. Would you be willing to obtain food safety/Good Agriculture Practices certification if it were required?

No	Yes, if there were no cost	Yes, if the cost was less than \$500 annually	Yes, if annual costs were less than \$1,000	Yes, if annual costs were less than \$5,000	I already have the certifications
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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34. How much of a time commitment would you be willing to make to meet food safety/tracking requirements of food hub operations (in terms of training hours, record keeping, inspections, etc.)

None	Less than 10 hours annually	Between 10 and 25 hours per year	Between 25 and 50 hours per year	One hour or more per week per year
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

35. Would you be willing to add products, grow specific products, or expand production based on the food hub needs?

☐ Yes

☐ No

36. To what level do you agree/disagree with the following statements:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I believe that participating in a food hub will allow me to expand my market reach and find new customers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that participating in a food hub will increase my business income.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I believe that participation in a food hub will allow me to spend more time farming.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Demographic Background and General Comments

37. Gender

☐ Female

☐ Male

38. Your ethnic and racial background (you may select more than one answer)

White	Native Hawaiian or Pacific Islander	Hispanic or Latino	Black or African American	Asian	American Indian or Alaska Native
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

39. What is your age _____

40. Which of the following best represents your level of education?

<input type="checkbox"/> Some grade school	<input type="checkbox"/> High School graduate	<input type="checkbox"/> Some graduate school
<input type="checkbox"/> Grade School graduate	<input type="checkbox"/> Some college	<input type="checkbox"/> Masters degree
<input type="checkbox"/> Some High School	<input type="checkbox"/> College graduate	<input type="checkbox"/> Doctoral degree

41. Additional comments:
