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KNOWING AND LEARNING GOOD AGRICULTURAL PRACTICES (GAPS): A COMPARATIVE CASE STUDY OF U.S. AND BRAZILIAN PRODUCE GROWERS

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ABSTRACT

In the past several years, food consumers around the world have witnessed a succession of foodborne disease outbreaks. As a result of these events, the safety of the global food system is now called into question and government regulators and private food retailers have responded by focusing on, in part, on-farm practices. Many local and international food retailers have begun requiring that produce growers obtain third-party certification ensuring that their produce is grown using Good Agricultural Practices (GAPs) to minimize food contamination risks. And in the United States, Congress recently passed into law the Food Safety Enhancement Act to give the Food and Drug Administration (FDA) greater regulatory powers to enforce adherence to on-farm food safety practices.

The purpose of this research is to examine grower perceptions regarding on-farm food safety. Such an examination can help to identify appropriate means of communication through which extension educators and other stakeholders in the food system can help growers learn about and meet food safety. Because fruit and vegetable value chains span across national borders, case study research was conducted in the states of Pennsylvania in the United States and Sao Paulo in Brazil. In total, thirty interviews – 14 in Pennsylvania and 16 in Brazil. Analysis of grower comments revealed discernible themes.

Growers in Pennsylvania evaluate food safety risks on their farm by considering pathogenic risks, perceive the consequences of food contamination to be devastating financially and socially, and take pride in their practiced or local knowledge. Pennsylvania growers also indicate that the multiplying effects of media reporting on foodborne illness outbreaks and the increasing distance between producers and consumers provide context for changes in the

regulation of on-farm food safety. As well, they believe that the responsibility for food safety should be shared by growers, processors, retailers, and consumers. Because farming is their livelihood, Pennsylvania growers staunchly expressed their commitment to protecting their livelihood by ensuring the safety of their produce. However, Pennsylvania growers do not think that consumers take enough responsibility in practicing safe food handling.

Growers in Sao Paulo evaluate food safety risks on their farm by monitoring the application of agricultural chemicals, such as pesticides and fungicides, perceive the consequences of food contamination to be much less than growers in Pennsylvania, and place tremendous amounts of trust in chemical sales representatives and agronomists at farmer supply cooperatives. Sao Paulo growers also indicate that the harsh, tropical climate and market prices provide context for concerns about food safety in Brazil. They believe that growers should take the most responsibility for ensuring food safety through the safe application of agricultural chemicals that protects both the environment and human health.

From the results of this study, a new model for understanding on-farm food safety was developed. Such a model helps us to understand grower perceptions about various variables that are associated with the topic of on-farm food safety and this understanding provides agricultural extension educators and other professionals with a starting point for developing appropriate on-farm food safety educational materials.

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Chapter 1

INTRODUCTION

Estimates of the Centers for Disease Control and Prevention (CDC) indicate that "each year roughly 1 out of 6 Americans (or 48 million people) get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases" from food consumed in the United States (CDC, 2011a). Among the most common pathogens that cause most foodborne illnesses are bacteria such as *Salmonella* enteritidis, E. *coli* O517:H7, and *Campylobacter*, viruses such as hepatitis, and parasites such as *Cryptosporidium*, *Cyclospora*, and *Giardia*. Naturally occurring hazards, such as the fungus aflatoxin, also are known to cause foodboorne illness (Becker, 2009; Scallan et al., 2011). These pathogens can be found in food of all kind, but a succession of foodborne illness outbreaks attributed to fresh or minimally processed fruits and vegetables has caused growing concern among the public (Becker, 2009). Examples of such outbreaks include the following:

- approximately 555 cases of illness and three deaths attributed to green onions contaminated with hepatitis A served at a Chi-Chi's chain restaurant in Pennsylvania in 2003 (CDC, 2003),
- more than 70 cases of illness attributed to *E. coli* O157:H7 contaminated lettuce that found its way into Taco Bell restaurants in five states in 2006 (CDC, 2006a),
- approximately 200 cases of illness and five deaths across 26 states in the United States as a result of *E. coli* O157:H7 contaminated bagged spinach from California in 2006 (CDC, 2006b),

- more than 1,400 individuals in 43 states and the District of Columbia in the United States and in Canada infected with *Salmonella* Saintpaul traced to contaminated jalapeno and Serrano peppers from Mexico in 2008 (CDC, 2008), and more than 400 individuals infected with various strains of Salmonella in three separate incidents of alfalfa sprout contamination in more than half of the United States in 2009 and 2010 (CDC, 2009, 2010, 2011b).

Painter et al. (2013) conducted analysis on the attribution of foodborne illness outbreaks reported to the CDC through the Foodborne Disease Outbreak Surveillance System from 1998 through 2008. They categorized the foods implicated in the outbreaks into 17 mutually exclusive food commodity groups and found that produce commodities accounting for six of the 17 commodity groups - including the categories of fruits and nuts, fungi, leafy greens, root produce, sprouts, and vine/stalk produce - accounted for 46 percent of illnesses. They also found that more illnesses (22%) were associated with leafy vegetables than any of the other commodity groups.

Using data from the CDC, a study commissioned by the Alliance for Food and Farming identified similar results and reported that approximately 12.3 percent of all foodborne outbreaks and 21.9 percent of illnesses from 1990 to 2007 were associated with produce (Duman, 2010). Further, Duman (2010) found that approximately six percent of all illnesses were associated with the growing, packing or shipping of produce.

In 2008 the United States Congress requested that the Food and Drug Administration (FDA) work with the National Academies to identify gaps in the food system that could result in threats to food safety and thereby result in foodborne illness. In response to the Congressional request, the Committee on the Review of the Food and Drug Administration's Role in Ensuring Safe Food was formed. In the report of the Committee's findings (Institute of Medicine &

National Research Council [IOM & NRC], 2010), the Committee indicated that the "gaps are most obvious in two areas – imported foods and on-farm food safety" (p. 61), thereby making on-farm food safety an urgent public priority.

While the FDA, an agency within the U.S. Department of Health and Human Services, is responsible for ensuring that all domestic and imported foods are safe and labeled correctly (except for most meat products derived from traditional domesticated animals, such as beef and poultry, and some egg products that are overseen by the USDA), it did not have authority to regulate on-farm activity until recently. The Food, Drug, and Cosmetic Act (FDCA), one of the FDA's primary governing statues, specifically exempted farms from requirements for registration and record keeping, thereby making on-farm activity exempt from FDA regulation (Burrows, 2008; Becker, 2009; IOM & NRC, 2010; Johnson, R., 2010). Thus, the FDA "has relied on farmers' [voluntary] adoption of so-called good agricultural practices to reduce hazards prior to harvest. Such practices are issued as FDA guidance, not regulations; they are advisory and not legally enforceable responsibilities" (Johnson, R., 2010, pp. 4-5). To address this lack of oversight, the 111th Congress (of 2009-2010) introduced a number of bills "seeking to regulate agricultural producers directly" (Johnson, R., 2010, p. 10). Among these proposals were H.R. 759, H.R. 875, H.R. 1332, H.R. 2749; S. 510; and H.R. 2751 (Becker, 2009; Johnson, R., 2010: Johnson, R., 2011; Johnson, Lister, Burrows, 2010). These proposals are reviewed below to provide additional context regarding the contemporary urgency to better understand on-farm food safety through exploratory research.

H. R. 759 was sponsored by Representative John Dingell [D-MI] and introduced to Congress in January 2009. It also is known as the Food and Drug Administration Globalization Act of 2009 (H.R. 759, 2009). If passed, it would have required the Secretary of Health and

Human Services to establish regulations setting "science-based minimum standards for the safe production and harvesting of those types of fruits and vegetables that are raw agricultural commodities for which the Secretary has determined that such standards minimize the risk of serious adverse health consequences or death" (H.R. 759, 2009, Sec. 103). The bill was referred to the House Committee on Energy and Commerce, Subcommittee on Health in April 2009, but it went no further (H.R. 759, 2009).

Known as the Food Safety Modernization Act of 2009, H.R. 875 was sponsored by Representative Rosa DeLauro [D-CT] and introduced to Congress on February 4, 2009. The bill proposed to establish a new Food Safety Authority Administration in the Department of Health and Human Services to which all functions related to the administration and enforcement of food safety laws would be transferred from other federal agencies (H.R. 875, 2009). If passed, H.R. 875 also would have "imposed various new record-keeping, risk reduction and certification requirements on both the domestic and imported food systems" and would have defined the definition of a "'food production facility' to be 'any farm, ranch, vineyard, aquaculture facility, or confined feeding animal operation" (Johnson, 2010, p. 10). In April 2009, the bill was referred to the House Committee on Agriculture, Subcommittee on Livestock, Dairy and Poultry, but it went no further (H.R. 875, 2009).

H.R. 1332 was known as the Safe FEAST Act of 2009. FEAST is an acronym for Food Enforcement, Assessment, Standards and Targeting. Representative Jim Costa [D-CA] sponsored the bill, which was introduced to Congress on March 5, 2009. It would have required the adoption of regulations on fruits and vegetables that are "raw agricultural products….for which the Secretary [of Health and Human Services] has determined that such regulations are necessary

to minimize the risk of serious adverse health consequences" (H.R. 1332, 2009, Sec. 106). In April 2009, the bill was referred to the House Committee on Agriculture but went no further.

The Food Safety Enhancement Act of 2009, or H.R. 2749, was a compilation of the food safety bills that preceded it. H.R. 2749 was sponsored by Representative John Dingell [D-MI] and introduced to Congress in June 2009. After referral to the House Committee on Energy and Commerce, Subcommittee on Health and the Senate Committee on Health, Education, Labor and Pensions, it passed in the House of Representatives in July 2009 by roll call vote. However, H.R. 2749 was not presented for debate in the Senate and therefore was cleared from the books at the end of the 111th Congressional session (H.R. 2749, 2009).

S. 510, known as the FDA Food Safety Modernization Act, was introduced to Congress in March 2009 to amend the Federal Food, Drug, and Cosmetic Act sponsored by Senator Richard Durbin [D-IL]. It passed in the Senate by roll call vote in November 2010. However, S. 510 was cleared from the books at the end of the 111th Congressional session; because it introduced revenue-raising measures, the Constitution required that it originate in the House of Representatives (S. 510, 2009). It was replaced with H.R. 2751.

H.R. 2751 was originally titled the Consumer Assistance to Recycle and Save Act and served as a 'vehicle' for the passage of S. 510 as a House-originating bill. Replacing S. 510, the Consumer Assistance to Recycle and Save Act was re-named the FDA Food Safety Modernization Act. It was sponsored by Representative Betty Sutton [D-OH] and introduced to Congress in June 2009. It passed in the House of Representatives in June 2009 and in the Senate in December 2010. It was signed into law by President Barack Obama in January 2011 (H.R. 2751, 2010).

According to Michael Taylor, who was appointed the Deputy Commissioner for Foods at the FDA in January 2010, the passage of the Food Safety Modernization Act means that the "prevention of foodborne illness, not reaction to problems, is now the guiding principle of our food safety law – with the primary responsibility for prevention resting squarely on the shoulders of food producers and processors" (Taylor, 2011, para.11). The new law includes provisions

- requiring food facilities to have written prevention control plans,
- mandating the FDA to establish science-based standards for the safe production and harvest of fresh fruits and vegetables,
- requiring the FDA to increase the frequency of inspections of national and foreign food facilities that sell products to U.S. consumers,
- authorizing the FDA to have mandatory food recall authority of unsafe food if a food facility fails to recall the food voluntarily, and
- recognizing the necessity for enhancing partnerships among all food safety agencies (FDA, 2010; FDA, 2011).

Thus, with the passing of the Food Safety Modernization Act, U.S. Congress was successful at providing the FDA with the authority to regulate on-farm activity with the goal of preventing foodborne illness.

Small growers and food system advocates have vocalized concern about how the new legislation would impact small farms and growers who engage in direct farm-to-market sales (see for example, Grist staff, 2010 and Johnson, P., 2010). However, the new law does provide flexibility and protections for these groups. First, it does not change the definition of "facility". Under the Bioterrorism Preparedness and Response Act of 2002, which added several food-related provisions to the Federal Food, Drug, and Cosmetic Act, certain food "facilities" were

required to register with the FDA and follow new record-keeping requirements. In the Bioterrorism Preparedness and Response Act of 2002, a farm is defined as

> a facility in one general physical location devoted to the growing and harvesting of crops, the raising of animals (including seafood), or both. Washing, trimming of outer leaves, and cooling produce are considered part of harvesting. The term "farm" includes: (1) Facilities that pack or hold food, provided that all food used in such activities is grown, raised, or consumed on that farm or another farm under the same ownership; and (2) Facilities that manufacture/process food, provided that all food used in such activities is consumed on that farm or another farm under the same ownership. (Food, Drug and Cosemetic Act § 415, 2010)

The Food Safety Modernization Act does not amend this definition. Therefore, farms will not be required to register as a facility with the FDA and thereby will be exempt from needing to create and maintain new records affiliated with registering as a food facility.

Second, the FDA in coordination with the U.S. Department of Agriculture (USDA) is mandated to establish science-based standards for the safe production and harvesting of fruits and vegetables. The FDA, however, has discretion to establish scale appropriate standards for small farms and to establish standards that take into account differences in growing, production and harvest techniques for diverse fruit and vegetable crops. In addition, the new law requires the FDA to coordinate with the National Institute of Food and Agriculture (NIFA) of the USDA to provide increased training opportunities to small growers on the new standards.

Finally, growers who grow fruits and vegetables for their own consumption or sell a majority of their produce directly to consumers, such as through farmers' markets, are exempt from the new recordkeeping requirements, as are small food processors and producers who have

less than $500,000 worth of annual sales (Consumer Federation of America, 2010). Clarifying language regarding the definition of "direct sales" was introduced by Senator Jon Tester as an amendment to the food safety bill. The Tester Amendment, as it has become to be known, requires the FDA to "clarify that direct sales of food to consumers includes sales that occur other than where the food was manufactured, such as at a roadside stand or farmer's market" (Tester Amendment, n.d.)

Despite the flexibility for small farms and protection for direct farm-to-market sales included in the new legislation, a more immediate response to concerns about the safety of fresh fruits and vegetables came from private food retailers both in the United States and abroad. An increasing number of supermarkets began to require that growers from whom they buy fresh fruits and vegetable provide evidence of compliance with good agricultural practices, or GAPs, which are a set of on-farm guidelines aimed at reducing the likelihood of microbial or other contamination of fresh fruits and vegetables. This compliance could take the form of having participated in GAP training, having developed a food safety plan, or having passed third-party certification audits for on-farm food safety practices. Globally the requirement for third-party certification, or TPC, which is a process through which an independent, third party auditor or organization, conducts an on-site farm inspection to determine whether a grower's practices comply with a set of specified standards (Hatanaka, Busch, & Bain, 2005) have been spurred on by the Euro-Retailer Produce Working Group (EUREP) and the EUREPGAP initiative, which began in 1997. EUREPGAP was a retailer led initiative to address growing consumer concerns about food safety, as well as concerns about environmental impact and the health and safety of farm workers and animals. EUREPGAP gained global significance with the impact of globalization and was renamed in 2007 to GLOBALGAP to reflect an expanded, global reach of

the initiative. GLOBALGAP currently certifies growers in more than 100 countries, thus implying that many produce growers around the world and outside of the United States have already had to navigate a new food safety policy environment (GLOBALGAP, n.d.).

While the food path "from production to consumption can involve only one step – from a farmer directly to a consumer at a farmer's market – or as many as six or even more steps – for example, from a farmer, to various processors, to a warehouse, to a transporter, to a grocer, to a consumer" (IOM & NRC, 2010, p. 21), the first step always starts on the farm. Accordingly the central question that guided this study is: How do farmers - those at the first step of the path from production to consumption - perceive on-farm food safety?

Purpose and Approach

The purpose of this study is to articulate a theory of change model to improve on-farm food safety practices through extension education[1]. To develop a theory of change model grounded in a situational analysis, case study research was employed to understand on-farm food safety practices of produce growers. The purpose and approach is described below.

Interventions that successfully create change are grounded in the needs of a community and based on a solid understanding of what logically might work. In program design, this

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[1] While the purpose of this study is to conduct case study research to articulate a theory of change model, a review of program theory is not included herein. The omission of a review of program theory was purposeful to allow the focus of this study to remain on the case study research. For a concise review on program theory, see Funnell and Rogers (2011), chapter 2.

understanding often is depicted in a program logic model. While program logic models are valuable tools for managing community interventions, it is critical that these models are grounded in a theory of change, which is an outline of "the central processes or drivers by which change comes about for individuals, groups, or communities [and is] derived from a research-based theory" (Knowlton & Philips, 2013, p. 34).

According to Knowlton and Philips (2013) a theory of change model and program logic model

> differ by level of detail and use but represent the same logic. A theory of change model is simply a general representation of how you believe change will occur. A program logic model details resources, planned activities, and their outputs and outcomes over time that reflect intended results. (p.5)

In other words, theories of change transcend localized or particular programs, while program logic models are grounded in local context and are specific to a particular program management entity.

To develop a theory of change, a qualitative multiple case study approach was utilized to conduct "decision-oriented research," or research that aids extension educators and others to make decisions about the nature and content of an intervention process to facilitate agricultural innovation (Leeuwis, 2004). Most simply, the case study research can be understood as the first step in developing an appropriate extension education program to increase grower understanding of on-farm food safety practices.

Leeuwis' (2004) farmer practices model informed the case study research to provide a framework for the development of the theory of change. Specific research questions that guided the case study include the following: (1) How do growers perceive the threat of foodborne contamination on their farms? (2) With whom do growers place responsibility for food safety?

(3) How do growers adapt their on-farm food safety management practices based on how they perceive the threat of foodborne contamination?

Pennsylvania offers a compelling case of study through which these questions can be researched. Multiple foodborne illness outbreaks have plagued the state. According to Scharff (2010), Pennsylvania ranks sixth among the 50 states and the District of Columbia for the highest number of foodborne illnesses in the United States. Further, an increasing number of supermarkets in Pennsylvania are requiring that growers from whom they buy fresh fruits and vegetable provide evidence of GAP compliance, such as having participated in GAP training, having developed a food safety plan, or having passed third-party audits for on-farm food safety practices (Tobin et al., 2011). According to the Agricultural Marketing Service (AMS) of the USDA, over 130 farms in Pennsylvania were GAP certified as of March 2011 and approximately 40 percent of these farms received certification covering more than one crop. Because most Pennsylvania growers have diversified, small-operations, Pennsylvania grower perceptions regarding food safety policy can provide valuable insight into how food safety standards may hinder or bolster their participation in the fruit and vegetable market.

Also, the nearly twenty year history and breadth of the reach of GLOBALGAP can offer additional insights into these questions based on farmer experiences outside of the United States. Such comparison also can illuminate similarities and differences in diverse contexts to enhance the delivery of an educational intervention to improve on-farm food safety practices. Thus, a fourth research question addressing global differences was considered. The fourth question that guided this research study is the following: (4) How do the perceptions of food safety differ among growers in the global North and global South?

The state of Sao Paulo in Brazil was chosen as a comparative case, because Sao Paulo provides an opportunity to explore the significance of how geographical context – particularly that of the North (Pennsylvania) and that of the South (Sao Paulo) – impact grower perceptions. The state of Sao Paulo is relatively similar to Pennsylvania in that both states are anchored by two major urban centers - Philadelphia and Pittsburgh in Pennsylvania and Sao Paulo and Campinas in Sao Paulo, both states have relatively small farms with higher levels of crop diversification, and in both states agriculture contributes less than 1.5 percent to the state GDP.

Definitions

Because the case study research is informed by Leeuwis' (2004) farmer practices model, this study adopts Leeuwis' (2004) definition of extension. According to Leeuwis (2004), extension is "a series of embedded communicative interventions that are meant, among others, to develop and/or induce innovations[2] which supposedly help to resolve (usually multi-actor) problematic situations" (p. 27). This definition moves beyond early, normative definitions of extension that reflected an approach through which extension educators persuaded farmers to adopt new technologies or innovations. Rather, Leeuwis' definition of extension recognizes that extension is a system of processes in which expert and non-experts participate and engage

[2] According to Leeuwis (2004) an innovation is "a new way of doing things or even doing new things, but it can only be considered an innovation if it actually works in everyday practice…. [An innovation] is not only composed of novel technical devises or procedures, but also of new or adapted human practices, including the conditions for such practices to happen" (p. 12).

simultaneously to develop and induce innovations. Using communicative intervention approaches[3], extension educators and other specialists facilitate a process that helps bring about changes at the individual level that serve as a trigger for other forms of change at a broader social level that are related to human practices, growth of crops, regulations, etc. (Leeuwis, 2004, p. 27). This definition also aligns more closely with the definition adopted by international agricultural research organizations, like the Institute for Food Policy Research Institute (IFPRI). Such definitions account for agricultural advisory activities that move away from top-down models of extension to more process oriented models, such as "assisting farmers to form groups, deal with marketing of agricultural products, and partner with a broad range of service providers" (Birner et al., 2006, p. 1). This distinction is important, because it implies that the source of extension education could be any of the following: public sector, farmers, private companies, non-governmental organizations, or farmer based organizations. Finally, from an

[3]In this study, *communicative intervention*, as opposed to *communication intervention*, will be used to convey an emphasis on an approach that analyzes and anticipates an audience's diversity with regards to life experience, aspirations, perceived environmental efficacy, perceived self-efficacy, experienced social pressures, and perceived future consequences and benefits of the possible, new intervention (Leeuwis, 2004, p. 124-125). According to Friederichsen (2009), *communicative intervention* "directly speaks to the demands for participatory research to produce useful and applicable knowledge referring to agricultural production" (p.50). Further, communicative action places strong emphasis on the role of mediation among outside actors and local rural people and the legitimation of the former "not only depends on their own activities but also is embedded in the wider issue of the local" (Friederichsen, 2009, p. 50).

educational theory perspective, this definition of extension reflects a shift from an instrumental to transformative learning approach.

Significance and Overview

This introductory chapter highlighted the significance of this study by presenting the policy context in which heightened attention to the safety of fresh fruit and vegetables arose. In Chapter 2 the context of the modern food system and the historical background of agricultural standards is reviewed. The conceptual framework designed to guide this research study, which emerges from agricultural extension and education approaches, such as adoption diffusion, social and behavior change, and participatory communication, is discussed in Chapter 3. In Chapter 4 the research methods used to conduct the study are described. Then the findings of the study are presented in Chapter 5. Finally, a discussion contrasting the perceptions of growers in the different case studies and the resulting implications of the study are offered in Chapter 6.

Chapter 2

CONTEXT AND HISTORICAL BACKGROUND

To be successful, any extension education intervention must be designed with an understanding of broader social and historical contexts. Within the modern food system, changes in global food production, in consumer behaviors and perceptions, and in the environment are contributing factors to the increasing complexity of the food safety system. These issues are discussed to provide the reader with a broad overview of how food safety concerns are situated within the current context of the modern food system. After taking these changes into account, a historical overview of food quality and safety standards is presented. The chapter concludes with a discussion about third-party certification of on-farm food safety.

About the Modern Food System

The 1998 Institute of Medicine (IOM) and National Research Council (NRC) report *Ensuring Safe Food: From Production to Consumption* identifies several issues that have sparked increased concern and discussion about food safety. These issues include "implications of emerging pathogens, the trend toward the consumption of more fresh produce, the trend toward eating more meals away from home, and changing demographics, with a greater proportion of the population being immunocompromised or otherwise at increased risk for foodborne illness" (Institution of Medicine & National Research Council [IOM & NRC], 2010, p. 22). To understand how these issues affect food safety, they must be examined within the

context of broader societal changes that are contributing to an increasingly complex food system. Among these broader societal changes are changes in global food production, in consumer behaviors and perceptions, and in the environment.

Global Food Production

Food production has increased dramatically in the last century. This dramatic increase is, in part, a reactionary result of a growing world population. The World Bank reports that the total world population grew from about 4.5 billion to just over 6 billion people between 1980 and 2000 (World Bank DEP, n.d.) and the U.S. Census Bureau estimates that the total world population has grown to over 7 billion (U.S. Census Bureau, 2011). Demand for food is expected to continue to grow as population growth continues to rise. The Food and Agriculture Organization (FAO) estimates that total demand for cereals, for both food and animal feed, is projected to reach 3 billion tons by 2050 (Food and Agriculture Organization [FAO], 2009). To keep up with increased demands for meat products, total world feed production has nearly doubled since 1980 – from 370 million tons in 1980 to 614 million tons in 2004 (International Feed Industry Federation [IFIF], 2010). The food and agriculture sector will need to continue to adapt to meet increased demand for food.

The current food and agriculture sector is characterized by widespread integration and consolidation and what Lacy (2000) called "an accelerating distancing of producer and consumer from each other and from the earth" (p. 19). Modern farm management techniques based on neoclassical economic factors of production have, for the most part, disembedded farming from the community (Lyson, 2004) and food trade has been liberalized greatly with the establishment

of the World Trade Organization (WTO). Busch and Bain (2004) pointed out that this liberalization has allowed the private agrifood sector to greatly expand their markets internationally, which in turn has led to rapid consolidation particularly among supermarkets.

The consolidation of supermarkets has changed the grocery retail landscape around the world. A small number of large companies now dominate the industry, thereby leaving fewer opportunities for small retailers. As the number of retailers decreases, the remaining large companies are left with "significant leverage to bargain for lower prices and demand safety standards" (IOM & NRC, 2010, p. 36). This ability to leverage resources provides retailers with a market advantage to establish terms on which they will purchase food products from suppliers, including fresh fruits and vegetables from growers.

Consequently, an increasing number of supermarkets have begun to require that growers from whom they buy fresh fruits and vegetable provide evidence of compliance with good agricultural practices (GAPs). GAPs are a set of on-farm guidelines aimed at reducing the likelihood of microbial or other contamination of fresh fruits and vegetables. This compliance could take the form of having participated in GAP training, having developed a food safety plan, or having passed third-party certification (TPC) audits for on-farm food safety practices (Tobin et al., 2011).

Consumer Behavior and Perceptions

This shift towards increasing regulation of on-farm practices for food safety of fresh produce also coincides with changing consumer perceptions and behaviors regarding fruit and vegetable consumption, including increased consumption of fruit and vegetables and increased

concerns about food safety. Increases in fruit and vegetable consumption have been documented in both the United States and Brazil – the country sites of the cases in this study. In the United States,

> Since 1970, the per capita consumption of fresh vegetables increased from 150 to nearly 200 pounds in 2006, while fresh fruit consumption during the same time period increased from 101 to 129 pounds. Overall, fresh fruit and vegetable consumption in the U.S. in 2006 was more than 325 pounds per person. (Gravani, 2009, p. 101)

In Brazil, consumption of fruits and vegetables has increased by 12 percent since 1993 (Valdes, Lopes & Lopes, 2009). Several reasons exist for increased consumption of fruits and vegetables. First, health benefits of fruit and vegetable consumption have been widely documented. Fruits and vegetables contain essential vitamins, minerals and fibers that provide a protective role in preventing chronic diseases such as certain cancers, stroke and heart disease (Duyn & Pivonka, 2000). Increasing fruit and vegetable consumption has become a global priority (Food and Agricultural Organization [FAO], 2003a) and consumers have responded to the increasingly common public education campaigns about the benefits of consuming fresh fruits and vegetables (Gravani, 2009).

In addition, a rising middle class around the globe with rising incomes, new growing practices, and market liberalization in the food and agriculture sector also have provided increased opportunities for people around the world to purchase and consume more fresh fruits and vegetables. Extended growing seasons through plant-breeding programs, changes in horticultural practices, and the expanded trade of a greater variety of fruits and vegetables make

it possible for individuals to buy at any time during the year exotic fruits and vegetables that may not be seasonal or native to the region in which they are consumed (Friedland, 1994, p. 176).

However, as fruit and vegetable consumption has increased, some research indicates that consumer confidence in food safety has waned. Brewer and Rojas (2008) found that in 2008 consumer confidence the safety of the food supply in Illinois had decreased by 10 percent since 2002; in 2008 only about half of consumers considered their food to be very safe.

In the *2011 Food and Health Survey* (n=1000), which was conducted by the International Food Information Council, only about half (51%) of the respondents expressed confidence in the safety of the U.S. food supply (International Food Information Council Foundation [IFIC], 2011). Foodborne illness from bacteria ranked as the most important food safety issue among the respondents; 50% cited it as their top concern. Sixty-one percent of respondents believe imported food is less safe than food produced in the U.S. and the top reason that respondents cited for their concern of imported food was that they believe there is less regulation of foods produced in other countries. Most respondents (71%) also believed that food safety is the responsibility of the government and only about one-third of the respondents of the survey believed that food safety is a shared responsibility among diverse stakeholder groups, such as government, retailers, producers, consumers, etc. Seventy-three percent of the respondents cited at least one media source as their source for information about food safety.

In addition to documenting consumer confidence in the safety of the food system, various studies also have documented consumer willingness to pay and support for food safety practices. Using economic research methods for analyzing risk reduction, Haninger and Hammitt (2011) surveyed 2,859 random adults and found that American consumers are willing to pay more for verifiably safer food; however their willingness to pay does not increase if the severity of

symptoms or duration of the illness were to increase. Also, Pirog and Larson (2007) reported that 79 percent of respondents indicated that information about whether the farm of origin had been inspected for food safety practices is important. And in a poll about federal food safety legislation of 1,0005 registered voters, Hart Research Associates and American Viewpoint (2009) found that a majority of consumers (94% and 90% respectively) support "tracing systems that enable the FDA to trace food back to its source" and "requiring produce growers to meet standards for water quality, manure use, and worker sanitation". Related, Mukhopadhaya, Adhikari, Mumma, and Teisl (2004) analyzed data from the 2002 FoodNet data source and found that consumers were willing to pay for a vaccine against foodborne pathogens, such as *E. coli, Salmonella,* and *Listeria* if one were to be developed. They also were more willing to pay more for longer protection and for protection against *E.coli.*

Environmental Changes

Taking into account trends relating to the increased consumption of more fresh fruits and vegetables, increases in foodborne illness outbreaks, and consumer willingness to pay more for food safety, it is not surprising that the rise in public food safety standards occurred when it did. In addition to considering these social influences on the food safety system, recognizing how changes in the environment also are affecting the food safety system is important.

According to Gravani (2009), "over the last 30-40 years, microbiologists have observed many genetic changes in microorganisms. These changes include adaptation to stresses in the environment, thereby allowing microorganisms to survive and grow where they once could not survive" (p. 107). There is strong reason to believe that these changes in microorganisms may be

linked to climate and other environmental changes. At the 2011 annual meeting of the American Association for the Advancement of Science, several scientists indicated that "they fear that global warming could lead to increased levels of contamination of food, from chemicals and pesticides to crop pests and fungal pathogens, as well as faster spreading of diseases," and according to the USDA, discussions about climate change and food safety only are beginning (Shurkin, 2011). Similarly the Food and Agriculture Organization (2008) identified a number of possible food safety issues as complications of climate change. Among these issues are increases in the incidences foodborne illness and diseases arising from

- stronger bacteria, viruses, parasitic protozoa and zoonotic diseases,
- toxic fungi and mycotoxin contamination as a result of more mold being present in the environment,
- harmful algal blooms as a result of temperature changes,
- environmental contaminants and chemical residues in the food chain as a result of flooding and contamination of water and soil, and
- increased climate related emergency situations during which food safety problems could arise.

Changes in global food production, consumer behaviors and perceptions, and the environment are reflected in the evolution of food safety standards. Accordingly an overview of the evolution of food safety standards is presented in the next section.

Overview of Food Standards

Standards are "commonplace in all aspects of social life" (p. 4). According to Busch and Bingen (2006) "standards are the measures by which products, processes and producers are judged" (p. 3) while "weights, measures and coinage appeared thousands of years ago as means of standardizing, of creating order out of chaos, and of facilitating trade and taxation" (p. 6). Standards can serve both economic and ethical functions in daily life.

As an economic function, they first can reduce the transaction costs related to the sale of products, i.e., "the costs of doing business, including inspection and identification of the product for sale" (Busch & Bingen, 2006, p. 14), because they allow for easy and quick identification of items. Second, standards can increase competition within the market. When comparing similar items, standards allow consumers to quickly determine which product is the cheapest value, thus encouraging retailers to sell products at a lower price to beat out their competitors. Finally, they reduce or eliminate information asymmetries. If a product is not standardized, it is likely that the seller will know more about the product than the buyer. However, agreed-upon standards for an item provide both the seller and buyer with the same amount of information about a product (Busch & Bingen, 2006).

In addition to serving these important economic functions, Busch (2000 as cited in Busch & Bingen, 2006) suggested that food standards also provide additional ethical functions. These additional functions included

- "Disciplining suppliers who do not meet the standard – either by removing them from the market or by relegating them to a lower grade,

- Reconstructing nature so as to make it conform to the [standards] in use at a particular point in space and time,
- Creating localized conditions of objectivity through negotiating what shall count, for example, for soybeans,
- Building complex networks through which people and things may move by virtue of agreement on what is the same,
- Standardizing markets such that personal contact is unnecessary and pricing is uniform, and
- Making capitalist markets possible by turning singularities into commodities" (p. 17).

Because standards are so familiar and pervasive in our daily lives, possibilities exist for exploiting the potential benefits of standardization. In standardization lies the ability to remove power from that which, or those that must, conform to such standardization. Economic and ethical functions aside, the concept of standards gave rise to the idea of private governance, which coincides with globalization– each important factors in the proliferation of food standards (Peine & McMichael, 2005). Peine and McMichael (2005) view private governance

> as an ideal-typical concept in two respects: first, it tends to be differentiated from 'government' as if the latter does not itself comprise or constitute relations of rule outside of formal institutional mechanisms, and second, it obscures the role of states in conditioning or constituting governing as part of their authorship of 'globalization.' (p. 21)

Busch and Bain (2004) argued that the establishment in 1995 of the World Trade Organization (WTO), the only international body organizing and able to enforce the rules of trade between nations, has "facilitated the ability of the private agrifood sector to consolidate and expand

internationally" (p. 321). Such consolidation and international expansion has allowed these retailers to dominate global food supply chains through their own rules for standardization. As food retailers begin to dominate supply chains and direct state regulation of markets is reduced by neoliberal economic policies, a "shift from food government centered on the state to food supply chain governance" occurs (Busch, 2011, p. 346). According to Busch, this shift

> is best understood as (1) an enhancement of the ability of certain firms (usually food retailers) to dominate supply chains, reducing costs by imposing a new form of discipline on other (usually upstream) firms in the chain, and (2) the realization by NGOs of their potential to pressure the dominant food firms. (p. 2)

Such shifts raise questions about the moral economy of standards with regards to who benefits and who loses in an agrifood system governed by private standards (Busch, 2000).

Because "food, like other basic human needs has a special moral status" (Caplan, 1986, p. 183), questions about food safety standards often occupy an important place in impassioned discussions about the future of the agrifood system. For example, DeLind and Howard (2008) critiqued the efforts by government and industry to remediate the situation of the 2006 outbreak of *E. coli O157:*H7 traced to bagged spinach in California. DeLind and Howard argued that by focusing solely on locating and eliminating the source of contamination, government and industry failed to ask important questions such as "why" *E. coli O157:*H7 was found. They argued that "the tendency to essentialize and decontextualize food safety problems" (p. 305) through a uniform set of standards and remediation procedures conceals "underlying problems and reinforcing powerful ideologies of individualism, scientism, and centralizing authority" (p. 301). Further, DeLind and Howard suggested that "food safety (or the illusion of safety) is being positioned to secure capital rather than welfare" (p. 301).

Likewise Caplan (1986) suggested that arguments in favor of consumer free choice with regards to food safety, "tend to depict consumers as independent, tough-minded, and autonomous agents" (p. 185). The problem lies herein, though, because such arguments "presume that every citizen is competent to decide what is in his or her own best interest in making decisions about food" (Caplan, 1986, p. 185). Yet there are groups of individuals with limited competency for making decisions about food safety. Those who are not able to make their own decisions about food include, among others, children, patients and residents of hospitals and nursing homes, and those who do not have full access to educational information about food safety risks (Caplan, 1986). Yet food safety regulations

> while decreasing freedom in the negative sense of that concept [by placing restriction on the food industry], increase it with respect to freedom's positive dimension. By allowing consumers the opportunity to obtain information about food safety from neutral parties, and, by forcing the food industry to maintain minimum standards of safety…, the government makes it possible for many citizens to make informed choices about the risks and dangers they wish to entertain with respect to food, while protecting the vulnerable and the incompetent from the untoward consequences of decisions that they are not able or free to make. (Caplan, 1986, p. 188)

It is with this understanding - that appropriate "regulation is not antithetical to freedom" – that the historical overview of public food quality and safety standards is presented in the next section (Caplan, 1986, p. 188).

Public Food Standards

According to Jouve (1998) "food safety legislation is generally understood as that body of acts, regulations, requirements, or procedures issued by public authorities, related to foodstuffs and intended to cover the protection of public health" (p. 75). However, many established food safety procedures are considered to be voluntary and cannot be enforced legally. It is with this understanding that the development of public food quality and safety standards within the global food system and the organizations involved in this development are described in this section. (See Table 2-1.)

While the focus of this research is on food safety issues, it often is hard to disentangle food safety from food quality issues particularly when food safety standards are viewed in a historical perspective. According to the Food and Agriculture Organization (FAO) and World Health Organization (WHO) (2003), the foremost goal of food quality and safety standards is to "protect the consumer against unsafe, impure and fraudulently presented food by prohibiting the sale of food not of the nature, substance, or quality demanded by the purchaser" (p. 6). Quality food is inherently safe. Thus safety and quality will be considered together in this section.

Table 2-1

Evolution of Key Global Food Safety Organizations, Regulations and Standards

Year Effective	**Organization, Regulation, or Standard**
1945	Food and Agriculture Organization (FAO)
1947	General Agreement on Tariffs and Trade (GATT)
1947	International Organization for Standardization (ISO)
1948	World Health Organization (WHO)
1963	FAO/WHO Codex Alimentarius Commission (CAC)
1970s*	FAO Food Quality and Standards Service (AGNS)
1987	ISO 9000 Standards for Quality Management
1992	ISO 14000 Standards for Environmental Management
1995	World Trade Organization (WTO) and the Agreement on the Application of Sanitary and Phytosanitary Measures (SPS)
1997	Codex Document on HACCP Principles and Application
1997	GLOBALG.A.P. (formerly EUREPG.A.P)
1999	United States Department of Agriculture (USDA) Good Agricultural Practices (GAP) and Good Handling Practices (GHP) Audit Verification Program
2005	ISO 22000 Standards for Food Safety
2011	Food Safety Modernization Act

Note. Adapted from "HAACP and transparency" by W. H. Sperber, 2005a, *Food Control,* 16(6), p. 506.
* Exact date is not known.

The current global food safety system began under the auspices of the United Nations (UN) when the UN established the Food and Agriculture Organization in 1945 to serve both developed and developing nations "raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy" (Food

and Agriculture Organization [FAO], 2011a). In the 1970s, FAO established what is now known as its Food Quality and Standards Service (AGNS). AGNS is charged with "protecting consumers and promoting the production and trade of safe, quality food" (Food and Agriculture Organization, 2011b). Even though AGNS does not have the legal authority to enforce food safety regulation, it does work with international, regional and national partners to develop guidelines and tools for food safety risk assessment, establish and improve regulatory frameworks for food quality and safety, in particular the Codex Alimentarius, and supply technical assistance and expert advice to build capacity in food safety and quality throughout the food system.

The Codex Alimentarius Commission (CAC) was established jointly by FAO and WHO in 1963 to implement the Food Standards Program. Under the Food Standards Program, the CAC was charged with developing a food code comprised of standards and guidelines that would protect the health of consumers and ensure fair practices in world trade. That code is known as the Codex Alimentarius, which is Latin for "food code" (Food and Agriculture Organization & World Health Organization [FAO & WHO], 2010). The CAC acts as "an umbrella organization for policy making regarding food on a global level" (Trienekens & Zuurbier, 2008, p. 110). Membership in the CAC is open to all members of the United Nations; currently 184 countries and one member organization participate (FAO & WHO, 2010).

Codex standards are voluntary and non-binding and cover all foods, whether processed, semi-processed or raw, as well as materials used in the processing of food products to the extent necessary for achieving the main objectives of the code. Responding to advancements in food science and the globalization of the food and agricultural system, Codex provisions now address issues such as the nutritional quality of food, including microbiological norms; food hygiene and

codes of hygienic practice such as the guidelines for the use of the Hazard Analysis and Critical Control Point (HACCP) system; food additives; pesticide and veterinary drug residues; contaminants in food; labeling and presentation; and methods of sampling and risk analysis, such as for the safety of foods derived from biotechnology. The Codex Alimentarius often is criticized because it has the dual and sometimes conflicting charge of promoting food safety by minimizing health risks associated with foodborne illness, as well as minimizing economic risks associated with food as a traded commodity (Ilcan & Phillips, 2006).

A product of the Uruguay Round of multinational trade negotiations that established the formation of the World Trade Organization (WTO) in 1995, the Agreement on Application of Sanitary and Phytosanitary Measures (SPS) is an agreement on how governments can apply food safety, as well as animal and plant health measures, without compromising the basic rules of the WTO. Succeeding the General Agreement on Tariffs and Trade (GATT) established in 1947, the WTO is an international organization that oversees the global rules of world trade. While the GATT now serves as the WTO's "principal rule-book for trade in goods" (WTO, n.d.), the WTO relies on the Codex Alimentarius as the standard by which trade disputes associated with food should be resolved.

One of the most widely acknowledged tools facilitating the international trade in food as governed by the WTO SPS agreement is the Hazard Analysis Critical Control Point (HACCP) concept system. The HACCP concept was developed in the 1960s – 1970s when the Pillsbury Company created and piloted the approach as part of its efforts to produce safe food for space exploration by NASA (HACCP International Alliance, n.d.). The concept system is based on seven principles (see Table 2-2) that the food industry can use to identify and prevent potential hazards that might occur in the food production process chain. Since its development, the

National Academy of Sciences, National Advisory Committee for Microbiological Criteria for Foods (NACMCF), and the CAC have endorsed HACCP as a process control system and in 1997 the CAC adopted the document on HACCP principles and application as an annex to the Codex Alimentarius (Goodrich, Schneider & Schmidt, 2005; Codex Alimentarius Commission [CAC], 2003).

Table 2-2

HACCP Principles

Step	Activity
1	Conduct a hazard analysis
2	Determine the critical control points (CCP)
3	Establish preventive measures with critical limit(s) for each control point
4	Establish a system to monitor control of the CCP
5	Establish corrective action to take when monitoring indicates a CCP is not under control
6	Establish verification procedures to confirm HACCP is working effectively
7	Establish documentation procedures appropriate to HACCP principles and their application

Note. Adapted from "Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application*"* by Codex Alimentarius Commission, 1997.

In the United States, the Food and Drug Administration (FDA) issued regulations making HACCP mandatory in 1995 for fish and seafood products and in 2001 for juice processing and packaging plants. In 1998, the USDA Food Safety and Inspection Service (FSIS) mandated HACCP for the nation's meat and poultry processing plants (Goodrich, Schneider & Schmidt, 2005). Despite its potential, HAACP is not a stand-alone process in securing the safety of the

food system. According to Sperber (2005b), "HACCP is a necessary, but insufficient, condition to assure food safety" (p. 514). Sperber argued that despite the successful use of HAACP in food processing facilities, additional food safety precautions or intervention models need to be implemented at other points along the food supply chain, such as on farms for crop production. Thus other food safety gaps existed in the supply chain of fruits and vegetables. However in the late 1990s those gaps soon began to be addressed with the advent of Good Agricultural Practices, or GAPs.

Like HAACP, GAPs represent a "proactive approach to averting health hazards" (Jouve, 1998). GAP refers to on-farm food safety standards which should be part of normal production practices to prevent food contamination. These standards addressed topics such as crop production water usage, worker health and hygiene, toilet and hand washing facilities, manure and biosolids storage and application, minimizing animal fecal contamination, harvest equipment sanitation, product trace back, adjacent land use, urban and animal encroachment onto land, and food defense (Center for Food Safety and Applied Nutrition, 1998).

In 1997, the Euro-Retailer Produce Working Group (EUREP) started to develop a common set of standards and procedures for the development of GAPs. These standards were commonly referred to as EUREPGAP. While British retailers and European supermarkets were the driving forces behind this standardization, producers who sold to retailers participating in EUREPGAP also benefited from the harmonization of standards in that they could sell to multiple retailers without undergoing multiple audits for different criteria established by different retailers. Over the next ten years, as more retailers around the globe became interested in harmonizing their standards for the purchase of safe produce, the name of the certification program was changed in 2007 from EUREPGAP to GLOBALGAP to reflect "the new realized

proposition as the pre-eminent international GAP-standard and to prevent confusion with its growing range of public sector and civil society stakeholders" (GLOBALGAP, n.d.)

Around the same time, the United States Department of Agriculture (USDA) also was recognizing the increasing focus by retailers on on-farm food safety assurances and established in 1999 the Good Agricultural Practices (GAPs) and Good Handling Practices (GHP) Audit Verification Program. The USDA Audit Verification Program provides opportunities for produce growers to obtain audits assuring their safe practices within one of three main areas: Good Agricultural Practices for on-farm practices; Good Handling Practices for packing facilities, storage facilities and wholesale distribution centers; and Food Defense for protocols utilized throughout the food chain (United States Department of Agriculture, Agricultural Marketing Service [USDA, AMS], 2011). Through these audits, up to seven 'scopes' of the food chain can be evaluated:

- on-farm reviews,
- field harvest and field packing activities,
- house packing facilities,
- storage and transportation of food products,
- trace back activities,
- wholesale distribution center and/or terminal warehouse activities, and
- preventative food security procedures.

Recognizing that no U.S. governmental agency had authority to enforce on-farm food safety practices such as GAPs, U.S. Congress passed the Food Safety Modernization Act, which was signed into law by President Barack Obama in January 2011 (H.R. 2751, 2010). The FDA Food Safety Modernization Act amends the Federal Food, Drug, and Cosmetic Act mandating

the FDA to establish science-based standards for the safe production and harvest of fresh fruits and vegetables and provides the FDA with regulatory oversight to enforce adherence to these standards.

A multiplicity of GAPs standards have been developed by various food industry and commodity organizations, governments and NGOs, but the FAO – the only global intergovernmental organization with a broad mandate to govern the world's food and agricultural system - broadly defines GAPs as "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products" (FAO, 2003b, p. vii). While the four 'pillars' of GAPs derived from the FAO definition -- economic viability, environmental sustainability, social acceptability and food safety and quality -- are included in most public and private sector standards, the scope that these standards actually cover varies widely.

In this regard, Trienekens and Zuurbier (2008) categorized GAPs and HACCP as "generic" food quality and safety assurance systems. Trienekens and Zuurbier also added to this group of generic assurance systems the International Organization for Standardization (ISO) standards. However, while GAPs and HACCP pay attention to both technical and managerial issues, ISO standards focus solely on management issues.

ISO is a network of the national standards institutes of 160 countries. As a non-governmental organization, the ISO bridges the public and private sectors. Many of the ISO member institutes are part of the governmental structure of their countries; other members - having been set up by national partnerships of industry associations - are rooted uniquely in the private sector. ISO standards that food growers, processors and retailers have begun to adopt include the series 9000 for quality management, series 1400 for environmental management, and

series 22000 for food safety management (International Organization for Standardization [ISO], 2011). The ISO 22000 series is being implemented in over 70 countries and emphasizes safe food throughout the entire food chain through interactive communication, systems management, and hazard control. Despite emphasizing safe food throughout the entire food chain, certification primarily has been awarded to food processors; certification of primary producers has been mostly in dairy. Very few produce farms have been ISO certified (Faergemand, 2008).

While 'generic' food quality and safety assurance systems such as GAPs, HAACP and ISO standards provide the foundation on which public and private standards aim to provide for economic viability, environmental sustainability, social acceptability and food safety and quality in the global agrifood system, the private sector arguably has defined food quality and safety standards more narrowly. On this point Henson and Hooker (2001) acknowledged that "the interrelationship between the regulatory activities of government and the strategic behavior of firms is well recognized," (p. 10) and suggested that incentives for firms to implement more sophisticated food safety controls operate at two levels. First, food safety controls can be recommended and/or mandated by public/governmental food safety regulations. Second, they can be market-driven, such as demand-side incentives to enhance reputation among customers or supply-side incentives to make improvements in efficiency.

After this brief overview of the former, the focus of this chapter now shifts to what Busch (2011) described as one of the most recent and noteworthy trends in the food sector: "that food retail and processing firms have embraced private standards, usually with some form of third party certification employed to verify adherence to those standards" (p. 345).

Private Food Standards

Consumer demands for safe and high quality food products in various assortments throughout the year and the globalization of the food system have "transformed the food industry towards an interconnected system with a large variety of complex relationships" (Trienekens & Zuurbier, 2008, p. 107). Responding to these changes, food businesses have expanded their strategic focus from primarily traditional economic interests to less tangible issues, such as food safety, environmental practices and labor conditions (Hatanaka, Bain & Busch, 2005). One such example is the increasing tendencies of supermarkets to require that produce growers from whom the supermarkets purchase fruits and vegetables obtain third-party certification for food safety (Tobin et al., 2011). Third-party certification is a process through which an independent, third-party auditor conducts an on-site inspection to determine whether a grower's practices comply with a certain set of standards, such as Good Agricultural Practices (GAPs) (Hatanaka, Busch, & Bain, 2005).

Hatanaka, Bain and Busch (2005) suggested that "rather than 'neutral market lubricants,' supermarkets increasingly view private standards as strategic business tools" (p. 356). In other words, food businesses use private standards strategically. Because public food quality and safety standards often do not encompass guidelines for promoting the quality attributes that allow firms to differentiate themselves within the market, firms are increasingly relying upon private standards to fill this gap. According to Bain and Busch (2004) retailers perceive the use of such private standards as a competitive tool. Third-party certification provides supermarkets with a means through which they can assure consumers that their product is safe and thereby a quality product.

In addition to providing retailers with the flexibility to differentiate food products by attributes such as safety, third-party certification also allows retailers to minimize potential for loss of reputation and financial liability in the event that a foodborne illness should be traced back to a product sold by their store. This aspect of third-party certification is particularly noteworthy in light of the increasing concentration in the food industry. Globally three supermarket chains, Wal-Mart, Carrefour, and Royal Ahold, dominate retail food sales. In the United States sales from five supermarkets accounted for 40% of all food retail sales in 2000. As retailers increasingly rely on centralized procurement and distribution centers to reduce transaction costs, the potential damage should a foodborne illness be traced back to their store is increased (Hatanaka, Bain & Busch, 2005). Third-party certification allows retailers to shift liability, "an obligation, enforceable by a lawsuit, to pay monetary damages to a person as compensation for injuries caused by an unsafe product" to producers if they can trace back the source of foodborne illness to a particular farm (Stearns, 2009, p. 385). Thus the element of traceability, which is "the ability to follow and document the origin and history of a food or feed product" (Joint Institute for Food Safety and Applied Nutrition [JIFSAN], 2007, p. 2) and also is something that growers must document in their food safety plans in order to pass a third-party certification food safety audit, has emerged as one of the most important, if not the most important, element of third-party certification.

Increasing reliance on private standards by retailers also has implications for producers who sell to supermarkets requiring a food safety audit. Obtaining third-party certification for on-farm food safety may increase economic opportunities of farmers who have the knowledge and resources to pass such audits. Such certification may be particularly important for growers in developing countries who previously may not have met the "standards necessary for participating

in the more lucrative markets of developed economies" (Hatanaka, Bain, & Busch, 2005, p. 361). According to Hatanaka, Bain and Busch (2005),

> TPC allows suppliers to demonstrate to other stakeholders within the commodity chain their commitment to more rigorous standards for their products…. [However], evidence suggests that the effects of TPC, and the opportunities open to producers, differentially vary by their size (p. 360).

Thus, third-party certification also can pose challenges to smaller growers, who have smaller economies of scale and less labor, and thereby have less flexibility and time to learn about such standards or to develop relevant safety plans.

In addition, the investments to meet the requirements of third-party certification and to pay for the actual audit itself often can be costly. In a study of the Michigan blueberry industry, Bain and Busch (2004) found that in some cases growers who ran their own processing facilities incurred costs of more than $100,000 to purchase and install new equipment and technology and to employ labor to manage the documentation of how food safety requirements was being met. Also, growers usually must bear the expenses of having a third-party food safety audit conducted. As of yet, there are no uniform or specific standards to which growers are required to adhere. Rather, supermarkets can require growers to follow whatever standards on which the supermarkets decide. Therefore growers who sell to multiple supermarkets may be required to pass different audits for each supermarket to which they sell. The expenses for passing multiple audits can be costly to the growers.

Despite some of the challenges posed by third-party certification, the increasing complexity of the food system necessitates a reexamination of food safety practices on the farm. Because on-farm food safety practices only are one activity in the food safety system, an

examination of communication and education approaches that address on-farm food safety could contribute to a more holistic understanding of some of the processes that are encompassed by the food safety system. Accordingly in the Chapter 3 theoretical knowledge about agricultural communication approaches and farmer risk perceptions and practices are reviewed and a conceptual framework through which on-farm food safety can be considered is presented.

Chapter 3

THEORETICAL AND CONCEPTUAL FRAMEWORKS

Miles and Huberman (1996) wrote that "qualitative research designs are not copyable patterns or panaceas that eliminate the need for building, revising, and choreographing your analytic work (p. 16)". Researchers must make important decisions about how to "focus and bound the collection of qualitative data" (Miles & Huberman, 1994, p. 16). Based on the guidelines recommended by Miles and Huberman (1994), a conceptual framework was designed to guide the development of the case study research questions and case selection for this study – the findings of which will serve as the foundation for the development of a theory of change that can be used for creating localized, extension education program logic models for on-farm food safety education. In this chapter, the theoretical and conceptual perspectives that influenced the design of the case study framework that structured this study are reviewed.

Farmer Practices and Risk Perceptions

Making sense of farmer practices as they relate to on-farm food safety can help extension educators better understand factors that may affect the success of on-farm food safety extension education programs. With this improved understanding, extension educators can improve the relevancy, effectiveness and efficiency of such programs. Accordingly, this section presents a review of relevant scholarly work on farmer practices and risk perceptions.

Farmer Practices

Every day farmers make important decisions on their farms about issues such as animal health, plant nutrition and growth, weed and pest management, soil quality, finance and markets, and operations management, among others (Olson, 2004). Early works in farm management described the on-farm decision making process as a series of five to eight linear steps (Ohlmer, Olson & Brehmer, 1998); see, for example, Johnson, Halter, Jensen, & Thomas, 1961; Castle, Becker, & Smith, 1972; and Kay & Edwards, 1994. However, subsequent research has demonstrated that the decision making process is not linear. Rather it "has many loops and feedback steps as new information is obtained and consequences are estimated and considered" (Olson, 2004, p. 11). The decision making process is complex; it is continuously shaped by and shapes individual farmer practices. According to Leeuwis (2004) farmer practices are

> things people 'do' (and'do not do') on a more or less regular basis. Thus, one particular event or human action is not a 'practice', but when a person engages in similar actions over time and/or if many people act in a particular way we can speak of a 'practice'. Thus, practices are essentially patterns of human action or regular activities. (p. 61)

In other words, farmer practices are the patterns of activities in which a farmer regularly engages over time on a farm.

Farmer practices, and resulting changes or innovations, can occur at different levels on a farm. Changes or innovations resulting from farmer practice could happen, for example, at the individual level of production objects like improving a new piece of equipment; at the aggregate level of production objects such as establishing a new machinery-sharing arrangement with farm neighbors; at the level of the farming system like transitioning from conventional to organic

farming; or at the level of the farm and its environment such as establishing grower cooperatives (Leeuwis, 2004). Because a change at one level most likely will have implications at any or all of the other levels, farmers consider - both explicitly and implicitly - how the introduction of changes or new innovations may impact the different farming levels and the different technical, economic and social-organizational aspects of the farm (Leeuwis 2004). Leeuwis (2004) attempted to capture in an heuristic model how the complex linkages among these different levels and aspects of a farm shape individual farmer practices. According to Leeuwis (2004), in "laymen's terms…this model suggests what farmers do or do not do depends on what they

- *believe to be true* about the biophysical and social world (i.e., what they *know*);
- *aspire* to achieve (i.e., what they *want*);
- (think they) are *able* to do;
- (think they) are *allowed* and/or *expected* to do" (p. 65).

Ultimately, what a farmer does or does not decide to do depends on his/her evaluative frame of reference, which is at the center of this model. Evaluative frame of reference encompasses a farmer's perceptions of consequences of certain practices, the farmer's perception of the likeliness that these consequences will happen, and the farmer's evaluation of such consequences in relation to a set of his/her own aspirations for his/her farm, i.e., will the consequences be negative or positive for the farm (Leeuwis, 2004, p. 67). Leeuwis (2004) asserted that even before enacting change on a farm, farmers usually have expectations about the consequences of the new change. Farmer knowledge or beliefs about the potential consequences and/or risks of change can originate from various sources including, but not limited to, lived or learned experiences, other growers, or agricultural research. According to Leeuwis (2004)

> for understanding what farmers do and do not do, it is irrelevant whether their beliefs about consequences are – in the eyes of, for example, scientists – valid, correct or complete. What is important here is that farmers' practices and/or their rejection or alternatives are, to a degree, associated with their perception of the consequences of such practices at various levels and domains of farming. (p. 68)

Leeuwis (2004) also outlines in his model variables that are relevant for understanding farmers' practices and responses to proposed alternatives: farmers' technical and social practices, perceived feedback from the agro-ecological and social world, perceived environmental effectiveness, social relations and perceived social pressure, and perceived self-efficacy (p. 66). Because a farmer's decision to accept or reject a new practice or innovation is based to a large extent on their perception of the consequences of such action, it is relevant to consider farmer risk perceptions in more detail.

Farmer Risk Perception

The definition of risk often is inconsistent and dependent upon its application. However, risk is always about uncertainty and probability. The International Organization for Standardization (ISO) defines risk as the "effect of uncertainty on objectives" (International Organization for Standardization [ISO], 2009), while the Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) defines risk as

> uncertainty in outcomes that are not equally desirable to the decision maker, and that may involve the probability of making (or losing) money, harm to human health, repercussions that affect resources (such as credit), or other types of events

> that affect a person's welfare. Risk is uncertainty that "matters." (Harwood, Heifner, Coble, Perry & Somwaru, 1999, p106)

Moreover, the definition of risk perception is different than risk itself. Boholm (1998) writes this about perceptions of risks:

> Perceptions of events and phenomena are conditioned by values which vary according to local bodies of assumptions, conventions and practices. Human societies constitute 'ultra-complex' systems, in that humans do not merely respond to the 'physical' impact of measurable and quantifiable aspects of events. Information about events, what is recorded and reported, in what way and by whom, is crucial to human life, as is the way that information is socially processed and morally valued – whether it is trusted or probed, esteemed or contested. (p. 135-136)

Sjoberg, Moen, and Rundmo (2004) define risk perception as "the subjective assessment of the probability of a specified type of accident happening and how concerned we are with the consequences" (p. 8).

Understanding farmer risk perception is important for two primary reasons. First, producers tend to be risk averse and therefore willing to accept lower average returns for higher certainty. Second, understanding risk in agriculture can help farmers better prevent and manage potential risk (Harwood, Heifner, Coble, Perry & Somwaru, 1999). According to the U.S. Department of Agriculture, Economic Research Service (2009), risk in agriculture can be classified into five general categories: (a) production or yield risk, (b) price or market risk, (c) financial risk, (d) institutional risk, and (e) human or personal risk. Factors that affect the operation of a farm, such as a decrease in crop yields, uncertainty in commodity prices, the

ability to adopt new technology, lawsuits, changes in consumer preferences, and changes in government laws and regulations, are examples of events or phenomena that can contribute to a farmer's perception of risk on his or her farm operation.

Researchers have documented risk factors, specifically as they relate to food safety issues, about which growers are concerned. Wilson, Parker, Kovacs, Doohan, & LeJeune (2009) used a mental models approach to understand farmers' knowledge and perceptions about and "to improve the effectiveness of on-farm decision making related to microbial contamination prevention and response" (p. 489). Their expert model revealed the main influences on "farmers' perception, understanding, and internalization of contamination threats" as being "regulatory (e.g., policy, guidelines, regulations, funding), societal (e.g., increasing frequency and awareness of incidents, increasing consumption) and a combination of other drivers (e.g., farm/food industry, retailers, economics)" (p. 491). Eggers, Ackerland, Thorne & Butte (2010) found that tomato growers in Florida and leafy greens growers in California and Arizona growers were motivated by factors such as customer expectations and financial interests to implement good agricultural practices (GAPs).

Further, both Wilson et al. (2009) and Eggers et al. (2010) concluded that there is a need for more understanding about grower knowledge and perceptions of GAPs in order for researchers and extension professionals to improve extension education programs for increased adoption of common on-farm food safety practices. In the final chapter of the report *Enhancing Food Safety: The Role of the Food and Drug Administration*, the Institute of Medicine and the National Research Council (IOM & NRC) (2010) "underscores the importance of conducting social research to design messages and to evaluate risk communication efforts as an essential

element of a risk-based program" (p. 259). The authors of the IOM & NRC report explicitly expressed that small growers should be a targeted audience:

> Risk and safety communications are critical at numerous points in the food system. Food producers, processors, and retailers play a vital part in the prevention of foodborne illness and require education tailored to their role in the food safety system…. [And] one particular subgroup of the food industry that may not have the resources to update its workforce on the latest policy developments and may need more targeted attention is small producers, processors, and retailers." (IOM & NRC, 2010, p. 272 & 274)

Consequently, the remainder of this chapter describes theoretical and conceptual agricultural extension education communicative intervention approaches that can inform the design and implementation of agricultural extension education programs and materials for on-farm food safety practices for small producers.

Agricultural Extension Education Communicative Intervention Approaches

Despite significant activity in agricultural communication, published research on this topic is widely scattered (Abbott, Scharpe, Evans, & Ly, 2009; Doerfert, Evans, Cartmell, & Irani, 2007; Zumalt, 2007; and Evans, 2006). Further, the role of communicative interventions in agricultural innovation systems has been considered primarily through traditional agricultural extension education lenses that view communicative interventions as "an intermediary function between science and its users" and thereby were "studied mainly in terms of the sources, media, or channels that provided people with information" (Leeuwis, 2010, p. 15). However, consideration about the role of communicative interventions in agricultural extension and

innovation systems has evolved over the years. Linear models of agricultural knowledge transfer that focused primarily on sources, media and channels, such as the diffusion and adoption model promulgated by Rogers, are being replaced by models that emphasize processes whereby innovation involves the "re-ordering of relations in multiple social networks" (Leeuwis, 2010, p. 18).

In this regard, Leeuwis (2004) identified three social levels where communicative intervention strategies could have impact– (1) those that focus solely on individual change at the farm management level, (2) those that focus solely on collective change, and (3) those for which the focus can be either individual or collective. Further, Leeuwis also synthesized a list of agricultural extension intervention goals and communicative intervention strategies used to achieve each of the goals. These goals and strategies, as well as the levels of change to which they align, are presented in Table 3-1.

Table 3-1

Communicative Intervention Goals and Relevant Strategies by Level of Change

Level of Change	**Intervention Goal**	**Strategy to Achieve Goal**
Individual change for farm level management	Problem solving or enhancing problem solving ability	Advisory communication
	Facilitating knowledge exchange or diffusion of innovations	Supporting horizontal exchange
Collective change for coordinated action	Building coherent innovations	Generating policy or technological innovations
	Managing pre-existing conflict	Conflict management
	Coalition building	Supporting organizational development and capacity building

Individual or collective change	Realizing policy objectives and/or pre-defined behavior change	Persuasive transfer of policy or technological innovations

Note: Adapted from *Communication for Rural Innovation: Rethinking Agricultural Extension (3rd ed.)*, by C. Leeuwis, 2004, Ames, Iowa: Blackwell Publishing Company.

Arguably, ensuring food safety through the enactment of good agricultural practices is analogous to realizing policy objectives through pre-defined behavior change. Thus, using Leeuwis' schema, the most relevant strategy for ensuring food safety through the enactment of good agricultural practices is the "persuasive transfer of policy or technological innovations" strategy. Accordingly the focus of the remainder of this section will be on three of the communicative intervention approaches that have dominated the agricultural extension and innovations systems literature - diffusion of innovations, social and behavior change, and participatory communication approaches.

Each of these approaches can be understood on a continuum that progresses from instrumental to interactive where diffusion of innovation approaches are the most instrumental and participatory communication approaches are the most interactive. Instrumental approaches tend to be more top-down, or persuasive, and are characterized by two prominent features. The first is that instrumental communicative interventions take place after the intervention goals have been defined by outside agencies. The second feature is that communication is used deliberately as a policy instrument to guide change. On the other hand, interactive approaches, which developed as a critique of instrumental approaches, engage stakeholders in a participatory manner to help generate and design appropriate goals, policies, and innovations (Leeuwis, 2004).

The diffusion of innovations model "encompasses a broad range of strategies aiming to solve problems that are due to a lack of knowledge and information," or in other words to

persuade stakeholders to learn this new knowledge and information. Social and behavior change approaches serve as an intermediary approach in the trajectory of the progression of agricultural communication intervention approaches, while the most recent and most interactive approach is the participatory approach (Tufte & Mefalopulos, 2009, p. 7). Participatory communication is based on the renewal of Paulo Freire's "liberating pedagogy from the 1960s" (Tufte & Mefalopulos, 2009, p. 7). Tufte & Mefalopulus (2009) suggested that this approach, as opposed to more one-way approaches of communication,

> is about articulating processes of collective action and reflection by relevant stakeholders…. [to empower citizens through] their active involvement in the identification of problems, development of solutions and implementation of strategies. (p. 7)

Each of these approaches is summarized in Table 3-2.

Table 3-2

A Continuum of Agricultural Communication Strategies

	Agricultural Communication Strategies		
	Instrumental →		***Transformative***
Parameters	**Diffusion**	**Social Behavior Change**	**Participatory**
Definition of the problem	Lack of information	Lack of information and skills	Lack of stakeholders' engagement
Notion of culture	Culture as obstacle	Culture as ally	Culture as "way of life"
Notion of catalyst	External change agent	External catalyst in partnership with the community	Joint partnership (external and internal)
Notion of education	Banking pedagogy	Life skills, didactics	Liberating pedagogy
Notion of groups of references	Passive: targets audiences	Active: targets trainee groups	Active: targets stakeholders
How are you communicating	Messages to persuade	Messages and experiences	Social issues engaged, problem-posing, dialogue
Main notion of change	Individual behavior	Individual behavior, social norms, experiential learning	Individual and social behavior, social norms, power relations
Expected outcome	Change of individual behavior, numerical results	Change of individual behavior, increased skills	Articulation of political and social processes, sustainable change, collective action
Duration of activity	Short- and mid-term	Short- and mid-term	Mid- and long-term

Note. Adapted from *Participatory communication: A practical guide*, by T. Tufte and P. Mefalopulos, 2009, Washington, DC: The World Bank.

Diffusion of Innovations

Emerging from the mandate of the Morrill Act of 1862 to land-grant universities (LGUs) to diffuse new knowledge spanning the fields of agriculture, community development, and family and consumer sciences, the national Cooperative Extension System (CES) in the United States historically has relied heavily on the diffusion of innovations model as an approach for knowledge transfer. Historically LGUs devoted a large percentage of their resources to educating and taking new knowledge about farm production,to rural agricultural populations. As a result, diffusion of innovation research occupies a prominent place within the discipline of agricultural sciences; agricultural educators and scholars of the sociology of agriculture have been studying diffusion theory since the 1940s (Rogers, 2003). According to Rogers (2003), the discipline of rural sociology "can be credited with forming the basic paradigm for diffusion research [and for producing] the largest number of diffusion studies "(p. 54).

The model on which the Cooperative Extension System in the United States relies to share new information with farmers has its roots in the diffusion of innovation theories promulgated by Everett Rogers since the late 1940s (2003). According to Rogers (2003), "diffusion is the process by which an innovation is communicated through certain channels over time among members of a social system" (p. 11). This theory assumes that the linear transfer of agricultural knowledge and technology from expert scientist to farmer will ignite development or change beyond the individual level; after early adopters successfully use the new knowledge or technology, then late adopters will follow. Each of the four main elements of diffusion - the innovation, communication channels, time and a social system – are described in further detail.

The first element of the diffusion process is the innovation. According to Rogers (2003), "an *innovation* is the idea, practice, or object that is perceived as new by an individual or the unit of adoption" (p. 12). Thus the innovation under consideration does not necessarily need to be a tangible object. It also does not need to be objectively new. Newness "may be expressed in terms of knowledge, persuasion, or a decision to adopt" (p. 12) over varying lengths of time depending upon the adopter. In addition certain characteristics of the innovation may influence or help explain the level and rate of adoption of the innovation. Such characteristics include

- relative advantage, or "the degree to which an innovation is perceived as better than the idea it supercedes",
- compatibility, or "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters",
- complexity, or "the degree to which an innovation is perceived as difficult to understand and use" ,
- trialability, or "the degree to which an innovation may be experimented with on a limited basis", and
- observability, or "the degree to which the results of an innovation are visible to others." (p. 15-16)

Communication channels, the second element of the diffusion process, are the means through which messages about the innovation are relayed to the individual (or other unit of adoption, such as a department in an organization). Diffusion is "a very social process that involves interpersonal communication relationship" (Rogers, 2003, p. 19). Diffusion can occur through mass media channels, such as radio, television, newspapers, or other print media;

through interpersonal channels, such as face-to-face consultations and group trainings; and through interactive channels, such as the Internet and videoconferencing (Rogers, 2003).

Time, the third element in diffusion, can be considered with regards to the innovation-decision process, the innovativness of the adopter, and the rate of adoption of the innovation. The innovation-decision process is the process through which an individual becomes familiar with an innovation, makes a decision about the innovation, and ultimately acts on this decision. Rogers (2003) conceptualizes five stages of the innovation-decision, which occur in a time-ordered sequence moving from one stage to the next sequentially. Rogers describes the stages in this manner.

> Knowledge is gained when an individual (or other decision-making unit) learns of the innovation's existence and gains some understanding of how it functions. Persuasion takes places when an individual forms a favorable or unfavorable attitude toward the innovation. Decision occurs when an individual engages in activities that lead to a choice to adopt or reject the innovation. Implementation takes places when an individual puts an innovation into use…. Confirmation occurs when an individual seeks reinforcement of an innovation-decision that has already been made, but he or she may reverse this previous decision if exposed to conflicting messages about the innovation. (p. 20)

The innovativeness of the adopter, which also is based on time, determines how early or late an individual adopts the innovation in relation to other adopters. Rogers (2003) identified five adopter categories. These categories in order of most innovative to least innovative, or earliest adopter to latest adopter, are innovators, early adopters, early majority, late majority, and laggards. Thus the measure of innovativeness is "based upon the relative time which an

innovation is adopted" (p.22); this is also known as the rate of adoption. More specifically, Rogers defined the rate of adoptions "as the relative speed with which an innovation is adopted by members of a social system" (p. 23).

Diffusion occurs within a social system. A social system is the fourth and final element of the diffusion process. According to Rogers (2003), a social system is "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (p. 24). Units in a social system (individuals, groups of people, or organizations) can be examined separately or in relation to one another. Social system structure may affect diffusion by facilitating or impeding the diffusion of innovations in a number of ways, such as by the norms and values held by units within a social system or by opinion leaders and change agents in a social system.

Since its first presentation in the 1940s, various research disciplines have conducted diffusion studies using the diffusion of innovations process framework described above. Among these disciplines are anthropology, sociology (including rural and public health/medical sociology), education, communication, marketing, and geography (Rogers, 2003). Rogers (2003) identified eight different types of diffusion research based on the dependent variables that were studied, including the following: (a) earliness of knowing about innovations, (b) rate of adoption of different innovations in a social system, (c) innovativeness, (d) opinion leadership, (e) diffusion networks, (f) rate of adoption in different social systems, (g) communication channel usage, and (h) consequences of innovation.

Overall, the greatest percentage of diffusion studies has focused on the innovativeness of members of a social system (Rogers, 2003). Table 3-3 presents the approximate percentage of each of these studies in the literature as well as types of independent variables and units of analysis for each type of study.

Table 3-3

Types and Occurrence of Diffusion Research

Type of Study / Main Dependent Variable	**Independent Variables**	**Units of Analysis**	**Approximate % of Type of Study in Publications**
Earliness of knowing about an innovation by members of a social system	Characteristics of members	Members of a social system (usually individuals)	5%
Rate of adoption of different innovations in a social system	Attributes of innovations	Innovations	1%
Innovativeness of members of a social system (the members may be individuals or organizations)	Characteristics of members: system-level variables	Members of a social system (usually individuals)	58%
Opinion leadership in diffusing innovations	Characteristics of members, system norms and other system variables, communication channel behavior	Members of a social system (usually individuals)	3%
Diffusion of networks	Patterns in the network links between two or more members of a system	Dyadic network links connecting pairs of individuals (or organizations) in a system	<1%
Rate of adoption of innovations in different social systems	System norms, characteristics of the social system, change agent variables, types of innovation decisions	Social systems	2%
Communication channel use (e.g., whether mass media or interpersonal)	Innovativeness and other characteristics of members of a social system, system norms, attributes of innovations	Members of systems (or the innovation-decision)	7%
Consequences of an innovation	Characteristics of members, the nature of the social system, the nature and use of the innovation	Members or social systems or innovations	<1%
Others	Various	Various	22%
Total	N/A	N/A	100%

Note. Adapted from *Diffusion of Innovations*, by E. M. Rogers, 2003, New York, NY: Free Press.

Diffusion of innovations research in agricultural sciences can be classified broadly into two categories: research on the diffusion and adoption of commercial innovations and research on the diffusion and adoption of environmental innovations. This distinction was not always the case, though. Until the late 1970s, traditional assumptions about the adoption of commercial innovations were extended to theories regarding the adoption of environmental innovations. Because the former are adopted typically in order to increase productivity and profit, commercial innovation adoption tends primarily to benefit the adopting farm, and thus is predicted to occur across the agricultural sectors. Therefore, in research on the adoption of commercial innovations, measures of rate of adoption tend to be of most interest. But because adoption of environmental innovations tends not to benefit farmers economically, an element of voluntarism needed to be introduced or considered in traditional adoption-diffusion models (Clearfield & Osgood, 1986; Miller, Mariola & Hansen, 2008).

In 1977, Pampel and van Es found that the traditional variables used in diffusion of innovations research, such as size of farm and farm income, explained higher proportions of variation in adoption of commercial innovations as opposed to environmental innovations. Pampel and van Es thus cautioned against the use of the commercial adoption-diffusion mode, which explained adoption based on the social and psychological variables of individual adopters, to predict the adoption of environmental innovations. They concluded that the structure of agriculture has changed so dramatically that voluntary adoption of environmental innovations is "a romantic concept divorced from the political and social realities of agriculture" (Clearfield & Osgood, 1986, p. 4).

According to Clearfield and Osgood (1986), the conclusions drawn by Pampel and van Es (1977) along with subsequent work have resulted in more separate distinctions of categories

of predictors of adoption of agricultural innovations, whether commercial or environmental. These categories include, for example, social-psychological variables (individual level characteristics of farmers and attitudinal variables related to individual level variables), attitudes related to farm structural variables, farm structural variables, and ecological variables. Yet despite theoretical advancement in the field, research on adoption-diffusion has waned since the early 1990s (Rogers, 2003). However, the global consolidation of the agricultural and food system and new advancements in agricultural and biological engineering have ignited a renewed need and interest in the role of diffusion of innovations theory and research in agricultural sciences (German, Mowo, & Kingamkono, 2006).

Social Behavior Change

Social marketing methods are frequently used as an effective behavior change approach for agricultural extension (Isoba, 1989; Snow & Benedict, 2003; Skelly, 2005; Monaghan, 2011). Some scholars trace back the idea that marketing could be adapted to promoting goods and services beyond those that profit corporations to G.D. Wiebe, a sociologist who in the 1950s "was concerned that marketing was not being applied to social problems," while others suggest that the social marketing movement did not really gain traction until the late 1960s and early 1970s when Kotler and Levy explored ideas for applying the ideas of marketing to social issues (Andreasen, 2003, p. 294). In 1971 Kotler and Levey coined the then new field of study as "social marketing" (Andreasen, 2003). One of the most cited early definitions of social marketing comes from Kotler (1975). According to Kotler, social marketing is "the design, implementation, and control of programs seeking to increase the acceptability of a social idea or practice in a target group(s)" (p. 283).

The emerging field of social marketing did not develop without challenges. Andreasen (2003) suggested that the field of social marketing went through an early identity crisis as practitioners struggled with confusion about how it differed from nonprofit marketing, socially responsible marketing, social advertising or education. According to Andreasen (2003) "it might be said that social marketing finally recognized its true nature in the 1990s when a number of leading scholars and practitioners came to the realization that its essence was not changing ideas but *changing behavior*" (Andreasen, 2003, p. 296). Andreasen's 1995 definition of social marketing reflects this realization:

> social marketing is the application of commercial marketing technologies to the analysis, planning, execution, and evaluation of programs designed to influence the voluntary behavior of target audiences in order to improve their personal welfare and that of the society of which they are a part. (p. 7)

Smith (2000) identified four characteristics that make social marketing different than commercial marketing. First, it is based on a philosophy of exchange, in which "both parties must receive something they want if the exchange is to be successful" (p. 12). Second, social marketing is a research approach defined by "its cyclical and iterative nature" (p. 14), such that social marketing research informs community and community informs social marketing research. Third, social marketing is characterized by positioning strategy. Citing Fine (1990), Smith (2000) stated that positioning strategy is "describing a product image and/or actions in relation to those of competing products" (p. 12). Positioning strategy essentially refers to the task of getting a consumer to see the benefit of an action and making the decision to enact the action being marketed, as opposed to engaging in other, competing activity. The final distinguishing characteristic identified by Smith is the way in which the concept of the traditional marketing

mix, also known as the 4 Ps, is applied. The 4 Ps are product, place, price and promotion. In social marketing, the product is the behavior change you are seeking to encourage (Weinreich, 2011). Place refers to "the system through which the 'products' flow" (p. 15) to individuals, whereby the products are new knowledge or skills on which the end user will act. Price "defines all the barriers that a person must overcome to accept the proposed social product" (p. 15). Such barriers include time, potential social status loss, effort, and giving up old habits (Weinrich, 2011; Smith, 2000). And promotion is the function of getting your message about the "product" to the target audience.

Despite trying to distinguish itself from commercial marketing, many of the concepts of social and commercial marketing remain similar. However, the main difference is that social marketing is not done for financial gain; the goal of social marketing is to change individual behavior for the benefit of the individual and society at large (Smith, 2000). According to Isoba (1986), "social marketing principles can be successful with the farmer" and therefore are relevant for consideration in this study (p. 66). One common social behavior change theory on which extension educators rely is the theory of planned behavior (Azjen, 2012).

Participatory Communication

Definitions of participatory communication are elusive and varied. Jacobson and Kolluri (2006) compiled these various descriptions of it:

> Diverse adjectives such as 'popular,' 'participatory,' 'indigenous,' 'self-governing,' and 'emancipatory' are all used to characterize it. Fuglesang and Chandler (1986, p. 62) argued that 'recognition of shared interests, accountability, and facilitating decision-making processes in a shared milieu of interests,

> constitute true communication and participation.' Ascroft's (1967) definition of participatory communication emphasized 'knowledge sharing and creating beneficiary comprehension of intentionalities…. According to Capriles (cited in Grinberg, 1986, p. 10), communication democratization is the 'conditio sine qua non of all possible democracies: the permanent dialogue, the spontaneous and relevant participation, never arbitrary or conditional, generating collective decisions and the socialization of production and its fruits. (p. 808)

Regardless of how participatory communication is defined, its essence implies two-way, or dialogical communication, in which voices of many stakeholders at various social structure levels are heard in a conscious attempt to level power structures in communities. Most practitioners and scholars agree that it originated in the field of international development in the 1970s and onwards when development practitioners and academics began to raise questions about how development policy is developed and who participates in decision-making processes (Tufte & Mefalopulos, 2009).

Early critique of communication for education approaches came from Latin America through the work of Paulo Freire on Brazilian adult education. He is most known for his articulation of transformative learning theory in which he used the term *conscientization* or consciousness raising (Freire, 1970). According to Gadotti (2001)

> Paulo Freire proposed a new conception of the teaching relationship. It is not a question of conceiving education as the transmission of contents only on the part of the educator. On the contrary, it is a question of establishing dialogue. This means that the person educating is also learning. (p. viii)

With an emphasis on dialogical communication, Freire's critical pedagogy approach liberates both the educator and the students from the constraints of what he identified as the "banking concept" of education by which education "becomes an act of depositing, in which the students are the depositories and the teacher is the depositor" (Freire, 2000, p. 72). Freire supported education in which both the "educator" and "student" are teachers; each learn from one another.

Likewise, in his examination of rural extension work (see Freire 1973), Freire also "emphasized the principles and fundamentals of promoting the practice of liberty" (Gerhardt, 2000, p. 7). Freire did not negate the value of an extension educator sharing new agricultural technology or skills. Rather, he argued against extension education in which experts try to codify the "natural, cultural and historical reality" of an agricultural community from which they are distanced and then dictate problem-solving strategies for that community (Goulet, 2005, p. ix). According to Freire, extension agents should adopt educational methods that foster dialogue and reciprocity.

Freire's work contributed to the understanding of the communication process "as an acting out of the abiding and mutually sustainable links between reflection and action" (Richards 2001, p.1). Through praxis, the interplay between action and reflection, Freire believed that individuals could construct their own meaning of the world, thereby changing it. Richards (2001) has suggested that this "nondualistic approach affirmed and enriched a variety of discourses of empowerment and led to a host of participatory communications projects" whereby many marginalized communities otherwise may have not had a voice for change" (p. 1).

This transformative learning process, whereby experiential learning and critical reflection plays a key role, also is reflected in the work of Mezirow. While Mezirow's work has been

clearly influence by Freire, Mezirow grounds his theory of adult learning in cognitive and developmental psychology (Dirkx, 1998). According to Mezirow (1997)

> Transformative learning is the process of effecting change in a *frame of reference*. Frames of reference are the structures of assumptions through which we understand our experiences. A frame of reference encompasses cognitive, conative, and emotional components, and is composed of two dimensions: *habits of mind* and a resulting *point of view*. (p. 5)

Mezirow (2000) suggests that transformative learning refers to the process of "transforming a problematic frame of reference to make it more dependable in our adult life" (p. 20). A frame of reference is more dependable if it is "inclusive, differentiating, permeable or open to other viewpoints, critically reflective of assumptions, emotionally capable of change, and integrative of experience" (p. 19). The more dependable a frame of reference is, the more likely it is that one is able to arrive at justified decisions - those based on balanced discursive and empirical assessments. This transformation happens through four processes: (1) elaborating an existing frame of reference, (2) establishing new frames of references, (3) transforming points of view, and (4) transforming habits of mind (Mezirow 2000; Mezirow 1997). Further, Mezirow argued that transformation often follows some variation of 10 phases that an individual goes through:

1. A disorienting dilemma
2. Self-examination with feelings of fear, anger, guilt, or shame
3. A critical assessment of assumptions
4. Recognition that one's discontent and the process of transformation are shared
5. Exploration of options for new roles, relationships, and actions
6. Planning a course of action

7. Acquiring knowledge and skills for implementing one's plans
8. Provisional trying of new roles
9. Building competence and self-confidence in the new roles and relationships
10. A reintegration into one's life on the basis of conditions dictated by one's new perspective (Mezirow, 2000).

Transformation can occur by being critically reflective of either the content and/or the process of problem solving, but we essentially change our point of view and therefore transform ourselves by "trying on another's point of view (Mezirow, 2000, p. 20).

Chapter 4

RESEARCH METHODS

In this chapter the research methods that guided this study are described. First the qualitative, multiple-case study methodological approach that was used to investigate the evaluative frame of reference of produce growers in Pennsylvania, United States and Sao Paulo, Brazil is presented. Then the procedures and techniques of data collection, which included personal interviews, documents and a survey, and an explanation of the data analysis process, are described. The chapter concludes with a discussion of research standards of quality and limitations of the study.

The Case Study Methodological Approach

The process of answering questions about social phenomena is scientific only to the extent that appropriate observations are made using appropriate research methods. Among the most basic, possible social research strategies are experiments, surveys, field research and the use of available data (Singleton & Straits, 2005). After careful consideration of each approach, a qualitative, multiple-case study methodological approach that primarily makes use of field research in the form of face-to-face interviews was chosen to guide this study.

A case study approach has several strengths for investigating how growers learn about and practice on-farm food safety. First, case studies are particularly appropriate for answering "how" and "why" questions that require descriptive explanations about current events. Singleton and Straits (2005, p. 309) suggested that a case study approach is "fruitful when one knows relatively little about the subject under investigation". The topic of on-farm food safety practices

is current; new legislation regarding the topic was passed recently in the United States (under the Food Safety Modernization Act) and GLOBALG.A.P. had its nascent beginnings just ten years ago. In addition, the previous chapter called attention to the lack of empirical research on the topic, thereby leaving for discussion many questions about how growers learn about and practice on-farm food safety.

According to Singleton and Straits (2005, p. 308), another strength of the case study is that case studies can provide an "insider's view of reality". Or what others call *verstehen,* McGuire (1998) called "methodological empathy." According to McGuire (1998), methodological empathy is

> trying to see things as [subjects] see them and use their categories of thought in the organization of experience…. It does not imply agreeing with a perspective but rather understanding it… The [researcher] does not accept the [subject's] taken-for-granted meanings as a given, but rather as an object of study. (p. 269)

Similarly Miles and Huberman (1994) posited that "qualitative studies have a quality of 'undeniability' [because] words, especially organized into incidents or stories, have a concrete, vivid, meaningful flavor" (p. 1). Policy makers, regulators, retailers and consumer groups have speculated about the precautions growers take to prevent food contamination and about how expanded food safety standards may affect growers' on-farm operations. Yet growers, the stakeholder group most directly impacted by these standards, have been provided few opportunities to have their perspectives documented through empirical research. Conducting case study research on this topic provides the growers' point of view – a view that for the most part is missing from discussions about on-farm food safety standards.

In addition a case study is useful for studying dynamic topics such as "when a situation is complex, involving interrelated phenomena that must be studied simultaneously and as a whole" (Singleton & Straits, 2005, p. 309). Yin (2003) suggested that the case study approach is particularly useful when "the boundaries between phenomenon and context are not clearly evident" (p. 13). This strength of the case study approach is notable, because it would be nearly impossible to separate a growers' frame of reference about how s/he perceives the risk of food contamination from the farm landscape. Moreover agriculture is highly context-dependent and agricultural practices on different farms vary based on numerous characteristics including, but not limited to, soil quality, precipitation amounts, irrigation sources, size of farm, variety of crops grown, on-farm infrastructure and grower management style. For example, food contamination risks posed by pond water on one farm may not be present on another farm where there is no pond. As a consequence, the phenomena of grower perception of food contamination risk, on-farm practices, farm landscape and pending food safety regulations must be studied as complex, interrelated parts of a whole.

Ultimately a case study approach is appropriate for studying this particular phenomenon. This research project can provide value in terms of informing and improving practice through rich, thick description of the various and diverse variables associated with learning about and practicing on-farm food safety in a given context, a relevant and under-examined topic. To actualize the goals of this research, the steps in the process of building theory from case study research that were outlined by Eisenhardt (2002) were followed (see Table 4-1). A review of these steps, beginning with case selection, follows.

Table 4-1

Process of Building Theory from Case Study Research

Step	Activity
1. Getting Started	• Definition of research question • Possibly a priori constructs • Neither theory nor hypotheses
2. Selecting Cases	• Specified population • Theoretical, not random, sampling
3. Crafting Instruments and Protocols	• Multiple data collection methods • Qualitative and quantitative data combine • Multiple investigtators
4. Entering the Field	• Overlap data collection and analysis, including field notes • Flexible and opportunistic data collection methods
5. Analyzing Data	• Within-case analysis • Cross-case pattern search using divergent techniques
6. Shaping Hypotheses	• Iterative tabulation of evidence for each construct • Replication, not sampling, logic across cases • Search evidence for "why" behind relationships
7. Enfolding Literature	• Comparison with conflicting literature • Comparison with similar literature
8. Reaching Closure	• Theoretical saturation when possible

Note. Adapted from "Building Theories from Case Study Research," by K. M. Eisenhardt in *The Qualitative Researcher's Companion (A. M. Huberman and M.B. Miles, Eds.),* 2002. Thousand Oaks, CA: Sage Publications, Inc.

Case Selection

According to Creswell (1998), "a case study is an exploration of a "bounded system" or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context" (p.60). Case studies can be either intrinsic, in that they are conducted because of the uniqueness of the research topic, or instrumental, in that they are used to illustrate an issue (Stake, 1995 as cited in Creswell, 1998). As Yin (2003) pointed out, a case may have multiple units of analysis so that subcases are embedded within the primary case. In this multiple-case study the cases are bound by the geographic area of a state. They are instrumental to illustrate how growers perceive the risk of foodborne contamination and learn to adapt their on-farm food safety management practices. Because the primary cases have multiple units of analysis (the growers) within the primary focus on the level of the state, the cases are embedded.

Sampling further bounds the collection of data. Of 16 possible strategies for sampling in qualitative research that Miles and Huberman (1994) outlined, a "maximum variation" sampling strategy was selected for this study. Using a "maximum variation" strategy, a researcher documents diverse and multiple experiences to identify important, common patterns. To examine global North-South differences with regards to on-farm food safety, the states of Sao Paulo, Brazil and Pennsylvania, United States were chosen as cases. These cases were chosen to provide theoretical replication – to predict "contrasting results but for predictable reasons" as opposed to literal replication – to predict "similar results" (Yin, 2003, p. 47). Replication logic should not be confused with sampling logic; the former refers to statistical procedures to

enumerate a sample from an entire population, while the latter is "analogous to that used in multiple experiments" (Yin, 2003, p. 47).

Specifically these cases were chosen to explore the significance of how geographical context impacts growers' evaluative frame of reference. Similarities and differences of these cases in terms of climate classification, diversity of crops grown, population, etc. are presented in Table 4-2. Various types of data were collected and analyzed for each case and a diversity of growers was selected for interviews in each case. Data collection procedures and techniques are described in the next section.

Table 4-2

Case Characteristics

	Pennsylvania Case	**Sao Paulo Case**
Köppen–Geiger Climate Classification	Humid Continental[1]	Humid subtropical[1]
Plant Hardiness Zone	5-6[2]	10[2]
% GDP Agriculture	< 1% (2004)[3]	1.4% (2008)[6]
Top 5 Produce Crops	Corn, Apples, Peaches, Potatoes, Tomatoes (2009)[4]	Oranges, Tomato, Potato, Beans, Banana (2009)[7]
Average Farm Size	124 acres (2007)[4]	63 acres (2007-08)[7]
Population of State	12, 604, 767 (2009)[5]	41,262,199 (2008)[6]
Population Density of State	274 per square mile (2000)[5]	431 per square mile (2008)[6]
Major Urban Centers (Population > 1 million)	Philadelphia and Pittsburgh[5]	Sao Paulo and Campinas[6]

Notes. [1]Peel, Finlayson, & McMahon (2007), [2]Magarey, Borchert & Schlegel (2008), [3]U.S. Department of Commerce, Bureau of Economic Analysis (2005), [4]U.S. Department of Agriculture, Economic Research Service (2010), [5]U.S. Census Bureau (2010), [6]Brazilian Institute of Geography and Statistics (IBGE), [7]Sao Paulo State Secretariat of Agriculture and Supply (n.d.)

Data Collection Procedures and Techniques

One of the major strengths of employing a case study approach is the opportunity it provides to use different sources of data, a process also known as data triangulation. Using multiple sources of evidence allows a researcher to develop "converging lines of inquiry", thereby increasing the credibility of the study findings by increasing construct validity (Yin, 2003). In this study three types of data were collected and analyzed: personal interviews, document review and survey data. Prior to any data collection or fieldwork, this research project was approved by the Institutional Review Board at The Pennsylvania State University (IRB Approval #30176).

Interviews

The primary source of data for the case studies is that which was collected through semi-structured, in-depth, face-to-face interviews with produce growers in Pennsylvania and Sao Paulo during Fall 2009 and Winter 2010. An interview guide was created following the format identified by Denzin (1970) in which "certain types of information are desired from all respondents but the particular phrasing of questions and their order are redefined to fit the characteristics of each respondent [and] formulated in words familiar to those interviewed" (p. 105). Thus a deliberate attempt was made to ensure that similar question topics were addressed in each interview so that comparisons could be made among responses. Yet questions were modified as needed to account for specific characteristics of the grower being interviewed, as well as particular characteristics of the grower's farm. For discussion the questions were

organized around three general topics: grower background and farm profile, agriculture and food system context, and food safety knowledge and practices (see Appendix A).

Growers interviewed in Pennsylvania participated in the *Farm Food Safety (GAP) Training* offered by food safety specialists from Penn State Cooperative Extension held in Pennsylvania in March 2009. Participants provided their contact information as potential volunteers for the interviews. Growers interviewed in Sao Paulo are participants of price index surveys that are conducted by the Center for Advanced Studies on Applied Economics (CEPEA). All growers were selected to represent the diversity of growers in each state based on farm size, types of produce crops grown, and to whom the growers sell their product. Access to the growers in Sao Paulo was facilitated by staff members of CEPEA. Before conducting each interview, an informed consent form assuring anonymity and confidentiality was reviewed and participants were provided with the option of having the interview recorded to assure a more accurate relaying of their perspectives.

Interviews were conducted until theoretical saturation - the point in data collection and analysis when no new conceptual insights are generated - was reached (Strauss, 1987). In total, 30 interviews were conducted with 31 growers. Of these interviews, 14 took place in Pennsylvania 16 of these interviews took place in Sao Paulo with 17 growers. One interview in the Sao Paulo case was conducted with two farmers, who jointly owned one farm. Most interviews took place at farms that self-identified as small/medium-sized. Refer to Table 4-3 for characteristics of the farms of the growers who participated in the interviews.

Table 4-3

Farm Characteristics

	Pennsylvania Case	Sao Paulo Case
Farm Size		
Small/Medium	13	13
Large	1	3
Produce Crop(s)		
Single Produce Crop Grown	1	8
Multiple Produce Crops Grown	13	8
Sell to Whom		
Grocery Stores / Retail	12	8
Wholesaler / Middle Man / Distributor	5	9
Direct Market	11	2
Processors / Industry	0	3
Total Farms	n = 14	n = 16

In Pennsylvania, 12 of the 16 interviews were conducted at the farm of the respondent; two of the interviews in Pennsylvania were conducted at the Mid-Atlantic Fruit and Vegetable Growers Conference. In Sao Paulo, all of the interviews were conducted at the farm of the respondent. Interviews lasted for an average of 50 minutes; individual interviews ranged from 30 to 100 minutes in length. The interviews, except for one in the Pennsylvania case, were recorded using a digital recording device and then transcribed. The interviews from the Sao Paulo case were transcribed first in Portuguese by CEPEA-affiliated researchers who speak native-Portuguese. The Portuguese transcriptions were translated into English using an Internet-based translation tool. These translations then were reviewed and edited by CEPEA-affiliated researchers who speak fluent English as a second language. For the interview in the

Pennsylvania case that was not recorded, hand-written notes were taken and then typed for the interview. This interview was not recorded for reasons associated with the Amish heritage of the respondent.

Document Review

Prior to, during, and after fieldwork, an extensive review of policy papers, economic data, fact sheets, training materials and the like – all of which were related to on-farm food safety and the viability of agriculture in each case – was conducted. These sources provided rich background information regarding the context in which the cases are situated and supplemented the data collected through the interviews. Table 4.4 provides an overview of the types documents that were reviewed for the purpose of this study.

Table 4-4

Select Examples of Document Reviewed

Document Title and Year Published	**Publishing Author or Organization**	**Type of Document**
Towards Good Social Practices in Agriculture (2007 and 2010)	GLOBALGAP	Project Report
Generic Manual on Quality Management Systems for Smallholder Horticultural Farmer Groups (2006)	GLOBALGAP	Training Materials
Smallholder Guide for GLOBALGAP – Hygiene Module (2010)	GLOBALGAP	Training Materials
Comparative study on the GLOBALGAP Fruit and Vegetables Standard and the EU Organic Agriculture Regulation (2009)	Prepared by Mattson, E. and Grolink, A.B.; commissioned by the UNCTAD secretariat	Discussion Paper
Fresh Insights - A series of technical working papers (2008)	IFID and IIED "Small-scale Producer and Standards in Agrifood Supply Chains Project"	Discussion Paper
Guidelines for Good Agricultural Production Practices Brazil (2002)	Emprapa	Training Materials
FAO Key Documents & FAO Training Materials on GAP (Various documents available at http://www.fao.org/prods/GAP/index_en.htm)	FAO	Discussion Paper & Training Materials
Stakeholders' Discussion Series / Growers' Comments for FDA (2010)	The Produce Safety Project at Georgetown University	Discussion Paper & Public Comments
PASA Comments for FDA Produce Rule Listening Session (2010)	PASA - Pennsylvania Assoc. for Sustainable Agriculture	Public Comments
Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables (1998)	FDA	Training Materials

Note. Complete citations for references can be found at the end of this document in the section *References.*

Survey (Pennsylvania Case)

During the *Farm Food Safety (GAP) Training* offered by food safety specialists from Penn State Cooperative Extension held at various locations across Pennsylvania in March 2009, grower participants were asked to participate in a survey prior to the start of the training; 227 participants completed the survey. Analysis of the survey provided additional contextual information to inform the development of the Pennsylvania case. In order to keep the case study parameters comparable, select findings from the survey analysis are presented only in the appendices and not as part of the main narrative (see Appendix B).

Data Analysis

According to Creswell (1998), the qualitative data analysis process is "best represented in a spiral image" and illustrates how "the researcher engages in the process of moving in analytic circles rather than using a fixed linear approach" (p. 142). Qualitative data analysis is an iterative process that requires the researcher to move from reading to describing, classifying, and interpreting to conclusion drawing and back again to reading and so on (Creswell, 1998; Miles & Huberman, 1994).

The primary source of data (the interviews) was analyzed using the constant comparative method approach promulgated by Glaser and Strauss (1967). According to Glaser and Strauss (1967), "the purpose of the constant comparative method of joint coding and analysis is to generate theory more systematically […], *by using explicit coding and analytic procedures*" (p.

102). Such an approach counters criticism that no scientific method underlies qualitative research. This approach provides skilled researchers with the "vagueness and flexibility that aid the creative generation of theory" (Glaser & Strauss, 1967, p. 103).

Using this approach, the researcher works through four stages. The first step is to code the data "into as many categories of analysis as possible" (p. 105). While coding the data, the researcher continually compares new codes with previous codes. This constant comparison of the codes allows the researcher to generate and integrate categories. After making theoretical sense of the data by grouping the codes into categories, the researcher then moves onto stage three, delimiting the theory. At this stage, the researcher strives "to achieve two major requirements of theory: (1) *parsimony* and formulation of variables, and (2) *scope* in the applicability of the theory to a wide range of situations, while keeping a close correspondence of theory and data" (p. 110-11).

Unlike deductive approaches that seek probable truth, inductive approaches, such as the constant comparative method of analysis, are inherently uncertain. According to Glaser (2008) "the constant comparative method is concerned with generating and plausibly suggesting (but not provisionally testing) many categories, properties, and hypotheses about general problems." Because the constant comparative method employs an approach of "joint coding and analysis," categories and codes are presented in Chapter Five with the presentation of results. Further, the absence of numerical data is deliberate. Maxwell (2010) cautions that the use of numbers in qualitative research can "slight the specific context with which a conclusion is drawn" (p. 479), can impose "a variance theory mental model on your research [that] undercuts the main strengths of qualitative research," and introduces a "danger of reducing evidence to the

amount of evidence (p. 480). Alternatively, verbal counting – to "imply numbers without actually giving any" – was used (Sandelowski, 2001, p. 236). Examples of verbal counts include *a few*, *some*, *many*, *most*, *sometimes*, *rare*, etc. (Sandelowski, 2001). Because of this inherent uncertainty and decision to not report counts, analysis was checked against suggested verification processes that are reviewed in the next section.

Research Standards and Verification

Because objectivity or "observation that is free from emotion, conjecture, or personal bias" is "rarely, if ever, possible" in any research project (Singleton & Straits, 2005, p.30), considering criteria for standards of quality and verification in qualitative research projects is important. In an effort to be transparent about the process through which this study was conducted, standards of quality to which I adhered, as well as the verification procedures that I followed, are reviewed.

Research Standards

The development of standards of quality in qualitative research has tended to evolve distinctly among two groups of scholars: those that "distinguish among research methods on one hand and epistemologies on the other" (Howe & Eisenhardt, 1990, p. 2). Among the scholars who have proposed new criteria for judging qualitative research are Howe and Eisenhardt, who assume a "staunchly anti-or nonpositivist" position (Howe & Eisenhardt, 1990, p. 6), and Lincoln, "who thinks about the quality issue in terms of *emerging* criteria" (Creswell, 1998, p.

195). Howe and Eisenhardt (1990) suggested five standards of quality be considered. These standards include (a) the fit between research questions and data collection and analysis techniques, (b) the competent application of data collection and analysis techniques, (c) the acknowledgement of a researcher's background and assumptions, (d) whether a study has overall warrant, or paying attention to and going beyond the first three items, and (e) the extent to which a study has value in terms of informing and improving practice. Lincoln (1995 as cited in Creswell, 1998) identified eight criteria that focus on the inquiry community, positionality, community, giving voice to research participants, critical subjectivity, reciprocity between the researcher and research participants, respect of others involved in the project, and sharing privileges or results of the research. Briefly, the adherence to these standards of research quality is reviewed.

Fit between research question and data collection and analysis and the competent application of the selected data collection and analysis techniques. Howe and Eisenhardt (1990) argue that "research questions should drive data collection techniques and analysis rather than vice versa" (p. 6). This standard was adhered to by reviewing the strengths of a case study research approach and weighing this approach against others to determine the most appropriate to answer the identified research questions. A multiple case study approach provides a framework through which how questions can be answered and therefore can be useful in providing descriptive detail about on-farm food safety standards within diverse geographical contexts.

Researcher reflexivity and positionality. Lincoln (1995) stated that, "Positionality, or standpoint epistemology, recognizes the poststructural, postmodern argument that texts, any texts

are always partial and incomplete; socially, culturally, historically, racially, and sexually located" (p. 280). To account for researcher biases regarding the issue of on-farm food safety standards, the a sample of interview responses were reviewed by colleagues, who considered how different stakeholders would interpret the data and whether those interpretations would be the same or different than the original interpretation. Memos about possible differences were included in the data analysis and were used in the process of categorizing data.

Overall warrant. According to Howe and Eisenhardt (1990) "the most warranted conclusions of which we are capable at any given point in time are those that are drawn after robust and respected theoretical explanations have been tentatively applied to the data – what Denzin (1989) and Shulman (1988) call "triangulation by theory"" (p. 7). As described in the previous section, this research project makes use of various sources of data. Thus this research project has warrant pursuant to the standards of Howe and Eisenhardt.

Community and giving voice to research participants. Lincoln (1995) proposed that the quality of qualitative research can be measured to the extent that the research "serves the purposes of the community in which it was carried out, rather than simply serving the community of knowledge producers and policymakers" (p. 280). She also suggests that "the extent to which alternative voices are heard is a criterion by which we can judge the openness, engagement, and problematic nature of any text" (p. 283). To meet these standards of quality, interviews were chosen as the primary source of data in this research project and direct quotes by the growers were used in the analysis to give the growers voice.

Sharing privileges. Lincoln discusses sharing privileges mainly to the extent that researchers contribute financial gains accrued as a result of the research project to the research

participants. However the results of this research project will be shared with participants, as well as other growers, in the form of outreach and improved on-farm food safety training materials.

Research Verification

In his exploration of perspectives regarding verification in qualitative research, Creswell (1998) presents eight verification procedures that are often discussed. These verification procedures include

- prolonged engagement and persistent observation in the field,
- triangulation,
- peer review or debriefing,
- negative case analysis,
- clarifying researcher bias,
- member checks,
- rich, thick description, and
- external audits.

Creswell (1998) recommends that researchers engage in at least two of these procedures in any particular research study. In this study the following verification procedures were used: triangulation, peer review, the clarification of researcher bias and rich, thick description. As previously mentioned, triangulation is the use of multiple sources of evidence to increase construct validity (Yin, 2003). The multiple sources of data that were used in this study include interviews, documents, and survey data. This research also was held to peer review by

dissertation committee members. Research bias was considered through the process of reflexivity and as described above. And rich, thick description, particularly in terms of including grower quotes, was used to describe the findings. Yet, despite conscientious attempts to ensure standards of quality and verification for this research study, there are limitations of this study.

Limitations of the Study

Before concluding this chapter, several limitations of this study need to be acknowledged. Some of these limitations pertain to case study research in general, while others are specific to this study. Among the weaknesses associated with case study research in general are that they are labor intensive, cost prohibitive and not very apt for "enumerating the distribution of certain demographic characteristics within a certain population" (Singleton & Straits, 2005, p.) Also because they are descriptive in nature, they are not suitable for testing hypotheses or for drawing cause and effect conclusions. A final limitation of case study research concerns external validity, the extent to which the findings are generalizable beyond the case(s) being studied (Yin, 2003).

This study was restricted by the amount of labor required and costs associated with traveling to produce farms to spend time interviewing producer growers at their sites of production both in Pennsylvania and Sao Paulo. However interviews were conducted until common themes within the data began to emerge. But because only 31 interviews were conducted, it was not possible to conduct statistical analysis on demographic and other characteristics, as well as cause and effect hypothesis-testing.

Scholars like Mitchell (1983) and Small (2009) argue, though, that the value of such research is that it is hypothesis generating. Smith (2009) suggests that a strength of qualitative research studies with small samples is dependent upon having "a set of cases with particular characteristics that, rather than being 'controlled away', should be understood, developed, and incorporated into [the] understanding of the cases at hand (p.14), while Mitchell (1983) makes a distinction between statistical and logical inference and suggests that statistical inference is not appropriate for the study of "an idiosyncratic combination of elements or events which constitute a 'case'" (1983, p. 188). According to Mitchell (1983), "a well executed single-case study can justifiably state that a particular process, phenomenon, mechanism, tendency, type, relationship, dynamic, or practice exists" (p. 23). In particular, one contribution that case study research offers is the production of ontological statements regarding the discovery of social phenomena previously not known to exist (Small, 2009).

Also these studies were conducted in two particular places at particular points in time, thereby limiting their generalizability. In order to test generalizability, Yin (2003) recommended that findings be replicated two or more times. Even though the research design employed in this study allows for repeat studies to be conducted, additional studies conducted in different places at different times might uncover different themes. Such differences would likely be due to the rapidly changing nature of the global market for fruits and vegetables and changes in food safety standards and regulation, as well as changes in human subjectivity and perceptions over time. According to Yin (2003), case study findings, even those from replicated studies, can only "be accepted as providing strong support for the theory" (p. 37).

Despite these limitations, the final result of a case study is a "richly detailed description of a segment of the social world" (Singleton & Straits, 2005, p. 308). Scholars like Mitchell (1983) and Small (2009) argue that the value of such research is that it is hypothesis generating. Small (2009) suggests that a strength of qualitative research studies with small samples is dependent upon having "a set of cases with particular characteristics that, rather than being 'controlled away', should be understood, developed, and incorporated into [the] understanding of the cases at hand (p.14), while Mitchell (1983) makes a distinction between statistical and logical inference and suggests that statistical inference is not appropriate for the study of "an idiosyncratic combination of elements or events which constitute a 'case'" (1983, p. 188). According to Mitchell (1983), "a well-executed single-case study can justifiably state that a particular process, phenomenon, mechanism, tendency, type, relationship, dynamic, or practice exists" (p. 23). In particular, one contribution that case study research offers is the production of ontological statements regarding the discovery of social phenomena previously not known to exist (Small, 2009). The value of informing and improving practice through rich, think description of the various and diverse variables associated with learning about and practicing on-farm food safety in a given context makes the case study approach appropriate. In this chapter the process of inquiry for this research was reviewed. In Chapter 5 the product of the inquiry is presented.

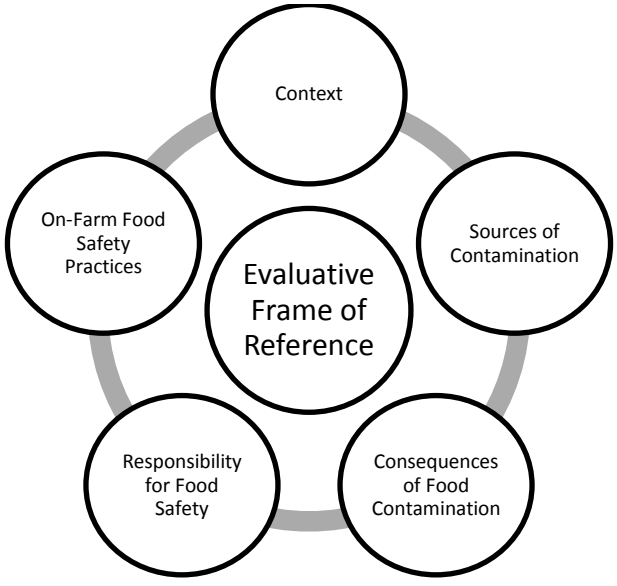
Chapter 5

CASE STUDIES

Qualitative analysis of the interviews for each case revealed the emergence of five categories that influence a grower's frame of reference with regards to decision making about on-farm food safety. On-farm food safety practices are shaped by a farmer's perception of *contextual factors*, how the geophysical and biological aspects of a grower's farm may or may not serve as *possible sources of contamination* for food foodborne illness, the perceived *consequences* that would ensue if a foodborne illness were traced back to the grower's farm, ideas about his or her current *on-farm food safety practices*, and who is *responsible for food safety*.

Figure 5-1

On-Farm food Safety Evaluative Frame of Reference Categories



In addition to revealing what variables influence a grower's decision making process about on-farm food safety practices, analysis also revealed themes associated with learning about on-farm food safety in each of the case contexts. Accordingly, a description of these themes, one that relies on the voice of the grower, and that is consistent with developing communicative education programs is presented for each case.

Pennsylvania Case

> *This whole buy local, buy fresh thing has really stirred some people. They realize that by buying food closer to home, they see the person producing it and they see where it is produced and there is a lot more consumer confidence in local food…. So, if Giant says you have to be GAP certified, we would consider just increasing our sales by starting a CSA. You get an article or two published in the newspaper about your CSA and you are off the hook. People want to buy into the farm.*

Increasing consumer concerns about food safety and a resurgence of interest in the local food system have sharpened a double-edged sword for produce growers in Pennsylvania. On one side, retailers and government have been mandating that produce growers abide by stricter food safety standards, generically known as good agricultural practices (GAPs). These mandates often are accompanied by requirements that growers pass third-party certification audits documenting a grower's adherence to GAPs. On the other side, renewed interest in local food systems also means that growers see the potential to forego these audits and invest their resources in developing enhanced direct marketing initiatives, such as community supported

agriculture (CSA) programs[4]. However, regardless of whether a grower decides to sell produce to a grocery store or to sell via direct market initiatives, a closer examination of how growers make decisions about on-farm food safety is warranted so that appropriate food safety educational programs can be developed for all growers.

Case Overview

Analysis of grower comments revealed easily discernible themes. Growers in Pennsylvania evaluate food safety risks on their farm by considering pathogenic risks, perceive the consequences of food contamination to be devastating financially and socially, and take pride in their practiced or local knowledge. Pennsylvania growers also indicate that the multiplying effects of media reporting on foodborne illness outbreaks and the increasing distance between producers and consumers provide context for changes in the regulation of on-farm food safety. As well, they believe that the responsibility for food safety should be shared by growers, processors, retailers, and consumers. Because farming is their livelihood, Pennsylvania growers staunchly expressed their commitment to protecting their livelihood by ensuring the safety of

[4] In the United States, the Tester Amendment of the Food Safety Modernization Act exempts growers who do not sell more than $500,000 in gross sales and those who primarily engage in direct market sales from new on-farm food safety standards. If retailers continue to require growers to pass a third-party certification food safety audit, then some growers might choose to forego selling their produce to grocery stores and increase their direct marketing sales initiatives instead.

their produce. However, Pennsylvania growers do not think that consumers take enough responsibility in practicing safe food handling. The key themes identified in Pennsylvania growers' evaluation of on-farm food safety are summarized in Table 5-1 and discussed in more detail below.

Table 5-1

Key Themes in Pennsylvania Growers' Evaluation of On-Farm Food Safety Risk

Categories	Codes
Contextual Factors	• Increasing distance between growers and consumers • Negative effects of media
Possible Sources of Contamination	• Poor hygiene and sanitation practices • Contaminated water sources
Consequences of Contamination	• Financial and social devastation
Responsibility for Food Safety	• Shared responsibility with need for more consumer education
On-Farm Food Safety Practices	• Reliance on experiential or local knowledge • Prefer to learn through Cooperative Extension

Contextual Factors

Growers were asked to discuss the reasons that food safety has become such an important topic. The two ideas that they cited most are 1) an increasing distance between growers and consumers and 2) negative effects of media.

Increasing distance between growers and consumers. According to the National Sustainable Agriculture Information Service (n.d.), produce travels an average of 1,300-2,000

miles from farm to consumer in the U.S. While the produce of most Pennsylvania growers does not travel this far, Pennsylvania growers think that the general pattern of the increasing distance between growers and consumers has contributed to increased consumer concern about food safety. Growers noted several issues that they perceive to be associated with this increasing distance. The first issue is the lack of influence over safety at large, concentrated food packing and distribution centers.

> I think the shipping of our produce and the value added part of our produce, in my mind, are the worst contributors. If there is a little bit of bacteria on your lettuce and that lettuce is put it in a plastic bag to be shipped across the country, well, that's the perfect environment for food contamination risks to increase and be more of an issue. I think the very fact that a problem on one large farm affects the whole country in one way or another is a problem. I mean look at the way shipping is, particularly in the off season when there is no local stuff. But, I really don't think anything has changed in local produce. We know the people we are selling to and we can keep things under control a little better, because we're not on such a big scale. I am sure there are growers in California or Mexico that are in charge of things and may never see the field. They have the workers out there working and other managers under them and just don't have the handle on things the way we do locally. Their risk is greater because they affect more people. Our things can get contaminated the same way theirs can when you look at it scientifically, but we don't affect as near as many people.

However, as this quote illustrates, growers often exempted themselves from this problem because farms in Pennsylvania tend to be much smaller than the national average farm size and most growers in Pennsylvania do not sell their produce beyond local or regional food networks.

Growers mentioned another issue associated with the increasing distance in the food system: consumer concern about the use of agricultural chemicals, such as herbicides, fungicides and pesticides, particularly in relation to imported fruits and vegetables. One grower commented:

> First of all, when fruit and vegetables come from outside the country, you don't know what has been used on it. They don't have the same rules and regulations, so you don't want something from another country. You want something that has some standards to how it was raised or grown.

While highlighting how the increasing distancing between producer and consumer contributes to increasing consumer concern about food safety, these grower comments also illuminate the paradoxical context surrounding increased food safety standardization. Concerned about food safety as a result of a complex agrifood system, consumers began purchasing more local produce and began campaigning for increased food safety standards. As a result, food safety standards potentially pose new challenges for the local growers to which the consumers turn for safe produce.

***Negative effect of media*.** Even though the Centers for Disease Control and Prevention (CDC) report that the greatest percentage of media coverage portrayals about foodborne illness outbreaks are accurate and favorable towards CDC and public health responses (CDC, 2011a), growers believe the impact that such coverage has on consumer perceptions of food safety is not favorable for them. Nearly all of the growers in the Pennsylvania case talked about the role that

the media coverage of foodborne illness outbreaks plays in influencing the political and social context of food safety, as well as the growers' own sales. One grower commented that

> The media talks about it a lot. And I can't say for sure, but I think food illnesses have been around forever. But now the media are so concentrated on it; every time there is an outbreak the media is on it. They focus a lot more attention on it. So now people want to know where there food comes from and who grew it and how they grew it. So that's why there is a lot more interest as far as the consumer side of it.

Other growers described how the multiplying effects of media can impact growers who were not even involved in a particular foodborne illness contamination incident:

> For example, say you have a problem with peppers. Even with the assurance of traceability, if the newspapers find out that somebody gets sick and they start asking questions, which they do. If it involves a recall or something, then they say what did you eat? They start with restaurants and then the supermarkets and all of this sort of stuff and the issue gets lost in the maze. So all of a sudden you have a recall of all of the peppers around…and they make all the customers gun shy about buying peppers. And then it just rolls down the hill and I don't know how you handle it. I really don't.

This multiplying effect most likely can be attributed to evidence that indicates media coverage of food safety issues most often covers multistate foodborne illness outbreaks (CDC, 2011). However, like another grower suggested, new forms of social media that enable fast and widespread communication also may contribute to the multiplying effect of media: "I'm more worried about the media. If 'Joe's Produce Far'

sickens 20 people who got deathly ill and that gets on the news and starts bouncing around on Facebook, then it would affect our business too."

Perceived Sources of Contamination

Growers were asked to talk about possible sources of produce contamination on their farm. They also were asked to discuss on which practices they think growers should focus to prevent contamination. Responses to both questions were similar and overlapped. The greatest dangers for foodborne contamination that growers cited were 1) poor hygiene and sanitation practices and 2) unsafe sources of water sources used for irrigation. Of these sources of food contamination, growers believed that they are better able to manage and prevent contamination from poor worker health and hygiene and sanitation practices and less able to manage and prevent contamination from potentially unsafe water sources.

Poor hygiene and sanitation practices. Growers often used the phrase "common sense" during their interviews and mostly in relation to worker health and hygiene practices, such as hand washing. One grower's perspective is presented here:

> I think so much of it is common sense. Of course, not everybody has that. I see a big difference between what my dad would deem acceptable and what I would deem acceptable, but most of that is because of the educational process. I did learn a few things over the years -- learned a few things at school, learned some things at seminars. But so much is just common sense things. Like hygiene - I think you eliminate a huge percent of potential problems if you follow common sense hygiene practices. Just keep things relatively clean…. That's the key thing –

> overall sanitation of your operation. Keep your contact surfaces clean, wash your hands, so on and so forth.

Another grower related a story about how consumers can gauge the cleanliness, and therefore food safety practices of a farm, by just "looking around":

> The key is common sense cleanliness - cleanliness straight across the board. You know the surroundings around your buildings, the property in general, the people who are doing your work, the containers you are putting your stuff in, and the equipment you are using. My dad had a way of explaining things. He said years ago the state of Pennsylvania had numerous farm tours. The vegetable and fruit growers had farm tours of one another's farms at different times. And he said all you have to do is look around and see what the appearance of the farm is like and that can explain how they produce the product. So cleanliness is the cornerstone of food safety.

Growers, however, tended to think differently about how to address this risk on their farm. Growers who only hire their own family members and those who hire only seasonal, part-time employees from their immediate community did not believe it was necessary to take special precautions beyond common sense approaches to prevent possible food contamination from poor worker health and hygiene practices. For example, one grower said this:

> My husband I are co-operators. It is just he and I and we have the direct contact with whoever is working with us whether it is the kids working or his Dad. So you know, I can't see there would be an actual problem [with hygienic practices]. They know not to go to the bathroom in the fields and to wash their hands. They know all the basic stuff. Did you see the signs [depicting how to dispose of toilet

tissue]? My customers would die if I put those signs up. They would start to think something was wrong. It would scare them more than anything.

On the other hand, growers who employ a greater number of employees, and particularly those who employ seasonal, migrant labor, commented on the usefulness of educational materials that depict safe worker health and hygiene practices. One grower offered this advice based on his own experience:

> Talk to your harvesters, especially if they are from a third world country, because they have a different culture than what we do. They do things that is normal for them but is a high risk for us…. I got the posters[5] to place in the bathrooms because that was a big problem and it is embarrassing to talk to these guys about it and so that was a huge help to have those poster. If you don't have the problem you think, "What the hell is wrong with [other growers]?" Why would they have a poster like that?" But even this year I had to talk to them about it. I think they forget so that is helpful…. A picture is worth a thousand words and they were nice, laminated posters that you could hang up…. That kind of stuff I am in favor of.

Contaminated water sources. While growers were likely to believe that they can manage worker health and hygiene practices either through common sense practices or by educating their employees, they were less likely to believe that they had control over managing the risk of food

[5] The posters to which the growers refer were distributed to growers who attended the Penn State Extension On-Farm Food Safety training. The posters depict images of how to properly dispose of used toilet tissue.

contamination from unsafe sources of water used for irrigation. Furthermore, despite being one of the top sources of possible food contamination that growers mentioned, growers seemed less inclined to believe that any of their own produce actually could become contaminated as a result of unsafe water sources. The primary reason for this belief is that none of the interviewed growers had any previous instances of contamination caused by unsafe water sources. Most farmers had been relying for years on the same sources of water for irrigation; therefore, they could not imagine that their water source could pose any danger in the future if it had not already posed any danger. Other reasons that growers seemed less inclined to believe that any of their own produce could become contaminated as a result of unsafe water sources included the perception that the types of produce that are being grown in Pennsylvania tend to not be high risk[6] and that a lack of clear empirically-based standards for safe irrigation methods exist. One grower indicated that the "highest risk" he has is "drip irrigation out of the river." He went on to say:

> But this risk isn't great because of the things I am raising. Like sweet corn, you don't eat the husks. And cantaloupes, well they have a little bit higher risk, but I wash them. It would be good to have your water tested in your own well, but I don't' know, I'm not a scientist so really don't know what the chances are that the

[6]A survey of Pennsylvania growers indicates otherwise. In a survey of Pennsylvania growers attending an on-farm food safety extension education program, the most cited produce grown by Pennsylvana growers was tomatoes. Outbreak surveillance data for 2000-2009 compiled by the Centers for Disease Control indicates that tomatoes were the second most common produce item associated with foodborne disease (leafy greens were the most common item).

> water is contaminated but I would think the chances are pretty slim. If I am drinking that water and doing it for years, then why do I need to test my water at the beginning of the season and the end of the season and during the season, especially if I am just washing a cantaloupe that somebody isn't eating the rind to begin with anyway. Now, if I was preparing fresh salad for people to eat and I was washing the salad, then that is a whole different thing. I think we are at the bottom of the safety thing. It's not that we don't have an important part in it, but I don't think we're at the part where you could really make someone sick.

In addition to highlighting perceptions regarding water as a possible source of contamination, this quote also illustrates another phenomenon revealed through the grower interviews. Consistent with previous risk perception research, growers were more likely to downplay natural risks, such as possible water contamination, than manmade risks, such as not washing your hands.

Consequences of Contamination

Growers were asked to talk about their perceptions of the consequences of a foodborne illness being traced back to their farms. All of the growers indicated that if foodborne illness were traced back to their farm, such an occurrence would be financially and socially devastating. However, growers also believed that if such a crisis should occur, then it potentially could be buffered by the security that their liability insurance policy provides.

***Financial and social devastation*.** Growers believe that the potential consequences of a foodborne illness being traced back to their farm would be financially and socially devastating,

primarily as a result of how the media would portray such an event. Growers discussed how the media coverage of a potential foodborne illness traced back to their farm would result in decreased or no sales and therefore could destroy their farming operation as a business.

> We would be out of business because of the type of media onslaught that there would be, regardless of how insignificant or how great the problem. Even if it were just one specific thing with a problem, there won't be anything sellable from our property, because everything would be subject to scrutiny. If that one thing is no good, then people believe that everything is probably no good and that is an unfortunate thing. It's just like with the peanut crisis. Just because of one plant, all peanut products regardless of where, when, or how the products were made were stopped from being sold. It didn't just stop at that plant. Unfortunately that is how media makes it.

In addition, growers believe that negative media coverage of a foodborne illness associated with their farm would cause social devastation by ruining their reputation. One grower said

> I think it would be devastating. I really do, especially with us. We do a lot of retail and you know how that if you are convicted in the paper. If they come out and say "Joe's Produce Farm" got somebody sick and they are in the hospital…that would kill your business instantly. And it would take you years, no matter what you said or did, to ever rebuild your reputation. Although, I don't know that you could ever rebuild your reputation. You seen that last year with tomatoes or something somewhere. It shut down the whole tomato industry and it kills all those guys. After the spinach thing, they said fresh spinach usage in this country has never come back. It would be devastating no doubt and it's scary.

And another grower made this comment:" It could wipe me out real quick. I have some pretty good liability policies but in today's dollar figures you could be done and it could wipe you out and not just the business – your reputation, too." However, a few growers felt confident that their liability insurance policy could provide adequate compensation if such a crisis were to occur, thereby remediating some of the devastating financial effects. For example, this alternative perspective was shared: "I am sure there would be consequences and some liability that comes back to the farm. Those are the kind of things that put you out of business. But that is why I carry five million dollars in liability insurance - for that reason."

Responsibility for Food Safety

Shared responsibility with need for more consumer education. Pennsylvania growers indicated that the responsibility for on-farm food safety should be shared by growers, processors, retailers, and consumers. Because farming is their livelihood, Pennsylvania growers staunchly expressed their commitment to protecting their livelihood by ensuring the safety of their product. However, Pennsylvania growers do not think consumers take enough responsibility in practicing safe food handling and suggested that consumers should be the target audience for food safety education.

All of the interviewed Pennsylvania growers have been farming for thirty or more years. Many are third or fourth generation farmers. So it is not surprising that growers repeatedly mentioned that growing quality, safe fruits and vegetables is not just a job. Rather, they indicated that it is a way of life that they would not want to jeopardize by selling contaminated

products. As this quote illustrates, growers are frustrated with food safety standards that might require changes in on-farm management practices – practices that the growers have been long carrying out as part of their long-practiced livelihood. A female grower shared her perspective:

> This is our living. If we mess up, then we've ruined it for ourselves. We have always been very careful about how things are done. The food safety issue really hasn't changed much on our farm… There is always a risk, but I guess you are careful because it is your own livelihood. It's not like a big business where you got 20 people working for you and they just want their paycheck and don't care what is going on. This reflects directly on us, which is why we get mad at all these regulations because it is requiring more time and more paper work.

They also are concerned about the signals that new food safety standards, and subsequent media coverage of such standards, might portray to consumers who have played a vital and familial-like role in ensuring the success of their livelihoods. A small grower voiced this concern:

> Well in reverse of what the media is trying to depict, growers are not out to poison the public. As a small grower we eat what we produce. And, believe it or not, we treat and feel that our customers' are our family, because without them coming back to us continually we are out of business. So it is for our own wellbeing – to stay in business - to provide something that isn't going to make them sick or having them feel we are producing something that is going to make them sick. But it is hard to compete with ABC and NBC and CBS and FOX. That is my perspective of it at the moment. We are beating our head against the

wall in trying to change our image. It has been changed for us regardless of how we like it. Our image has been changed.

Yet, despite their perception about the effects of media coverage of foodborne illness outbreaks, growers expressed that they do not feel victimized, nor do they believe that they are being burdened with an unfair share of the responsibility for food safety. As illustrated by the comment below, growers believe that all stakeholder groups along the food chain from farm-to-table are responsible for food safety. However, they do not believe that consumers accept enough responsibility for food safety:

> I think everybody is responsible for food safety. It starts with the farmer to raise quality food, but the consumer needs to understand when you get an apple you need to wash it. You don't know who was touching it at the grocery store or where it has been from the time it left the farm to the time it got to a packaging plant until it got to the store shelf. It could have gotten contaminated in the kitchen at home, even. So I mean as far as fruits and vegetables go, the consumer has to take some responsibility. It's not always the growers fault.

Even though growers maintain that consumers need to be better informed about food safety, they also are sympathetic with consumers. As this one grower indicates, "it is tricky" to identify appropriate, non-offensive food safety education programs. He elaborated:

> I see three basic groups. I see the producer, the consumer and everybody in between. For us here, we deliver directly to the supermarkets. So I can do everything proper and get a clean product to the supermarket, but if the stock boy putting it on the shelf sneezes on it or goes to the bathroom and doesn't wash his hands, then I have no control over that. And because of these regulations, they

> are coming at me and they aren't going to look internally within the store. They are going to come back to the farm and that is where this whole initiative scares me a little bit. Because by bringing this up and by being proactive we are also accepting risk and accepting the blame for a lot of these problems… The consumer should bear a good bit of this, but how do you go to the consumer and say, "Wash your food; it may be contaminated." It's a tricky thing. They just assume it is safe and that it is good. Ninety percent of the time it is, but every once in a while, there can be a problem that could easily have been erased if they wash everything.

On-Farm Food Safety Practices

Reliance on experiential or local knowledge. Almost none of the Pennsylvania growers interviewed for this study have written an on-farm food safety plan and most have not yet applied for an on-farm food safety third-party certification audit. Therefore the growers' on-farm practices at the time of data collection had not changed practices in response to increased concerns about food safety. Growers overwhelmingly discussed how their on-farm food safety practices stemmed from a reliance on their own, experiential knowledge

In defense of their practices, which they believe are good agricultural practices, growers cited how their years of farming experience have provided them with knowledge about how to prevent food contamination on their farm. One grower curtly suggested, "I don't need to write out a plan. I do it through practice." Others identified described their practiced knowledge in

relation to specific GAP guidelines, such as being able to trace back which produce crops were grown in which areas on the farm:

> One of the things about the GAP program is that they want us to separate the crop by field. I don't know if you have ever been in a potato cellar, but it's long and you fill up this one side and then the other side and you fill one side with one kind and the other side with another kind. My husband is really good and has been doing this forever. He is a fourth generation farmer and he can tell you, "Okay, this is approximately when we started such and such a field" without nothing written on paper. And I keep track of harvest - who was here and on what days. And he knows in what fields they harvested, so there would be an ability to trace back as long as his mind is good. But nothing is written on paper about when this or that field got started. My husband just has that ability to tell. He has been doing it forever.

Similarly, another grower indicated that he "sort of" has a traceability plan. His plan, however, is not a plan articulated in writing. Rather, he "just knows" from where his crops are being harvested and this knowledge can be attributed to the relatively small size of his farm.

> In one sense, I really don't have a trace back plan, but in another sense I do, because I know exactly where I am in the field. And when I sell sweet corn, my name is on the box and my address and all that. So what the store got yesterday or a week ago, I can pretty much tell you where it came from in the field. I don't' move that fast, so I can tell them exactly where it's coming from… I'm not in the same scope as a grower that has 1,000 acres and 150 employees and who is pulling stuff from all different places into a packing house.

In addition to highlighting the value of their practiced or local knowledge as a reliable alternative to a written food safety and traceability plan, growers discussed their frustration with what they perceive is a devaluing of grower knowledge by regulators, particularly by regulators who may not have as much knowledge about agriculture and/or have little to no practical experience working on a farm. One grower described that frustration this way:

> Some of the people are writing these rules and regulations have never been in the field. They don't' have the proper background and I don't know how you give them the proper background. It is a problem. What they do is they hire a journalist and the journalist winds up in the department of Ag and the next thing you know, because of the need for good writers, the journalist is writing the rules and regulations…. It is enough to make me throw up, because every time you go down and talk to them, all it does is create more rules. They don't listen to you.

A related theme about which growers also talked is the extent to which local farm knowledge has been passed through generations of farming families without record of foodborne illness. One multi-generational farmer shared this particular frustration:

> It just seems like to me the farmer is the one pointing his butt to the sun all day. He is the one who is working the hardest. Meanwhile, there are these people sitting here and there making up all these rules and regulations. This poor guy is on the farm and the guy behind the desk is saying you have to do more and it just bugs me. They need to think how civilization got this far. I think about my grandparents, and I spent a lot of time with them. They raised three or four pigs and they had a chicken coop out back which they grab eggs from and all this stuff and none of us got sick.

However, all of the interviewed growers were very receptive to learning more about on-farm food safety. As one grower stated, it is "better to get your wagons in the know" about good agricultural practices (GAPs). Despite their interest in learning more about on-farm food safety, they do have concerns about the pace of change associated with becoming GAP certified. One grower expressed this sentiment this way:

> I may not like everything, but when you sit down and think about it, you realize they are right. It just takes some getting used to. It's like, "Do I have to do it?" Everybody is set in their ways. Us old farmers don't like change. I think that is what a lot of it is.

Learning from Cooperative Extension. As one grower said, "We are all out for ourselves it seems at times and without someone driving the bus so to speak who knows where we will end up." According to growers, the "driver of the bus should be Cooperative Extension, the organization through which growers most prefer to learn about on-farm food safety. Growers indicated that they rely on Cooperative Extension for information because they perceive it to be a credible and non-biased source. For example, one grower said this: "I tend to put more weight on the info and recommendations from the extension service because it is more tried and true and is research, rather than just being off the cuff by someone trying to sell you something."

More specifically, growers indicated that they would like a simple, step-by-step guide. Some growers even suggested that on-farm food safety education follow a model like the pesticide education program. GAPs education also should address socio-cultural issues, such as small farm culture, working with farm workers who are non-native English speakers, and being practical for a grower. This grower comment encompasses each of these suggestions:

> Extension teaches you. The training they had last year got you thinking as to how food safety has evolved. But it wasn't shoved on you in a hard way…. This is the way this should evolve – as a slow process. There should not be a lot of fines and it should not cost thousands of dollars in audits until they get a system that will work…. We need a step-by-step plan that would get us started and it needs to evolve like the pesticide safety and spraying program has evolved. It wasn't something they came in one year and said you had to do and then the next year you just got compliant… Also we need to educate our help. Some of our older help never done this stuff and doesn't think it's a big deal because they never did it differently. It takes years to get that mindset changed…. I'd like to see it evolve slower and in a more gentle manner…. So back it up a little bit and give us time to get used to doing things. It's like getting the whole country to go green by changing light bulbs. You don't do that in a day. It takes some time and you need to have older people, especially, hear it over and over, before if finally sinks in. And this is the same thing.

While growers were appreciative of on-farm food safety guidebooks that have been made available by Cooperative Extension, most do not have the time to read, synthesize, and apply all of the information that is presented in these three inch thick guidebooks. Growers suggested that perhaps Cooperative Extension could create a step-by-step guide that more concisely outlines how to write an on-farm food safety plan in preparation for passing a third-party certification audit. They would like "something stupid simple so the average farmer can understand it better." One grower suggested this:

> So if we are talking audits, for example, and you want to make our life easier with audits and potential GAP requirements, then it would be easier to be given a blueprint instead of saying, "Hey Mr. Farmer. Here is a book. Go thru it and figure it out." That isn't us trying to skirt responsibility, but that allows farms our size to be compliant without beating our heads against the wall. If we have a basic blueprint to work on to adjust to our own process that would be valuable beyond words to guys like us.

Amish growers also expressed concerns about how GAPs requirements and education are presented. Like other growers, they are concerned about how new food safety regulations may discourage young and new growers. One grower talked about how young men in their community may choose other professions, such as construction, if the regulations become too difficult to understand.

> We have a lot of young families and the economy isn't good right now to go out and find a job. So they are asking us older guys what is the possibility of growing some produce and where are the markets. And if the first thing they are going to get slapped with is a whole book full of questions that we don't know how to answer, then they are going to say, "I will swing a hammer." And that is a concern to me.

Growers also identified additional concerns about presenting GAPs education in a manner that is socio-culturally acceptable by small farm growers. For example, growers who do not hire employees outside of the family identified some potential GAP guidelines that could be perceived as over-reaching. This includes guidelines that prohibit family pets from being in the field and guidelines that require guidance about hand washing or other hygienic practice be

displayed publicly. The latter is particularly a concern among growers at small, family farms where worker bathrooms essentially are located in grower's home. One grower said this:

> The guy said if we drive up and your dog is running through vegetable patch, then you automatically fail the audit…. If somebody took a picture of your dog in garden and then posted it on the computer – even if it wasn't showing anything negative - we would have failed [the GAPs audit]. Some of that is unrealistic.

The same grower also described what she imagined her customers' reactions would be if she hung posters illustrating how to dispose properly of toilet tissue. She said that, "My customers would die if I put those signs up. They would start to think something was wrong." However some growers who do employ seasonal, non-English speaking laborers believe that they could benefit from culturally appropriate educational materials and training for non-native English speakers:

> I know there are a lot of Mexican workers on the big farms and I can see how it can happen. There are a lot of Mexicans on those crews and they just aren't use to sanitary ways like us Americans are because they come from a third world country. Same thing I see on the literature I receive on how to use the restroom and how to clean your hands, how to dispose of the tissue and all that. They put the tissue in the wastebasket and not the toilet. They just don't know the safety precautions – weren't taught it.

Regardless of the content of the training materials, growers agreed that they do not want to waste time discussing hypothetical examples when they attend educational trainings. For example this grower explained:

> I don't like hypothetical examples. For a HACCP training, we were given these hypothetical situations and we were to make up a HACCP plan. I would much rather spend that time working on my own plan and have someone look at it and say you don't need this, or if this happens you might want to plug this in here, instead of doing this hypothetical plan that has no use. Stuff like that is so frustrating and we were more angry when we left because they wasted our time making us do stuff like that.

As this one grower remarked, they really just prefer to invest as much time as possible growing the fruits and vegetables.

> Help us figure out how to deal with all this paperwork…. Otherwise, you are spending all your time going through papers rather than working on production. There has to be a simpler way of being able to accomplish the documentation and verification for food safety.

As an alternative solution to some of the challenges, many of the growers suggested a flexible delivery model of on-farm food safety educational trainings, such as the model for pesticide applicator certification.

> I would do it if it is something we can do, like, how we get our pesticide license. You go to meetings a couple of times a year. You get some understanding. You get some information. But if it is something you have to spend a couple of thousand of dollars every year just to get someone here to see if you are doing everything right, then I probably won't do it.

Likewise another grower offered these ideas for creating an on-farm food safety certification training program.

> Maybe we should be doing something with the farmers to make food safety training available, but not mandatory. And make a reward for doing it and make it simple. Do it via correspondence, in a classroom, etc., like a master gardener program. Have something like that for the farmers. You could have a section on pesticides, farm management, manure management. Maybe have 10 sections and if you do each one then you get a certificate when you get finished and get listed as a master farmer. Stuff like that goes a long way with people who have never had any recognition before and most of these farmers never have had any recognition at all. It has to be positive, so I can say that I am good and then expand it. It's only limited by imagination and farmer groups would buy into that in a minute.

While growers are concerned mostly about the process through which such education and certification will be required to occur, they also acknowledged their need to be recognized – in a positive manner – for their on-farm food safety education and training. One grower said:

> It is the verbiage they come up with. They just tell you what to do. They need to get away from threats. The information has to come thru as being a positive effort to help us. It has to be positive and it has to be looked at as strengthening. They're doing the biggest disservice to our country by telling people how terrible we are.

While these grower comments differ slightly, they reflect similarities in that they each suggest a continuing education program model that provides for a flexible certification process that establishes a standard by which grower qualifications in good agricultural practices can be recognized formally and as something positive.

Sao Paulo Case

> *The primary challenge that I find is that to make a profit, you have to be competitive. The first objective is for you not to lose money. I think that this is the crucial one. It is to remain in the game itself. If you lose with the market, then you lose the game. So then the biggest challenge is for you to grow things to diversify yourself in the market and diminish risk. It means you have to adjust and grow new varieties that are better for the market.*

If the Pennsylvania case is characterized by social and relational issues driven by consumers, then the Sao Paulo case is characterized by market issues, influenced by tropical climate and retailer demands. In Brazil growers often adapt to market and climatic pressures by growing new varieties of produce to meet buyer expectations and preferences for quality. A closer examination of these issues and how growers in Sao Paulo make decisions about on-farm food safety can be contrasted with the Pennsylvania case to improve our understanding of global differences regarding on-farm food safety practices and the education thereof.

Case Overview

Growers in Sao Paulo evaluate food safety risks on their farm by monitoring the application of agricultural chemicals like pesticides and fungicides, perceive the consequences of food contamination to be less severe than growers in Pennsylvania and primarily of a financial nature, and place trust in information provided by agrochemical sales representatives and agronomists at farmer supply cooperatives. Sao Paulo growers indicate that contextual factors, such as the tropical climate and changing market prices for produce, also influence their perceptions about food safety in Brazil. They believe that growers should take the primary responsibility for ensuring food safety by practicing safe application of agrochemicals to protect

both the environment and human health. The key themes identified in Sao Paulo growers' evaluation of on-farm food safety are summarized in Table 5-2 and discussed in more detail below.

Table 5-2

Key Themes in Sao Paulo Growers' Evaluation of On-Farm Food Safety Risks

Model Elements	Categories
Contextual Factors	• Weather effects • Market issues
Possible Sources of Contamination	• Agricultural chemicals
Consequences of Contamination	• Loss of contract
Responsibility for Food Safety	• Grower knows best
On-Farm Food Safety Practices	• Reliance on agronomy chemical sales representatives • Prefer to learn through agribusinesses and cooperatives

Contextual Factors

Growers were asked to discuss the reasons that food safety has become such an important topic. They most often cited market-related concerns and the effects of weather. In order to sell their produce, growers must grow varieties of crops that are hardy enough to survive the harsh, tropical climate. Growers cite difficulties associated with horticultural crop production in a tropical climate, such as highly acidic soils, high levels of humidity and large amounts of precipitation during the rainy season, and mild winters that allow for year-round flourishing

insect and pest populations. Often the solution to counter these agricultural constraints, and thereby sell enough produce to make enough money, is the heavy application of agricultural chemicals, such as fertilizers, fungicides, and pesticides, which pose a different kind of challenge for ensuring food safety.

Weather effects. Weather is one of the biggest growing variables for farmers anywhere, and growers in Sao Paolo face no less difficulty in managing effects of the weather. One grower commented that weather "is against us half of the time." However, for produce growers in Sao Paulo, the challenges caused by weather ultimately impact their on-farm food safety practices, as well as their ability to sell produce on the market.

> A serious problem that we're having for the time being is nature, which is kind of against us. For example, the carrot that was supposed to grow in summer, actually came up in winter. It is quite complicated. This heat wave throws everything way off base. The plants cannot stand. We cannot stand. But as a farmer, it's worse that your plant can't stand, right? Then you can't sell them. And the diseases appeared, but the diseases were very resistant to the chemicals. The chemicals just don't work anymore.

Another grower talked about how unpredictable weather patterns make it difficult to grow quality red beets even in a region that is known for good red beet production.

> Here the region has grown because we grow beets very well. Our beets in the Sao Paolo region are the best grown in Brazil. They are very red! But if you go to the Northeast, the beat is black; it is dark. Ours is very red. The best beets in Brazil are ours. The region grew much by selling beets. But now the summer weather

> makes it complicated. If the is rain off base, then it gets too hot. So here it is complicated, hard work.

While the relationship between climate and food safety may be difficult to quantify, climate change can lead to changes in the emergence of microbes, decreases in water availability and safety, as well as difficulties in managing the cold chain, a temperature controlled supply chain. Each of these changes can increase the potential for foodborne illness.

Market issues. When discussing the context of fruit and vegetable farming and food safety in Sao Paulo, all of the growers commented on the challenges of keeping up with the market, particularly in terms of growing crop varieties that can thrive in a tropical climate and still satisfy retail and consumer expectations for extended shelf-life and blemish-free products. These difficulties often are compounded by what growers describe as a small window to get their products to market. For example, one grower talked about the challenges of growing onions at the right time in the right environment to meet market demands.

> Challenges? Those two, three years in the case of onion, which is a culture that needs to be renewed, the difficulty is knowing whether to plant the same area as the market will accept and verify the climate. We have a short window, they are 10 weeks to 10 weeks and other planting to marketing, so that does not oversupply due to other regions offer at that time. We're in a very restricted area of the varieties. So the challenge would be to meet these weeks to climate options, to give a reasonable productivity to achieve a lower price and even by the difficulty of information to know if people are planting more or less. Even if I talk

directly with staff CEPEA, even relying on their information does not represent 100% of the information.

In particular, growers talked about pressures to provide retailers with fruits and vegetables that are free of blemishes. One grower indicated that, "The Brazilian consumer is concerned only with beauty, not the taste." Another grower commented that, "The market has no notion of what it consumes, so they buy green fruit, which is easier to sell, but is sour. For them taking beauty is what matters. Unfortunately the Brazilian still goes by appearance." And an onion grower shared this:

> In the case of onions, the retailer feels that consumers want an onion with a little more skin, right? So that's why I spoke about the varieties in my decisions about what to grow. Our consumer wants an onion with a shell a little redder, a little rougher, but with a milder flavor. Our onion is not really an onion compared to those coming from Argentina. When they come here they are strong. They are beautiful outside, but inside the taste is strong too.

Therefore in order to sell high volumes of produce, growers take whatever measures they can to guarantee that their produce meets buyer standards for appearance. Such measures often include the use, and perhaps over use, of agricultural chemicals.

Perceived Sources of Contamination

Agricultural chemicals. Every grower interviewed for the Sao Paulo case cited the use of agricultural chemicals, and pesticides in particular, as the major threat to the safety of fruits and vegetables grown in Sao Paulo. Keeping up with the market demands

for blemish-free produce, while managing difficulties associated with unpredictable and often drastic weather changes, growers believe that they must use a lot of agricultural chemicals. One grower remarked:

> Ah! Pests are especially a problem. When it rains, we get slugs and snails. And when the weather is very dry, there is a pest that is a type of fungus in some lettuce. It's hard because you have to use a lot of chemicals and then have no way to market a product full of poison.

Growers also suggested that "there is an increasing trend to use more products, unfortunately, because we have an increasingly unfavorable environment." This grower talked about the treadmill effect of applying agricultural chemicals:

> I think the producer should make changes, but when you're working trying to keep up with the demands of the market you have to run back and sell their product and [the application of chemicals] ends up accelerating.

While all of the interviewed growers in the Sao Paolo case indicated that agricultural chemical application is the biggest threat to food safety, none of them thought that they could continue to farm without the use agricultural chemicals. Rather they believed that the best approach for reducing on-farm food safety risks is to use "weaker" products. For example, one grower suggested that on his farm, "there is not much risk, because I do not use very strong products. So, on a scale of 1-10, I think our risk is only a 2 or 3." While another grower described his remediation approach also is avoiding "strong" products. He said that, "One of the things I try to do is that I pretty much ban all products with a red band, and if there is any product with a red band that I use, it is only because there is no other substitute."

Consequences of Contamination

Loss of contract. Unlike in the Pennsylvania case, growers in Sao Paolo are not as concerned about the potentially devastating effects of having contaminated food traced back to their farm. Rather, growers in Sao Paolo believed the greatest consequence would be to lose their contract with the buyer, who could be a middleman, a wholesaler or a grocery store. For example, one grower said, "I believe that they would ban my crop and they would certainly stop buying from me." Another communicated that, "Contaminated food could be traced back to my farm, but that never happened. But, if it did, I would be punished by losing my buyer." Likewise another replied nonchalantly that, "Sure we would lose the customer. And if this were to happen we would look to see where we went wrong, to improve our operations so it wouldn't happen again." And another described when the contract would be suspended, "Our contract is written that if there is a problem of traceability with our fruit, the industry has the right to cancel the contract, to suspend it immediately. But only from the moment they detected the problem." Growers did not elaborate much on their responses about the consequences of contaminated food being traced back to their farm and seemed rather nonchalant about the potential of this happening.

Responsibility for Food Safety

Grower knows best. Sao Paolo growers believe that growers should take the most responsibility for ensuring food safety of consumers by ensuring safe application of agricultural chemicals. They believe that they should bear the burden of responsibility, because they ultimately are the only ones who really know which chemicals are being used on their farms –

not the retailers and especially not the consumers. One grower directly said that, "The customer will not know what is being produced on my farm, so I think it is the responsibility of the producer. It is 100% of the producer." Another grower indicated that everyone along the food chain "excluding the consumer should be responsible. Each party, each segment has its responsibility." His rationale is that, "This is because the consumer is only buying products, so he has no information [about how those products are produced]. But that's just my opinion."

Despite acknowledging that only the growers know which products are applied on their farms, growers do think that retailers and other agencies should play a role in being responsible for food safety. First, they think that retailers should screen their growers better. For example, one grower said this:

> I think the producer should take primary responsibility and second is the retailer that should stop buying from just any grower. Retailers need to make a more serious selection of suppliers, because then we will get a higher price. Because being a decent producer has a higher cost.

Second, they support more regulation of food safety, which they equate with the safe application of agricultural chemicals. A grower, primarily of oranges, shared these thoughts:

> The safety of fruit for the domestic market will depend heavily on regulatory agencies. I do not know which agency that would be, but the legislation should come from the top down. There should be a penalty if the producer does not follow these regulations.

One of the reasons why growers in Sao Paolo seem to favor more regulatory intervention in Brazil is because they do not believe that all of their peers, or other produce growers,

follow the safe guidelines for the use of agrochemicals. This grower suggested the idea of a certification program:

> It is a shared responsibility, because we often apply chemicals that are not good for health, but some growers ignore what it does on health, so we must also have the bodies to certify the products and their use. They should give licenses to both health agencies, as well as those of agriculture, so that they would have to approve or not approve the product. They also should say what the grace period is for applying such products.

One grower even suggested that other growers apply products that have been banned from legal use:

> Cabbage, for example, a caterpillar on cabbage is hard to fight hard even in the heat now. There is a [chemical], which might work, but it is prohibited for use, but some people are using it. The cooperative does not sell it, but you can get it. I do not use that, honestly, because it is something that kills. It kills moths instantly. Absurd! And people are using it directly, because of this caterpillar. The caterpillar is complicated and nothing works against it, so people are going through this stuff three, four times maybe.

Because growers do not trust that their peers are practicing safe use of agrochemicals, they believe that increased regulation and transparency about certification could protect consumers. In particular, this grower, who sells his produce to the French-owned grocery store Carrefour, thinks that the produce tracking system that allows Carrefour's customers to obtain additional information about the source and path of their purchased produce items, should be expanded to include additional safety information:

> When the consumer goes to the market, I think that there should be a place to show that the screened product is healthier and safer, because from the moment the grower is tracked and the consumer knows where to find the farm, the grower has to work right. That's what public bodies can do to help.

On-farm Food Safety Practices

Reliance on agronomy chemical sales representatives. Sao Paolo growers who sell to grocery stores, particularly those who have gone through the process of obtaining third-party certification for on-farm food safety, indicated that they have changed their on-farm operations. For example, one grower said that, "to continue selling to the grocery store, we changed the very way of handling. We avoid as handling the merchandise by hand as much as possible. Now everything is more mechanized. So that was the main change we did for food safety."
A tomato grower talked about how these practices, which were once new, are now normal:

> Such practices are normal now. The staff wears gloves and safety equipment. And now they use a [mechanized shears-like instrument], whereas before, the staff cut the stalk of the tomato by hand, and they had to disinfect every cut. Previously the cut stalk was just open, and many bacteria could enter through it. But, not now.

This same grower went on to describe how the staff prevent bacteria from entering the cut tomato stalk: "They walk with a bag with a liquid that I do not know what it is. This

is with the agronomist tells us to do. But before this, we had a problem with bacteria and now that problem has declined significantly."

Growers who have and have not yet modified their practices to undergo a third-party certification audit are depending upon agronomy chemical sales representatives for guidance about on-farm food safety. One grower indicated that food safety is "a matter of trust, which also includes trusting the bodies that endorse the products." Growers explained that they place trust in sales representatives, because the sales representatives must sign a receipt indicating that s/he provided the grower with instruction about safe chemical use. One grower explained that:

> Any store that sells the product is bound to help you. If you buy a product at the show, you get the ingredient list and then have an agronomist sign the receipt. Any sale must have an agronomist's signature indicating that they gave you instruction about the product.

The practice of signing-off on chemical application instruction shifts the liability for use of the chemicals from the sales representatives and the companies for which they work to the growers. Growers seem to accept this shifting of liability because they do not believe that dangers associated with agrochemical usage cease to exist, so long as they follow the instructions for use. One grower estimated that he was "at about a medium risk of liability." He went on to say, "But contamination is not likely to happen, because I follow what the coach said. Only if he made a mistake will I be wrong because I listened to him." Highlighting the challenges of growing produce in a tropical climate, another grower summed it up by saying that, "Food safety practices are very nice on paper. But when it comes to the garden, pests do not die of fright or of blessings. You must throw the product on it."

Learning from agribusiness and cooperatives. Growers in Sao Paulo learn about on-farm food safety through two main sources – cooperatives and agribusinesses. This also tends to be the preferred order in which sources are consulted – cooperatives first, then agribusinesses. For example, one grower shared this:

> I learn about food safety in lectures, at most of the cooperatives, also through some other companies who sell agricultural chemicals that we buy through the cooperative, a brochure or magazine, or just watching television. You end up with a focus on information. And if the cooperative is not able to provide the function of education, it has a register of industries and agricultural chemical factories that it makes available to its members, so they can get more information.

An orange grower also talked about seeking information from cooperatives and agribusinesses, as well as a few other sources:

> So we have an association of producers, Alicitrus, where we get a lot of information. We also seek information on the Internet and at CEPEA. Multinationals also provide us with information. For example, Dupont has an annual meeting with the producers and their partners and always deals with important issues of production. Bayer also holds some meetings. And the vending companies bring speakers. In our company we hire an agronomist to give us technical advice and to talk about what we need. Information comes in many forms, such as from the newspaper too, like Valor Economico, the business newspaper. And we also have over 30 years of experience with oranges, so it is easy to find information. It even comes naturally in daily conversation and gossip.

Consistent with the finding that growers in Sao Paulo rely on agronomy chemical sales representatives to inform their on-farm food safety practices, growers indicated that they try not to miss the agribusiness lectures:

> There are a lot of lectures provided by the agricultural chemical companies. For example, Bayer gives lectures and the Monsanto staff is very helpful. They take great care. When you consider a new product, they make a speech of two or three hours after dinner. This is very important, I do not miss one.

Chapter 6

DISSCUSSION AND CONCLUSION

The purpose of this study was to articulate a theory of change to improve on-farm food safety practices through extension education. To develop a theory of change grounded in a situational analysis, case study research was conducted to understand on-farm food safety practices of produce growers. Leeuwis' (2004) farmer practices model was used as a guiding framework through which farmer practices, specifically as they relate to on-farm food safety, could be understood. In this final chapter, the findings of the study are discussed and a theory of change that can be used by extension educators to develop localized, extension education programs is proposed.

Discussion of Findings

Analysis of grower comments revealed easily discernible themes. Growers in Pennsylvania evaluate food safety risks on their farm by considering pathogenic risks, perceive the consequences of food contamination to be devastating financially and socially, and take pride in their practiced or local knowledge to inform their on-farm food safety practices. Pennsylvania growers also indicate that the multiplying effects of media reporting on foodborne illness outbreaks and the increasing distance between producers and consumers provide context for changes in the regulation of on-farm food safety. Furthermore, they believe that the responsibility for food safety should be shared by growers, processors, retailers, and consumers. Because farming is their livelihood, Pennsylvania growers staunchly expressed their commitment to protecting their livelihood by ensuring the safety of their produce. However,

Pennsylvania growers do not think that consumers take enough responsibility in practicing safe food handling.

Growers in Sao Paulo evaluate food safety risks on their farm by monitoring the application of agricultural chemicals, such as pesticides and fungicides, perceive the consequences of food contamination to be much less than growers in Pennsylvania, and place tremendous amounts of trust in chemical sales representatives and agronomists at farmer supply cooperatives. Sao Paulo growers also indicate that the harsh, tropical climate and market prices provide context for concerns about food safety in Brazil. They believe that growers should take the most responsibility for ensuring food safety through the safe application of agricultural chemicals that protects both the environment and human health. The key themes identified in each of the cases are summarized in Table 6-1.

Table 6-1

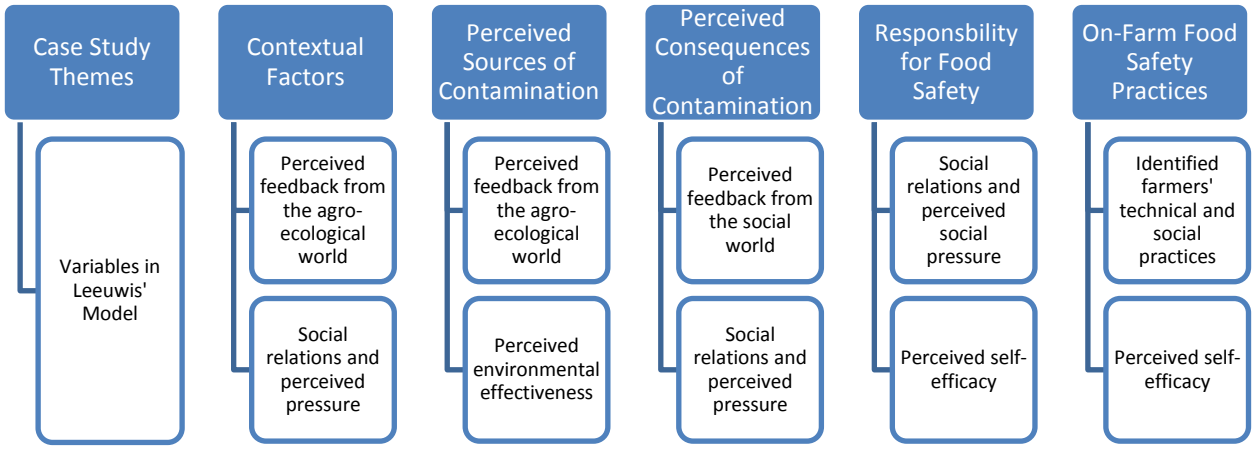
Comparison of Key Themes Growers' Evaluation of On-Farm Food Safety Risk

Categories	Pennsylvania Codes	Sao Paulo Codes
Contextual Factors	• Increasing distance between growers and consumers • Negative effects of media	• Weather effects • Market issues
Possible Sources of Contamination	• Poor hygiene and sanitation practices • Contaminated water sources	• Agricultural chemicals
Consequences of Contamination	• Financial and social devastation	• Loss of contract
Responsibility for Food Safety	• Shared responsibility with need for more consumer education	• Grower knows best
On-Farm Food Safety Practices	• Reliance on experiential or local knowledge • Prefer to learn through Cooperative Extension	• Reliance on agronomy chemical sales representatives • Prefer to learn through agribusinesses and cooperatives

These themes similarly align to the variables in Leeuwis' model for understanding farmers' practices and responses to proposed alternatives (Leeuwis, 2004). In Leeuwis' model, he identified farmers' technical and social practices, perceived feedback from the agro-ecological and social world, perceived environmental effectiveness, social relations and perceived social pressure, and perceived self-efficacy as critical variables. The alignment, however, is not one-to-one. Figure 6-1 maps the key themes from the case studies presented herein to Leeuwis' variables.

Figure 6-1

Comparison of Categories and Leeuwis' Evaluative Frame of Reference Model Variables

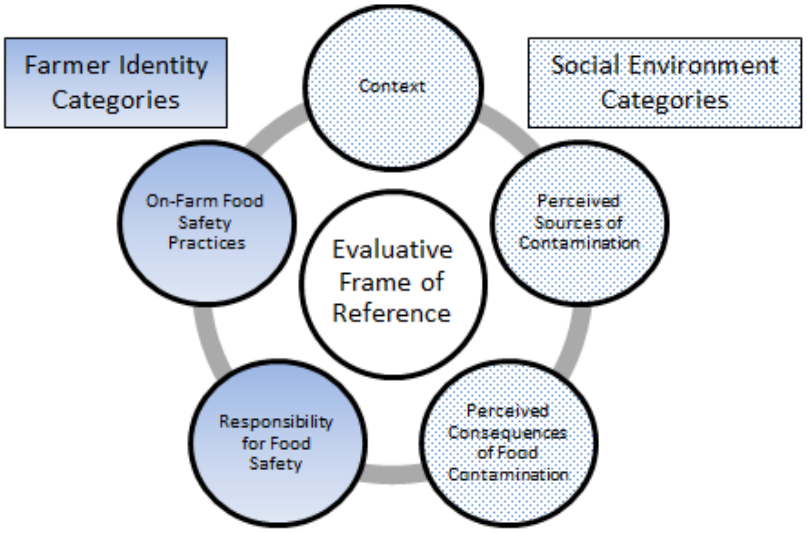


Further analysis of the themes related to each element revealed even more useful information. A demarcation between the categories *contextual factors*, *possible sources of contamination*, and *consequences of contamination* and the categories *on-farm food safety practices* and *responsibility for food safety* exists in each case. The former three categories tend

to describe the social environment, while the latter two tend to relate to how a grower perceives his or her social identity within the food safety social environment (see Figure 6.2).

Figure 6.2

Social Environment versus Farmer Social Identity



For example, in the Pennsylvania case, the codes within the categories *contextual factors*, *perceived sources of contamination*, and *consequences of contamination* emphasize relational issues. Thus, the Pennsylvania case can be characterized as exhibiting high levels of social embeddedness. In the Sao Paulo case, the codes within categories *contextual factors*, *possible sources of contamination*, and *consequences of contamination* emphasize issues associated with the market. Thus, the Sao Paulo case can be characterized as exhibiting high levels of marketness. Social embeddedness means there is a high presence of social ties, or "sense of social connection, reciprocity and trust" embedded within a local economy, whereas marketness "expresses the relevance of price" in economic transactions (Hinrichs, 2000, p. 296-7).

When considered together, the latter two categories of the model describe how the growers perceive their social identity with relation to the food safety social environment. In the Pennsylvania case, the categories associated with *on-farm food safety practices* and *responsibility for food safety* highlight growers' self-perception as civic stewards, whereas in the Sao Paulo case the categories associated with these same elements highlight growers' self-perception as market stewards. Growers like those in the Pennsylvania case exhibit civic stewardship when describing customers as "like family." Because they feel socially connected, they also feel morally responsible for ensuring the safety of their customers. However, such personal attachment also makes these growers vulnerable to feeling attacked by proposals to legislate food safety. On the other hand, growers like those in the Sao Paulo case, who describe food safety in terms of market principles, tend to view the adherence to food safety standards as just another part of doing business; they do not view the imposition of food safety standards as a personal offensive.

Table 6-2

Social Environment versus Farmer Social Identity Typologies

	Social Environment	Farmer Social Identity
Pennsylvania Case	Social Embeddedness	Civic Steward
Sao Paulo Case	Marketness	Market Steward

This analysis better informs an understanding about on-farm food safety practices. In particular, describing the cases as exhibiting higher or lower levels of social embeddedness or marketness while also identifying the extent to which the growers exhibit higher or lower levels of civic or market stewardships (see Table 6-2) provides agricultural extension educators and

other professionals with typologies for developing contextually and behaviorally appropriate on-farm food safety educational materials and programs emerging from the theory of change presented below.

Implications for Agricultural Extension Education

In Chapter 2 the three approaches that have dominated the agricultural extension and innovations systems literature - diffusion of innovations, social and behavior change, and participatory communication approaches were presented. Of these three approaches, the participatory communication approach is the most interactive (as opposed to other more instrumental approaches). Servaes (1996) tells us that participatory communication approaches are

> More concerned with process and context, on the exchange of 'meanings' and on the importance of this process. The focus is on social relational patterns and social institutions that result from and are determined by the process….. With this shift in focus, one is no longer attempting to create a need for the information disseminated, but instead, information is disseminated for which there is a need. Experts respond rather than dictate. (p. 16)

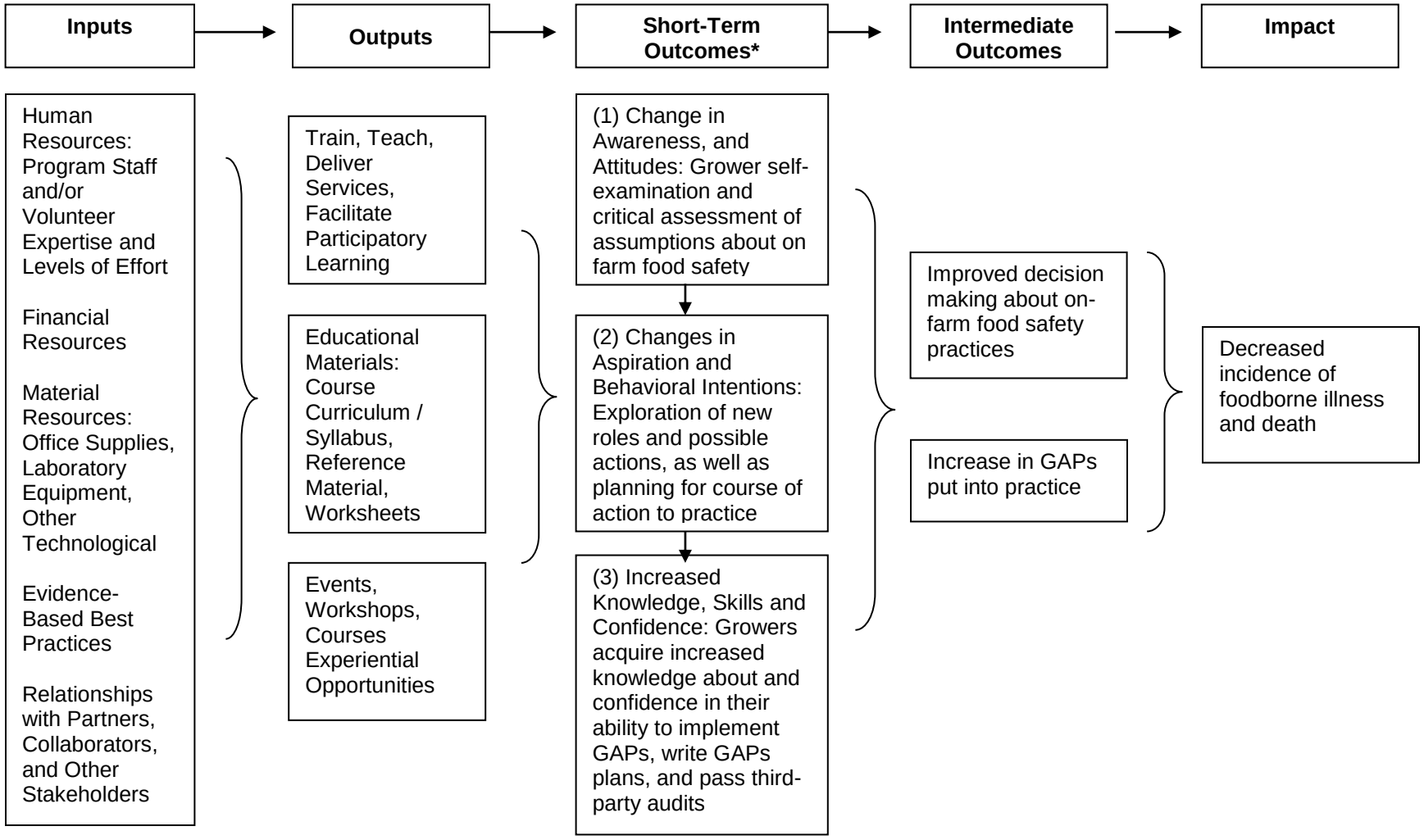
A specific participatory communication approach that aligns with the extension goal of ensuring food safety through the enactment of good agricultural practices is the transformative learning approach. "Transformative learning is the process of effecting change in a frame of reference" (Mezirow, 1997, p. 5). It "empowers the individual to think as an autonomous agent in a

collaborative context" (Mezirow, 1997, p. 8). Using this approach can help extension educators realize pre-defined behavior change that can lead to the collective impact of decreasing the incidence of foodborne illness and death.

The findings of the case study research, coupled with evidence-based research on agricultural extension education communicative intervention approaches - particularly Mezirow's transformative learning approach, provided the foundation for the development of the theory of change presented in this section. The case study findings suggest that growers develop a frame of reference about on-farm food safety composed of two main themes – the social environment and social identity. To improve decision making about on-farm food safety practices and to increase grower implementation of GAPs, extension educators must facilitate a process that transforms grower frames of reference to make them more dependable, or in other words, more "inclusive, differentiating, permeable or open to other viewpoints, critically reflective of assumptions, emotionally capable of change, and integrative of experience" (p. 19-20). According to Mezirow (2000 and 1997), this transformation happens through four processes that can be elaborated into 10 phases through which an individual often goes as part of his or her educational maturation or transformation about a given subject.

Consequently, the program logical model presented below emphasizes an approach to facilitate progression through these transformational phases, which are identified as short-term programmatic outcomes in the model (see Figure 6-2). Further, Funnell and Rogers (2011) assert that "the outcomes chain is (or should be) the centerpiece for developing all other aspects of the program theory and thus the description of the model focuses primarily on the outcomes.

Figure 6-2. *Program Logic Model for On-Farm Food Safety Transformative Learning*



*Short-term outcomes are numbered to reflect a chronological ordering.

According to Knowlton and Phillips (2013), inputs are the resources that are necessary for program activities to occur and outputs are the specific, tangible results that the program activities create or produce.. Each local program management team should conduct a comprehensive assessment and analysis of available human, financial and material resources and determine local capacity to deliver the program efficiently. Outputs, such as training materials and event content, should be designed using evidence-based best practices. In addition local program management teams also should consider how relationships with other collaborators and key stakeholders, including the growers, will be managed to create a structured approach through which stakeholder feedback can be provided and incorporated into the program design and delivery. Implementation plans, which take into account the local context and the social environment, should articulate specific details for each of these items.

Knowlton and Phillips (2013, p. 36) state that outcomes are the "specific changes in awareness, knowledge, skill and behavior" that a program attends to achieve. Further, they "are dependent on the preceding resources, activities, and outputs." This dependency is the reason that it is so important for inputs and outputs to be designed by local program offices that can consider local contexts. Building on Mezirow's transformative learning model and the case study research, this theory of change emphasizes three consecutive short-term outcome level changes towards which all activities in an on-farm food safety educational program should contribute. Based on the input provided by the growers, these transformational, educational events should be planned and scheduled to occur over a longer period of time at a pace that not only fits into their busy schedules, but also provides ample time for the growers to reflect on their learning and to become accustomed to the new ideas. For example, each of these three short-term outcomes

could be achieved in a complete, longer-term training program that is comprised of three shorter-term modules.

The first short-term outcome towards which extension educators should work is fostering a change in awareness and attitudes. In order to achieve this outcome, extension educators should develop programs and trainings that allow growers ample time to self-examine and critically assess their own and others' assumptions about on-farm food safety. For example, growers could be presented with the findings of this case study to illustrate how the Pennsylvania case tends to exhibit social embeddedness, while the Sao Paulo case tends to exhibit marketness. Becoming aware of these characterizations may create a "disorienting dilemma" for the growers – an important first step in transformational learning whereby learners are exposed to the limitations of their own current knowledge or approaches. Disorienting dilemmas evoke emotion, which can be an important impetus for change (Mezirow, 2000).

In the case of Pennsylvania, growers should be encouraged to consider how improving their on-farm food safety practices may benefit their economic gain, whereas in the case of Sao Paulo, growers should be encouraged to consider how improving their on-farm food safety practices beyond the safe use of agrochemicals may improve their social relations. Through this process of examining other points of views, extension educators can facilitate opportunities for growers to engage in rational discussion with one another to critically assess their own and others' assumptions about on-farm food safety.

Building on this disorientation, the second short-term outcome towards which extension educators should work is fostering a change in aspiration and behavior intentions. In this stage, growers should be encouraged to explore new roles and possible actions and then plan for a new course of action to practice. In both cases, growers should be guided through a process to

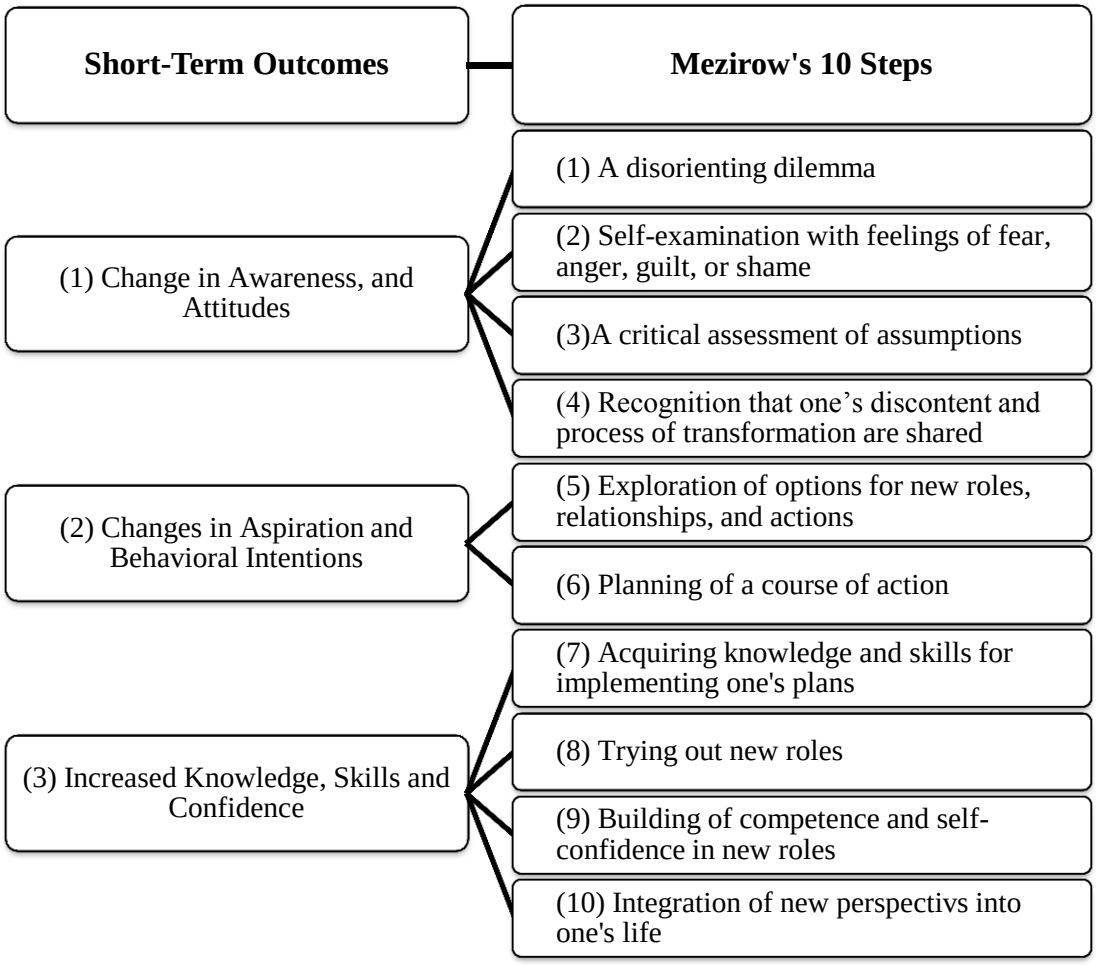
consider what steps they would need to pass a third party certification audit for on-farm food safety and to write a detailed on-farm food safety plan. However, in the case of Pennsylvania, growers should be challenged to think about how their plans may make them stronger in the market arena and Sao Paulo growers should consider how their plans may build stronger social relations, thereby setting intentions for both groups of growers to think more holistically about the positioning and functioning of their livelihoods.

Finally, extension educators should facilitate opportunities for the growers to increase their knowledge, skills and confidence in implementing new on-farm food safety practices to pass third-party audits and improve more broadly their on-farm management of practices for better yields and quality of product. In addition, educators may facilitate increased opportunities for growers in Pennsylvania to expand their frames of reference to consider learning from one another, whereas growers in Sao Paulo may be encouraged to consider learning from state agencies of extension. See Figure 6.3 for an illustration of how the short-term outcomes in this theory of change align to Mezirow's 10 steps for transformative learning.

Achieving each of those lower-level, or short-term outcomes, logically should lead to improved decision making about on-farm food safety practices, thereby increasing the GAPs being put into practice. Ultimately, following developing strong extension education programs to achieve the results outlined in this logic model can assist the growers, as learners, to integrate, develop and make sense of the shifted meaning perspective that they had developed to lower the incidence of foodborne related illness and death.

Figure 6-3.

Alignment of Short-term Outcomes to Mezirow's Steps for Transformative Learning



Future Research Recommendations

Extension education programs should be designed using evidence-based best practices and additional research on this topic could strengthen our understanding of the phenomena of on-farm food safety. This case study relied on an adaptation of Leeuwis' (2004) evaluative frame of reference model in that it identified and examined the farmer's perceptions of consequences of certain practices, the farmer's perception of the likeliness that these consequences will happen, and the farmer's evaluation of such consequences in relation to a set of his/her own aspirations for his/her farm, i.e., will the consequences be negative or positive for the farm (Leeuwis, 2004, p. 67) as they relate specifically to on-farm food safety practices . The case study framework presented herein could be used to answer new and different research questions. Some suggestions for future research are presented here.

This study could be replicated in similar or different geographic locales. Yin (2003) asserts that an important factor in the replication of qualitative case study research is "the development of a rich theoretical framework (p. 47)." He goes on to suggest that such a framework "needs to state the conditions under which a particular phenomenon is likely to be found (a literal replication) as well as the conditions when it is not likely to be found (a theoretical replication)" (p. 48). One could expect that findings like those in the Pennsylvania case could be found in more developed countries in continental climates and also where there may be more developed local food system infrastructure. Findings similar to those identified in the Sao Paolo case likely are to be found in less developed countries in tropical climate and where there may be less developed local food system infrastructure and where communities rely heavily on imported foods for consumption and exported foods for economic stability. Future

research activity also might include developing a mixed-methods study in which qualitative case study findings are complemented with quantitative data that reveals growers' risk-taking propensity with regards to food safety.

While Leeuwis (2004) acknowledges that understanding farmers' practices is highly complex" (p. 71), the ways in which his model variables align to the case study themes presented herein suggests that Leeuwis' model is perhaps too broad to facilitate understanding of farmer practices related to diverse issues (e.g., food safety, agricultural productivity, market risk, etc.) . So, the case study framework presented in this study also could be used to research farmer perceptions and consequences of other specific practices, such as integrated pest management (IPM) practices in tropical climates, particularly in tropical climates like Sao Paulo, as an element of safe food growing. Findings from such research could inform the design of relevant and appropriate extension education programs that help growers practice more environmentally and health-friendly farming practices to meet increased market demands for organic produce.

Further, research could be done to test the assumed linkages in the proposed logic model. In testing this logical model, different phenomena could be studied. First, a rigorous impact evaluation could be conducted of a program that utilizes this logical model to assess whether adherence to this model leads to decreased incidence of foodborne illness and death. Second, qualitative research could be conducted to further understand the proposed alignment between the short-term outcomes and Mezirow's 10 steps for transformative learning. These types of research activities can help broaden our understanding of how a transformative learning approach can be better utilized in the design, implementation, and evaluation of extension education programs.

Conclusion

In 1998, Jouve suggested that "modern food safety legislation should reconcile science, the interests and concerns of food operators and the exigence of free trade" (p. 76). The findings from the case study research documented in this manuscript provide a grower perspective that should be included in future policy discussions about food safety. While this research project attempted to follow the guidelines for a participatory communication project in that grower perceptions were being solicited to shape future on-farm food safety communication and extension education materials, a participatory communication project that involves multiple groups of stakeholders as part of the assessment, or case study research, would be ideal. According to Servaes (1996), "genuine participation directly addresses power and its distribution in society. Participation involves the more equitable sharing of both political and economic power, which often decreases the advantage of certain groups" (p. 16). Thus a project that creates space and provides opportunity for diverse groups of stakeholders would provide for the development of an expanded food safety framework in which the grower frame of reference is just one part may be developed to offer transformational learning opportunities about food safety along the entire food chain.

Ultimately, though, Caplan (1986) reminds us that

> It is almost trite to observe that uncertainty and doubt about risks and benefits are characteristic of all aspects of life. There are various risks to health, well-being and the quality of life one enjoys that are associated with even the simplest of human actions. (p. 182)

One of the most basic and simplest of human actions is eating. Hopefully a better understanding of the differences in Pennsylvania and Sao Paulo grower frames of reference regarding on-farm food safety can contribute to the development of more appropriate food safety standards at the local, national and global levels and of more appropriate food safety educational programs for all growers, so that growers may continue to excel at and enjoy their livelihood while providing the rest of us with the continued, safe sustenance and satisfaction of engaging in the basic and simple act of eating fresh produce.

Appendix A

Questionnaire Guide

Grower Background/Profile

1. Tell me about what it's like to be a produce grower in Pennsylvania (or Sao Paulo)? What are some of the benefits? What are some of the problems?

2. How large is your farm in acres? What do you farm? What percent of your farm is dedicated to growing fruits and vegetables? What percent of the land that you farm is owned by you? Who owns the farmland you do not own?

3. Tell me about the past and present of growing and selling produce in Pennsylvania in as much detail and time as you like. Was it once and is it a worthwhile and viable endeavor? Was it and is it a kind of life that you would recommend to others?

4. Tell me about what you see as the future of fruit and vegetable farming in as much detail and time as you like. Do you think it will be a worthwhile and viable endeavor?

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5. Tell me about the community that you live in? Are people in this community supportive of agriculture? If so, in what ways? If not, how do they express their non-support?

6. Nowadays, people are becoming more concerned about how and where their food is grown and whether it is safe to eat. Why do you think this has become so important to people? Do this increased concerns affect your operation? If not, why not? If so, how?

7. What do you think about the ways in which fresh fruits and vegetables are grown and sold all over the globe? Does the globalized agriculture and food system make it harder for you than for growers who came before you? Why not or how so? What kind of opportunities does the globalized agriculture and food system provide you?

Food Safety Knowledge and Practices

8. You recently participated in the Penn State Extension food safety workshops for produce growers. Did your thoughts about on-farm food safety change after your participation in this workshop? If so, in what ways? If not, why do you think they remain the same?

9. Generally, how do you learn about on-farm food safety? Is it the same or different than how you learn about other topics related to growing produce? How so?

10. Do you plan to write an on-farm food safety plan? To get a USDA food safety audit? Why or why not? If yes, what do you think are the benefits of passing such an audit? If not, do you think you will consider getting the audit in the future?

11. Do you think it will be easy or hard to write an on-farm food safety plan? To pass the USDA food safety audit? Why or why not? How could organizations, like Penn State Extension, help fruit and vegetable growers? How could such organizations help farmers in regards to on-farm food safety practices?

12. What do you think the role of the farmer should be in food safety? What about grocery stores? Food processors? Consumers? Do you think the burden of responsibility for ensuring food safety is spread equally among all of these types of people? Why or why not?

13. Do you have any other thoughts regarding being a produce grower in Pennsylvania? Any other thoughts about on-farm food safety practices?

Appendix B

Understanding the Relationship between Farm Size and On-Farm Food Safety Practices: A Case Study of Pennsylvania Fruit and Vegetable Growers

Introduction

In the past several years, food consumers around the world have witnessed a succession of foodborne disease outbreaks. As a result of these events, the safety of the global food system has been called into question. Government regulators and private food retailers have responded by focusing on, in part, on-farm practices. Many local and international food retailers have begun requiring that produce growers obtain third-party certification ensuring that their produce is grown using Good Agricultural Practices (GAPs) to minimize food contamination risks and in January 2010 President Obama signed into law the Food Safety Modernization Act [P.L. 111-353], which gives the Food and Drug Administration (FDA) greater regulatory powers to enforce adherence to on-farm food safety practices. Despite concern among local food system advocates about how the new legislation would impact small farms and growers who engage in direct farm-to-market sales, the new law does provide flexibility and protections for these groups under what has become known as the Tester Amendment. Nevertheless empirical research documenting the relationship between farm size and on-farm food safety is nearly nonexistent. This study helps fill this void by presenting survey data that indicates there is a statistically significant relationship between farm size and on-farm food safety.

Background

According to Michael Taylor, who was appointed the Deputy Commissioner for Foods at the FDA in January 2010, the passage of the Food Safety Modernization Act means that the

> *prevention of foodborne illness, not reaction to problems, is now the guiding principle of our food safety law – with the primary responsibility for prevention resting squarely on the shoulders of food producers and processors (Taylor, 2011, para.11).*

Major elements of the new law include provisions that

- require food facilities to have written prevention control plans,
- mandate the FDA to establish science-based standards for the safe production and harvest of fresh fruits and vegetables,
- require the FDA to increase the frequency of inspections of national and foreign food facilities that sell products to U.S. consumers,
- authorize the FDA to have mandatory food recall authority of unsafe food if a food facility fails to recall the food voluntarily, and
- recognize the necessity for enhancing partnerships among all food safety agencies (FDA, 2011; FDA, 2010).

Thus, with the passing of the Food Safety Modernization Act, U.S. Congress was successful at providing the FDA with the authority to regulate on-farm activity.

Initially, however, small farm owners and local food policy advocates conveyed criticisms about the proposed legislations. Critics raised questions about how the new legislation would impact small farms and growers who engage in direct farm-to-market sales and particularly were concerned about whether small-and mid-size farmers, who have smaller economies of scale and less labor, would be able to bear the human and financial resources necessary to comply with the new legislation. In addition, these criticisms were augmented with anecdotal suggestions that growers on small farms tend to be more civic-minded and therefore more conscientious about their growing practices.

Despite the concern among small farm owners and local food policy advocates, the new law does provide flexibility and protections for small farms and growers who engage in direct

farm-to-market sales. First, because the Food Safety Modernization Act does not change the definition of "facility", small farm owners are not required to register as a facility with the FDA and thereby will be exempt from needing to create and maintain new records affiliated with registering as a facility. Under the Bioterrorism Preparedness and Response Act of 2002, which added several food-related provisions to the Federal Food, Drug, and Cosmetic Act, certain food "facilities" were required to register with the FDA and follow new record-keeping requirements. In the Bioterrorism Preparedness and Response Act of 2002, a farm is defined as

> *A facility in one general physical location devoted to the growing and harvesting of crops, the raising of animals (including seafood), or both. Washing, trimming of outer leaves, and cooling produce are considered part of harvesting. The term "farm" includes: (1) Facilities that pack or hold food, provided that all food used in such activities is grown, raised, or consumed on that farm or another farm under the same ownership; and (2) Facilities that manufacture/process food, provided that all food used in such activities is consumed on that farm or another farm under the same ownership (FDCA § 415).*

The Food Safety Modernization Act does not amend this definition; many small farm owners and local food advocates were concerned that the Act would.

Second, the FDA in coordination with the U.S. Department of Agriculture (USDA) is mandated to establish science-based standards for the safe production and harvesting of fruits and vegetables. The FDA, however, has discretion to establish scale-appropriate standards for small farms and to establish standards that take into account differences in growing, production and harvest techniques for diverse fruit and vegetable crops. In addition, the new law requires the FDA to coordinate with the National Institute of Food and Agriculture (NIFA) of the USDA to provide increased training opportunities to small growers on the new standards.

Finally, growers who grow fruits and vegetables for their own consumption or sell a majority of their produce directly to consumers, such as through farmers' markets, are exempt

from the new recordkeeping requirements, as are small food processors and producers who have less than $500,000 worth of annual sales (CFA, 2010). Clarifying language regarding the definition of "direct sales" was introduced by Senator Jon Tester as an amendment to the food safety bill. The Tester Amendment, as it has become to be known, requires the FDA to "clarify that direct sales of food to consumers includes sales that occur other than where the food was manufactured, such as at a roadside stand or farmer's market" (Tester Amendment, n.d.)

Because many of the provisions of the Food Safety Modernization Act have yet to be implemented and funding for the new activities has not been appropriated, the full impact of the new legislation remains to be known. Despite this, few empirical research studies have been conducted to determine whether a relationship exists between the size of a farm on which a grower works and his/her attitudes about on-farm food safety.

Pennsylvania offers a compelling case of study through which this phenomena can be examined Multiple foodborne illness outbreaks have plagued the state. According to Scharff (2010), Pennsylvania ranks sixth among the 50 states and the District of Columbia for the higher number of foodborne illnesses in the United States. In addition, an increasing number of supermarkets in Pennsylvania are requiring that growers from whom they buy fresh fruits and vegetables provide evidence of GAP compliance, such as having participated in GAP training, having developed a food safety plan, or having passed third-party audits for on-farm food safety practices (Tobin et al., 2011). According to the Agricultural Marketing Service (AMS) of the USDA, over 130 farms in Pennsylvania were GAP certified as of March 2011 and approximately 40 percent of these farms received certification covering more than one crop. Because most Pennsylvania growers are diversified, small operations, Pennsylvania grower perceptions regarding food safety policy can provide valuable insight about establishing scale-appropriate

food safety standards for small farms and how extension educators can best help growers learn about food safety standards.

Purpose

The purpose of this study was to explore anecdotal suggestions that growers on small farms tend to be more civic-minded and therefore more conscientious about their on-farm growing practices. Specifically, this study examined whether there is a significant difference between growers on small farms and growers on large farms with regards to attitudes about on-farm food safety.

Methods

In March 2009, Penn State Cooperative Extension conducted the teleconference workshop "*On-Farm Food Safety Practices*." The day-long workshop provided growers with information about implementing GAPs on their farms. Participants completed a questionnaire reporting their knowledge, attitude and intentions for implementing GAPs. To assess grower attitudes, growers were asked to rate their agreement with five statements on a five-point Likert scale (1 = do not agree to 5 = very much agree). Statements reflected attitudes about responsibility for food safety, voluntary implementation of GAPs practices, the affect of consumer perceptions, and the value of the USDA food safety audit.

Farm-size classes were defined using the value of the total farm sales variable from the 2007 Census of Agriculture**.** Small farms are those that annually earn $249,000 or less in gross farm sales and larger farms are those that annually earn $250,000 or more in gross farm sales. Using this classification, a majority of the growers represented small farms (71%).

Overall, 227 participants submitted a completed (or partially completed) questionnaire. However, the number of responses for each item varied, because fewer individuals answered the questionnaire in its entirety. Data was analyzed using SSS software. Independent t-tests were conducted to test whether significant differences in means between growers on small farms and growers on large farms with regards to attitudes about on-farm food safety. Effect size also is reported. According to Cohen (1998), effect sizes of less than 0.2 are small, *0.3-0*.5 are medium, and greater than 0.8 are large.

Results

Demographics

Survey respondents were from diverse geographic regions within Pennsylvania. The percentage of respondents from farms located in the Northeast (27.8%), Southeast (34.8%), and Western (28.6%) regions of Pennsylvania was nearly evenly distributed. The fewest number of respondents were from the Central region (8.8%), which also is the region from where the teleconference workshops were broadcast. More of the respondents were male (83.5%) than female (16.5%). Nearly two-thirds of the respondents (62.1%) reported that more than 60 percent of their income is derived from the sale of fruits and vegetables. Approximately two-thirds of respondents (66.4%) reported that they sell their produce to retailers in Pennsylvania; approximately one third only sell their produce at direct market outlets, such as farmers' markets. Refer to Table 1 for more information about the demographics of the respondents.

Table 1

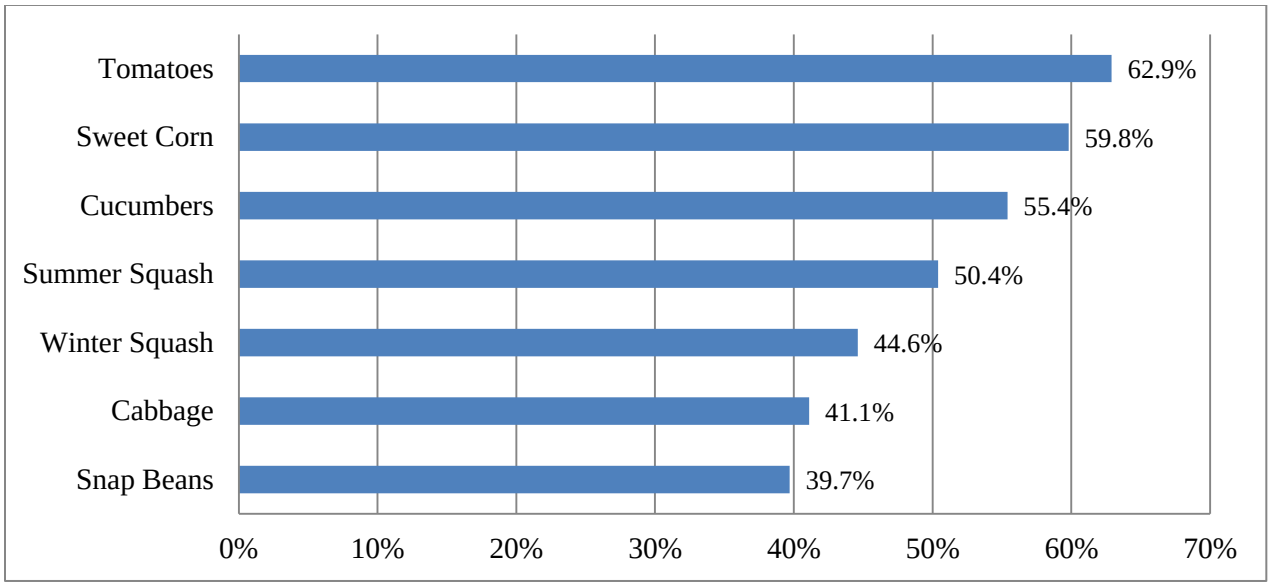
Demographics of Respondents

Variable	Disaggregation	Frequency	Percent
Region	Central	20	8.8
	Northeast	63	27.8
	Southeast	79	34.8
	Western	65	28.6
	Total	227	100
Gender	Male	182	83.5
	Female	36	16.5
	Total	218	100.0
Farm Size by Gross Farm Sales	Small, Low Sales (< $99,999)	80	45.2
	Small, High Sales ($100,000 - $249,999)	46	26.0
	Large ($250,000 - $499,999)	15	8.5
	Very Large (> $500,000)	36	20.3
	Total	177	100.0
Percent of Income from Fruits & Vegetables	1 – 19 %	18	9.9
	20 – 39 %	14	7.7
	40 – 59 %	37	20.3
	60 – 79 %	26	14.3
	80 – 100 %	87	47.8
	Total	182	100
Currently Selling to Grocery Stores	Yes	150	66.4
	No	76	33.6.6
	Total	226	100

In addition, respondents were asked to check on a list which crops are grown on their farm. Of the more than 40 crops listed, respondents identified seven "top crops" - tomatoes, sweet corn, cucumbers, summer squash, winter squash, cabbage, and snap beans. The percentage of respondents that grow each of these top crops is presented in Figure 1.

Figure 1

Percentage of Respondents Growing Top Crops (n=227)



Relationship between Farm Size and Grower Perception

Independent t-tests were conducted to test if a significant difference exists between growers on small farms and growers on large farms with regards to attitudes about on-farm food safety at the completion of a day-long workshop about on-farm food safety practices. A t-test revealed a statistically significant difference between the mean attitudinal score of small farm growers (M = 4.74, s = 0.57) and of large farm growers (M = 4.50, s = 0.65) for the statement on grower responsibility for the safe produce; t(77.95) = 2.22, p= 0.029. (See Table 2.) The statement was *"I am responsible for the safety of produce coming off my farm."*

Table 2

T-test results comparing small farm grower and large farm grower attitudes about grower responsibility for safe produce

Farm Size	n	Mean	SD	t	df	p-value	Cohen's d
Small Farm Growers	119	4.74	0.57	2.22	77.95	0.029*	0.50
Large Farm Growers	48	4.50	0.65				*(Medium effect)*
Total	167						

*Significant at $p<0.05$

In addition, a t-test revealed a statistically significant difference between the mean attitudinal score of small farm growers (M = 4.71, s = 0.61) and of large farm growers (M = 4.40, s = 0.62) for the statement on shared responsibility for food safety; t(165) = 2.04, p= 0.043. (See Table 3.) The statement was *"Food safety is a shared responsibility among growers, packers, processors, and retailers."*

Table 3

T-test results comparing small farm grower and large farm grower attitudes about shared responsibility for food safety

Farm Size	n	Mean	SD	t	df	p-value	Cohen's d
Small Farm Growers	119	4.71	0.61	2.04	165	0.043*	0.32
Large Farm Growers	48	4.50	0.62				*(Medium effect)*
Total	167						

*Significant at $p<0.05$

Unlike for the statements about food safety responsibility, a t-test failed to reveal a statistically significant difference between the mean attitudinal score of small farm growers (M = 4.07, s = 1.28) and of large farm growers (M = 3.68, s = 1.27) for the statement on the voluntary implementation of on-farm food safety practices; t(162) = 1.80, p= 0.075. (See Table 4.) The statement was *"Implementing on-farm food safety practices should be voluntary."*

Table 4

T-test results comparing small farm grower and large farm grower attitudes about voluntary implementation of on-farm food safety practices

Farm Size	n	Mean	SD	t	df	p-value	Cohen's d
Small Farm Growers	117	4.07	1.28	1.80	162	0.075	0.28
Large Farm Growers	47	3.68	1.27				*(Small effect)*
Total	164						

A t-test also failed to reveal a statistically significant difference between the mean attitudinal score of small farm growers (M = 4.53, s = 0.82) and of large farm growers (M = 4.43, s = 0.65) for the statement on the affect of consumer perceptions; t(165) = 0.756, p= 0.451. (See Table 5.) The statement was *"How consumers feel about the safety of my farm's produce affects how much produce my farm sells."*

Table 5

T-test results comparing small farm grower and large farm grower attitudes about the affect of consumer perceptions

Farm Size	n	Mean	SD	t	df	p-value	Cohen's d
Small Farm Growers	119	4.53	0.82	0.756	165	0.451	0.11
Large Farm Growers	48	4.43	0.65				*(Small effect)*

Total	167						

Finally, a t-test failed to reveal a statistically significant difference between the mean attitudinal score of small farm growers (M = 3.50, s = 1.35) and of large farm growers (M = 3.72, s = 1.21) for the statement obtaining a USDA food safety audit; t(165) = 0.790, p= 0.301. (See Table 6.) The statement was: *"Getting a USDA food safety audit will help my farm sell more produce."*

Table 6

T-test results comparing small farm grower and large farm grower attitudes about obtaining a USDA food safety audit

Farm Size	**n**	**Mean**	**SD**	**t**	**df**	**p-value**	**Cohen's d**
Small Farm Growers	119	3.50	1.35	0.790	165	0.301	0.12
Large Farm Growers	48	3.72	1.21				*(Small effect)*
Total	167						

Discussion and Implications

The purpose of this study was to explore anecdotal suggestions that growers on small farms tend to be more civic-minded and therefore more conscientious about their on-farm growing practices. Specifically, this study examined whether there is a significant difference between growers on small farms and growers on large farms with regards to attitudes about on-farm food safety. Growers rated their agreement with five statements on a five-point Likert scale (1 = do not agree to 5 = very much agree). A significant difference was found to exist between small farm growers and large farm growers and their reported attitudes about individual and

shared responsibility for food safety. No significant differences were found to exist between small farm growers and large farm growers in this sample with regards to attitudes about voluntary implementation of GAPs practices, the affect of consumer perceptions, and the value of the USDA food safety audit. These findings suggests that there is some evidence to support the anecdotal claims that small farmers are more civic-minded. Because they are more likely to agree that they are responsible for food safety, small farm growers may be more inclined than large farm growers to take more care to ensure that the food they grow is deemed safe.

Because this study was explanatory, future research could expand the survey to examine if differences exist with regards to knowledge and skills or confidence in implementing GAPs. In addition, future research is needed to understand if these differences exist in other states or even other countries. Identifying the existence of differences in grower attitudes about on-farm food safety can help food safety experts and policymakers establish scale-appropriate standards and provide extension educators and other stakeholders in the food system with useful information for the design of on-farm food safety educational programs.

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Thomson, J., Radhakrishna, R., & **Bagdonis, J.** (2011). Extension educators' perceptions of the local food system. Journal of Extension [On-line], 49(4), Article 4RIB4. Available at: http://www.joe.org/joe/2011august/rb4.php

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