Motivations, challenges, benefits, and educational needs associated with organic grain farming adoption in Iowa

by

Guang Han

A dissertation submitted to the graduate faculty in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Co-majors: Sustainable Agriculture; Agricultural Education (Agricultural Extension Education)

Program of Study Committee:
Nancy Grudens-Schuck, Co-major Professor
Robert A. Martin, Co-major Professor
J. Gordon Arbuckle Jr.
Kathleen Delate
David J. Peters

The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University
Ames, Iowa

2020

Copyright © Guang Han, 2020. All rights reserved.
DEDICATION

This dissertation is dedicated to all researchers, educators, and practitioners in the area of sustainable agriculture. May the world’s food and agriculture systems become more sustainable, resilient, and beautiful.
# TABLE OF CONTENTS

ACKNOWLEDGMENTS ........................................................................................................... vi

ABSTRACT ................................................................................................................................. viii

CHAPTER 1. INTRODUCTION ................................................................................................... 1
  Background ................................................................................................................................. 1
  Low Adoption of Organic Grain ............................................................................................... 2
  Barriers to Organic Grain Farming Adoption ........................................................................... 4
  Lack of Educational Support for Organic Farming ................................................................. 4
  Needs for Studying Factors that Influence the Adoption ......................................................... 5
  Purpose of Study and Research Questions ............................................................................. 6
  Dissertation Organization ........................................................................................................ 7
  Definitions of Selected Terms ................................................................................................... 8
    Organic Agriculture ................................................................................................................ 8
    Organic Farm .......................................................................................................................... 8
    Conventional Agriculture ...................................................................................................... 8
    Extension ............................................................................................................................... 8
    Adoption ............................................................................................................................... 9
    Innovation ............................................................................................................................. 9
    Motivation ............................................................................................................................. 9
  Summary ................................................................................................................................... 9

CHAPTER 2. LITERATURE REVIEW ......................................................................................... 11
  Introduction ............................................................................................................................... 11
  Adoption: Diffusion of Innovation ......................................................................................... 11
    Elements of Diffusion ............................................................................................................ 11
    Model of Innovation-Decision Process ................................................................................. 13
    Attributes of Innovation ....................................................................................................... 15
    Types of Adopters ................................................................................................................ 18
  Motivation: Self-Determination Theory ................................................................................. 20
  Behavior: The Theory of Planned Behavior ........................................................................... 23
  Alternative Agriculture Paradigm ............................................................................................ 30
  Education and Extension ......................................................................................................... 33
  Summary of Literature Review ............................................................................................... 37

CHAPTER 3. MOTIVATIONS AND CHALLENGES FOR ADOPTION OF ORGANIC GRAIN PRODUCTION: A QUALITATIVE STUDY OF IOWA ORGANIC FARMERS ......42
  Abstract ................................................................................................................................. 42
  Introduction ............................................................................................................................... 42
  Demand .................................................................................................................................... 43
  Externality ............................................................................................................................... 44
  Adoption, Motivations, and Challenges .................................................................................. 44
  Theoretical Framework .......................................................................................................... 47
CHAPTER 5. MOTIVATIONS, GOALS, AND BENEFITS ASSOCIATED WITH U.S. CORN BELT PROGRAM DELIVERY FORMATS FOR ORGANIC GRAIN PRODUCERS IN THE U.S. CORN BELT

Diffusion of Innovation
Self-Determination Theory
Theory of Planned Behavior
Methods
Sample and Participants Characteristics
Results
Motivations for Adopting Organic Grain Farming
Challenges for Farmers to Adopt Organic Grain Farming
Discussion
Motivations Embedded into Theories
Evolving Challenges for Organic Grain Farming
Conclusions
Acknowledgments
References

CHAPTER 4. ADOPTION CHALLENGES, EXTENSION PROGRAM NEEDS, AND PROGRAM DELIVERY FORMATS FOR ORGANIC GRAIN PRODUCERS IN THE U.S. CORN BELT

Abstract
Introduction
Diffusion of Innovation and Extension Education
Methods
Results and findings
Challenges of Organic Grain Farming Adoption
Extension Programming Needs
Effectiveness of Extension Education Delivery Formats
Discussion
Long-Standing and Shifting Challenges
Challenges Drive Program Needs
Social Learning, Peer Learning, and Mentoring
Conclusion, Recommendations, and Limitations
Acknowledgments
Disclosure Statement
References

CHAPTER 5. MOTIVATIONS, GOALS, AND BENEFITS ASSOCIATED WITH ORGANIC GRAIN FARMING BY PRODUCERS IN THE IOWA, US

Abstract
Introduction
Theories and Conceptualization
Materials and Methods
Study Site
Overall Approach
Survey Construction
Sample and Data Collection
Data Analysis
Results and Interpretation
ACKNOWLEDGMENTS

I would like to first thank my family members, including my parents, parents-in-law, sister, and especially my lovely wife. I am thankful to these special people in my life who love me, uplift me, comfort me, and bring joy to my soul. Without you, I would not be where I am today.

Next, I express my appreciation to the committee members. Dr. Martin has been my mentor for the past eight years. His kindness, support, and fatherly care for an international student like me have always encouraged me to pursue my dream. At the same time, I am also very grateful for Dr. Grudens-Schuck’s mentoring for grant writing, research project management, qualitative research, and manuscript writing. Her dedication to the feedback provided high-standard requirements to make me a better researcher. I want to sincerely thank Dr. Arbuckle for mentoring me in conducting survey research and bringing me other fantastic research opportunities. It was my privilege to be a part of the J-Crew lab. Those conversations and discussions inspired me to pursue an academic career in the area of social-agroecology. I deeply appreciate Dr. Delate’s help and guidance for this research project. It was Dr. Delate’s organic agriculture class that first brought me to the world of organic agriculture. Dr. Delate used her expertise to help me develop my interview questions, and used her professional network to help me recruit research participants and share research information. I would like to thank Dr. Peters’ guidance on statistical analysis. Most of the statistical analysis techniques used in this dissertation were learned through Dr. Peters’ classes.

I give many thanks to the granters and partners of this dissertation research. This research was funded through USDA- Sustainable Agriculture Research and Education (SARE) #GNC16-221. This work was also supported by the Iowa Agriculture and Home Economics Experiment
Station, Ames, Iowa, USA Project No. 3813 sponsored by the Hatch Act and State of Iowa funds. I also gratefully acknowledge the following organizations for their help with this research: Practical Farmers of Iowa, Iowa Organic Association, and Iowa State University Organic Agriculture Program.

In addition, I want to express my gratitude for the teaching and research assistantship opportunities offered by Dr. Retallick, Dr. Martin, and Dr. Qu in the Department of Agricultural Education and Studies; the Sustainable Agriculture Program; the Midwest Climate Hub; and Bioeconomy Institute at Iowa State University. These opportunities not only financially helped me with the costs of attending graduate school, but also developed my professional skills in both teaching and research.

Finally, I thank many of my friends and colleagues in the J-Crew Lab, Department of Agricultural Education and Studies, the Sustainable Agriculture Program, the Hospitality Management program, and the School of Education at Iowa State University, for the support I have received during these years. I am very appreciative to those who were willing to participate in my interviews and surveys, without whom, this dissertation would not have been possible.
The low adoption rate of organic grain production in the United States contrasts with strong consumer demands for organic foods. The low adoption of organic grain farming has constrained further development of the organic sector. Organic agriculture stakeholders have appealed to increase domestic organic grain production. The federal government has provided support for research and extension education regarding organic farming. However, low adoption persists. A better understanding of cognitive and motivational aspects of farmer’s decision making could help policymakers, agricultural scientists, and extension educators to encourage more farmers to adopt organic grain production. This study identified (1) factors that motivated farmers to adopt organic grain farming; (2) challenges that hindered farmers’ adoption of organic grain farming; (3) benefits farmers experienced after adopting organic grain farming; (4) farmers’ needs for extension education regarding organic grain farming; and (5) educational program delivery formats preferred by farmers who raise organic grain crops. I conducted in-depth interviews with seventeen Iowa organic grain farmers. Based on the responses from the interviews, I designed a survey incorporating multiple, five-point scales and administered the instrument to all farmers (672) who raised organic grain in Iowa. Farmers reported five motivations to adopt organic grain farming, which included profitability, personal safety, natural resources stewardship, consumers and public health, and honor and tradition. Challenges to adopting organic grain farming included elements of organic farming operation, particularly weeds; marketing, particularly access to organic hay, small grains and transitional crops markets; policies, particularly complex certification; finance, especially during the transitional period; inputs and information, mainly in the local level; social pressures from conventional farmers. Five areas of benefits associated with organic grain farming consisted of increased profitability,
addressed health concerns, improved natural resources, validation of values and beliefs, and positive social interactions with other organic farmers. Benefits associated with organic grain farming mostly aligned with farmers’ original adoption motivations and long-term goals. Finally, farmers expressed needs for more extension programs that provided education, research, and technical services. Field days, one-on-one mentors, and farmer-to-farmer workshops were rated as highly effective delivery formats by the organic grain farmers.
CHAPTER 1. INTRODUCTION

Background

The U.S. has a vigorous market for organic food (IFOAM, 2020; Willer & Lernoud, 2019). At the end of 2016, organic food sales in the U.S. set a record $47 billion, to make the U.S. the world’s largest organic market, which outcompeted the entire European Union’s organic food market (OTA, 2017; Willer & Lernoud, 2018). Organic food sales accounted for 5.5% of the total U.S. food sales in 2016 and the organic sector continues to increase its market share in the total American food market system (OTA, 2017).

Consumers’ fast-growing demands for organic food require a large supply of organic grains for domestic organic food processing and animal feeding (Greene et al., 2009; Li et al., 2007; Reaves et al., 2019). However, low production of organic grain farming among American farmers has led to recurring shortages of organic grain in the U.S. (Charles, 2017; Greene et al., 2009). Shortages of domestic organic grain supplies have restricted further development of the organic food processing sector. Some organic food processors cut their product lines, due to an insufficient supply of organic ingredients (Roseboro, 2015). At the same time, organic livestock farmers indicated the availability and affordability of organic feed were their biggest challenges (Digiacomo & King, 2015). Under-supply and lack of access to organic feed became barriers for conventional livestock producers entering the organic sector, as well as a causal factor that organic livestock producers deregister from organic certification (Sierra et al., 2008).

Supply can come from increased production per acre or increased acres in production (or both). Although organic grain yield per acre has increased since 2008, the average yield of organic grain tends lower than conventional grain (Reaves et al., 2019). Hence, increased supply likely depends on increased adoption rather than increased yield.
Low Adoption of Organic Grain

The adoption of organic farming in the U.S. has remained at a low level, no doubt contributing to low supplies relative to the market share. The U.S. had 5.02 million acres of farmland under certified organic operation in 2016, accounting for only 0.5% of the country’s farmland (USDA NASS, 2014; USDA NASS, 2017). Correspondingly, the number of certified organic farms accounted for 0.69% of the total number of farms in the U.S. (USDA NASS, 2017; 2018). The adoption rate of organic grains was even lower. Organic corn acreage represented only 0.24% of the nation’s total corn acreage; organic soybean acreage is 0.16% of the total soybean acreage (USDA NASS, 2014; 2017). Small grains have slightly higher organic adoption rate than corn and soybean (organic wheat: 0.68%, organic oat: 4.7%, organic barley: 1.5%, and organic rice: 1.1%), and small grains had fewer total production acreage than corn and soybean.

A low adoption rate limits organic farming from delivering potential benefits consistent with a definition of sustainable agriculture. In the U.S. Corn Belt, surface water is contaminated with sediment, phosphorus, and nitrogen from fertilizers and pesticides (Hendricks et al., 2014; Jacobson et al., 2011). Excess nutrients from the Corn Belt states have contributed to a hypoxic “dead zone” in the Gulf of Mexico by way of the Mississippi River (Jacobson et al., 2011). Increased adoption of organic farming in the Corn Belt could help address these issues because organic farming systems can mitigate pollution by reducing nitrate leaching, soil erosion, and pesticide residue in the environment (Cambardella et al., 2015; Tuomisto et al., 2012). Organic farming practices can also increase soil organic matter content, improve biodiversity, and lower fossil energy consumption (Delate et al., 2015; Pimentel et al., 2005; Tuomisto et al., 2012). Besides providing environmental benefits, organic farming can also be considered an
economically-sound farming system. Organic farming can reduce production costs and bring a price premium to farmers, which improves the overall farming profitability (Nieberg & Offermann, 2000; Posner et al., 2008). Long-term comparison studies show organic grain farming systems can achieve yields that compete with conventional counterparts (Delate et al., 2013). Marasteanu and Jaenicke (2018) examined the economic impact of nationwide organic hotspots (areas with high organic agricultural production and processing activities) in the U.S. These researchers concluded organic hotspots benefit the county-level economy, lower the local poverty rate, and increase median household income (Marasteanu & Jaenicke, 2018). Studies in Europe also show organic farming can provide rural development benefits that include increasing farming incomes, securing farming livelihoods, reconnecting farmers and consumers, generating employment, adding value to agricultural products, and retaining income in the local economy (Darnhofer, 2005; Lobley et al., 2009; Toader & Roman, 2015). Therefore, these scholars advocated organic farming to promote economic growth in rural areas and to transform agricultural production into a more sustainable farming system.

**Calls for Increasing Organic Grain Farming Adoption**

An increase in the adoption of organic grain farming could further boost the entire organic sector's development. Organic dairy, poultry, and livestock producers, food processors, and consumers have been strongly calling for increased domestic organic grain supplies (Alonzo, 2016; Doering, 2015; OTA, 2019; Roseboro, 2016; Silva et al., 2012; Singh, 2015). Major organic food companies and organizations recently formed an initiative—the U.S. Organic Grain Collaboration (Sustainable Food Lab, 2020). This initiative claimed an increasing domestic organic grain supply could help stabilize prices for necessary input and strengthen the organic sector in the U.S. (Sustainable Food Lab, 2020). Moreover, because grain operations have larger
operating acreages than other agricultural enterprises, an increase in organic grain farming could lead to a wider, fundamental improvement in the environment, farm viability, and rural communities.

**Barriers to Organic Grain Farming Adoption**

Organic grain farming adoption requires farmers to make systemic changes in their operations and farmers may encounter many barriers to adopt organic grain farming (Duram, 1999; Padel, 2001; Schneeberger et al., 2002). Since the National Organic Program (NOP) requires farmland to have no applied synthetic fertilizers and pesticides for the past 36 months, it usually takes three years to convert conventional farmland into certified organic farmland. Farmers are not allowed to sell their products as organic products until the end of this transition period (USDA AMS, 2016). The three-year transition period may increase farmers’ financial risk, due to low yields and no organic price premium (Constance & Choi, 2010; Duram, 1999). Organic grain farming, to some extent, may challenge traditional agricultural values that bring social pressure to organic farmers (Padel, 2001; Sullivan, 1996). As the NOP restricts the use of any synthetic chemicals for organic production, farmers need to learn different farming techniques and strategies, such as performing cultivation, planning rotations, introducing biological control, adjusting planting time and seeding rates, growing different crops, and exploring new markets (Duram, 1999; Hanson et al., 2004).

**Lack of Educational Support for Organic Farming**

Organic farming relies on information and knowledge (Delate & Dewitt, 2004; Padel, 2001). However, early in the history of organic farming in the U.S., agriculture information sources, such as conventional agricultural input dealers, crop advisors, and most extension educators were unable to provide adequate information for organic farming methods (Constance
& Choi, 2010; Duram, 1999; Hanson et al., 2004). More recently, supported by the USDA Sustainable Agriculture Research and Education program, state-level extension educators, university researchers, and non-profit organizations started to invest their roles as educators and information sources for sustainable agriculture practices (Poincelot et al., 2006). Empirical studies (Agunga & Igodan, 2007; Delate & Dewitt, 2004; Hanson et al., 2004; Suvedi et al., 2010) reported organic farmers generally have a favorable attitude towards extension educators, but they expressed a need for more extension programs—specifically for organic farming. USDA-NIFA (2019) established an Organic Agriculture Research and Extension Initiative to encourage land-grant universities and agricultural organizations to develop and deliver more extension education and research programs to promote organic farming and address issues related to organic agriculture.

**Needs for Studying Factors that Influence the Adoption**

Organic stakeholders and scholars have called for an increase in domestic organic grain production. However, it comes down to the people who manage farms. They decide on the production practices used. Producers have complex motivations, needs, and situations for decisions they make for themselves, their farms, and their family situations. Therefore, organic agricultural specialists, extension educators, and policy-makers need to recognize cognitive and motivational factors of a farmer’s decision-making and understand how these factors influence adoption decisions (Abadi et al., 2020; Mills et al., 2018).

Motivations that impel farmers to adopt organic farming should be addressed in the relevant extension education programs (Charatsari et al., 2017; Triste et al., 2018). Rogers (2003) called for extension educators to increase understanding of people’s motivations for adopting this innovation. Trout et al. (2006) recommended outreach and extension programs should stimulate
farmers’ learning to accelerate organic farming conversion. They recommended agricultural extension educators and organic agriculture specialists identify challenges that impeded farmers’ adoption of organic grain farming. Organic farmers’ adoption decisions will be reinforced if farmers experience benefits of organic grain farming that align their original motivations and goals (Rogers, 2003). By recognizing the benefits of organic grain farming perceived by farmers, extension educators and organic specialists can help farmer audiences draw a mental picture about the positive consequences that can be brought by adopting organic grain farming (Trout et al., 2006). Sanders and Maunder (1966) emphasized, “extension must be directed toward satisfying the needs of people, and must be started at the population’s own level of understanding” (p. 10). Therefore, to develop effective extension programs, extension educators and organic specialists must assess farmers’ needs. Finally, extension educators could find value in developing communication messages, such as educational content and topics based on a clienteles’ needs, and deliver the messages through effective communication channels and formats (Rogers 2003; Seevers et al., 2007). These principles could be more frequently applied to the content area of organic farming education.

**Purpose of Study and Research Questions**

The overall purpose of this dissertation research project was to increase the understanding of factors that influence farmers’ decisions to adopt organic grain farming, and to fill the gap in the body of knowledge. Specific research questions were:

1) What are the factors that motivated farmers to adopt organic grain farming?

2) What are the challenges that impeded farmers’ adoption of organic grain farming?

3) What are the benefits that farmers experienced after adopting organic grain farming?
4) What are the extension programs that farmers needed regarding organic grain farming?

5) What are the effective educational program delivery formats preferred by organic grain farmers?

**Dissertation Organization**

This dissertation is composed of six chapters. Chapter 1 provides background, problem statements, needs for study, the overall purpose of the study, and research questions for this dissertation research project.

Chapter 2 introduces the theoretical frameworks that guided this research and includes a review of studies related to farmer’s adoption decisions on organic farming, and educational approaches and limitations with respect of education to organic farmers and producers who are in a position to investigate organic practices.

Chapter 3 provides a manuscript intended for publication in the journal, *Agriculture and Human Values*. This manuscript is based on findings from qualitative data collected by 17 in-depth interviews with farmers.

Chapter 4 is a manuscript intended for publication in *The Journal of Agricultural Education and Extension*. This manuscript is based on results of quantitative data collected through surveys from 258 farmers.

Chapter 5 is a manuscript intended for publication in the journal, *Agricultural Systems*. This manuscript examines the relationships between farmers’ perceived benefits of organic grain farming, their original adoption motivation, and long-term goals.

Chapter 6 provides General Conclusions which synthesize the findings across the previous chapters and provides recommendations for future research.
Definitions of Selected Terms

**Organic Agriculture**

The National Organic Standards Board defined organic agriculture as:

[The] ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony. (Gold, 2007, para. 1)

**Organic Farm**

Organic farms follow organic agricultural production principles and practices. In this study, organic farms refer to certified organic farms and transitional certified organic farms in accordance with the NOP.

**Conventional Agriculture**

Conventional agriculture is the farming system relying on:

Rapid technological innovation; large capital investments in order to apply production and management technology; large-scale farms; single crops/row crops grown continuously over many seasons; uniform high-yield hybrid crops; extensive use of pesticides, fertilizers, and external energy inputs; high labor efficiency; and dependency on agribusiness. (Gold, 1999, para. 13)

**Extension**

Extension provides non-formal education and learning activities to farmers and other residents of rural communities as well as to people living in urban areas. It emphasizes taking knowledge gained through research and education and
bringing it directly to the people to create positive changes. (USDA NIFA, 2019b, para 1-2)

**Adoption**

Adoption is “a decision to make full use of an innovation as the best course of action available” (Rogers, 2003, p. 177).

**Innovation**

“An innovation is an idea, practice, or object that is perceived as new by individuals or units of adoption” (Rogers, 2003, p. 12).

**Motivation**

Motivation is defined generally as “the psychological process that initiates, guides, and maintains human behavior” (Sichler, 2014, p. 1204).

**Summary**

The low adoption rate of organic farming in organic grain operations became a bottleneck in the organic sector’s development. It also constricts broader environmental impacts and socioeconomic benefits that organic farming systems should have presented. The USDA encourages land-grant universities and agricultural organizations to develop and deliver extension education and research programs to promote organic farming and solve some of the organic agriculture production supply and demand-related issues. This research aims to help extension educators and organic specialists understand farmers’ decisions and the processes of organic grain farming adoption by identifying farmers’ motivations, challenges, benefits, and specific needs for extension education programs. Through farmer interviews and surveys, this research project will have implications for land-grant university extension and agricultural
organizations to further development and delivery of programs for organic grain farmers and for producers who are willing to investigate adding organic practices to their operation.
CHAPTER 2. LITERATURE REVIEW

Introduction

The literature review incorporates both theories and empirical studies related to organic farming adoption. The literature is presented in five sections: 1) adoption: diffusion of innovation, 2) motivation: self-determination theory, 3) behavior: the theory of planned behavior, 4) alternative agriculture paradigm, and 5) education and extension.

Adoption: Diffusion of Innovation

The theory of diffusion of innovation (DOI) was synthesized and popularized by Rogers (1962), built upon earlier studies, mainly from sociology, communication, and education. DOI has been widely used by researchers, extension, and outreach professionals in the U.S. Cooperative Extension Service (CES), land-grant universities, and worldwide, and contributed to forming a classical agricultural extension model (National Research Council, 2002; Rogers, 2003). In addition to the diffusion of agricultural technologies, such as weed sprays, fertilizers, and new crop varieties (Rogers, 2003), this theory was utilized to predict and follow adoption of sustainable agriculture approaches, including organic farming systems (McCann et al., 1997; Padel, 2001; Stofferahn, 2009; Wiegel, 2009).

Elements of Diffusion

Diffusion is defined as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 5). The four elements of DOI include “innovation, communication, time, and a social system” (Rogers, 2003, p. 11). Padel (2001) thoroughly compared the different features between typical agricultural technologies and organic farming as innovations. Table 1 also provides typical features of
agricultural technology diffusion and unique features of organic agriculture diffusion for each element.

### Table 1
**Elements of Diffusion of Innovation**

<table>
<thead>
<tr>
<th>Elements</th>
<th>Definition</th>
<th>Typical features of agricultural technologies diffusion</th>
<th>Unique features of organic agriculture diffusion</th>
</tr>
</thead>
</table>
| Innovation | “Idea, practice, or object that is perceived as new by individuals or units of adoption” (Rogers, 2003, p. 12) | • Easily adopt  
• Obvious economic advantages and low risks  
• Technology-based  
• Single/partial change | • Potential economic loss with high risks  
• Knowledge and information-based  
• Systemic change |
| Communication | “The process by which participants create and share information with one another to reach a mutual understanding” (Rogers, 2003, p. 18) | • Top-down communications  
• Agricultural extension service  
• Agro-chemical and seed companies | • Bottom-up communications  
• Inter farmer communications  
• Grass-roots organizations |
| Time | “The time length of innovation-decision process/ earliness of adoption/ time to take for reaching a specific adoption rate” (Rogers, 2003, p. 20) | • S-shape curve  
• Take-off with early adopters  
• Immediacy | • Slower pace  
• Long-term |
| Social system | “A set of interrelated units that are engaged in joint problem solving to accomplish a common goal” (Rogers, 2003, p. 23) | • Compatible with existing rural community values and social norms  
• External | • Challenge the existing rural community values and social norms  
• Self-help networks |

*Note. This table is based on studies by Rogers (2003) and Padel (2001).*

Although there are differences between the diffusion of agricultural technology for use in conventional agriculture versus in organic farming, Padel (2001) concluded DOI is still applicable to the studies of organic farming adoption because the diffusion of organic farming...
also requires the same four elements and generally follows a similar diffusion process, but with a slower diffusion rate. Responding to the critics on use of DOI to study adoption of organic farming, Padel provided suggestions for future scholars to employ in the context of studying organic adoption:

1) Researchers should pay attention to farmers’ lifestyle choices and subsistence goals among early adopters.

2) Besides personal and farm characteristics, researchers should pay attention to economic, structural, and institutional circumstances.

3) Researchers and extension professionals should pay attention to the “bottom-up” diffusion approach and “two-way” communications for organic farming adoption rather than the traditional “top-down” technology transfer approach used in cooperative extension.

4) Extension activities should target farmers who lack information about organic farming (pp. 54-55).

**Model of Innovation-Decision Process**

Another contribution of the DOI is the model for the Innovation-Decision Process. This theory indicates individuals need to go through an innovation-decision process to successfully adopt an innovation (Rogers, 2003). The five stages of the innovation-decision process include knowledge, persuasion, decision, implementation, and confirmation (Figure 1).

Based on this model, an individual should first have basic knowledge or awareness of innovation at the knowledge stage (Rogers, 2003). Individuals’ knowledge or awareness of innovation is influenced by their “socioeconomic characteristics, personalities, communication
Figure 1. Model of the Innovation-Decision Process (Rogers, 2003).

behavior” (Rogers, 2003, p. 170). At the persuasion stage, the individual mentally applies the innovation to the situation and evaluates the innovation according to these five attributes—relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). Then, the individual forms a favorable/unfavorable attitude towards the innovation, based on his/her evaluation. At the decision stage, the individual decides to accept/reject adoption of the innovation. If the individual decides to adopt the innovation, he/she will implement the innovation in a real-world setting, and possible re-invention could occur (Rogers, 2003). Finally, after a real-world implementation and evaluation of the advantage or disadvantage, individuals’ adoption decisions may be reinforced or discontinued (Rogers, 2003).

In the model of the innovation-decision process, communication of the relevant knowledge and information about the innovation plays a vital role at each stage. In the process of adopting innovation, potential adopters continuously seek and process relevant knowledge and information to reduce uncertainty about the innovation (Rogers, 2003). Relevant knowledge about innovation includes awareness knowledge, principle knowledge, implementation knowledge, and confirmation knowledge (Rogers, 2003).
Attributes of Innovation

The theory of DOI indicates the rate of adoption of an innovation is mainly determined by people’s perceptions of five attributes of the innovation. The five attributes are: “(1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability” (Rogers, 2003, p. 221) (Table 2). Wiegel (2009) empirically studied the attributes of organic farming as an innovation. Building upon Rogers’ (2003) theoretical descriptions, Wiegel (2009) contributed to the body of literature with each attribute’s measurement (Table 2).

To find out how farmers perceived the advantages and compatibility of organic farming, Wiegel (2009) made parallel comparisons between farmers from different commodity groups (grain, vegetable, livestock, and dairy). Wiegel found grain and vegetable farmers rated more advantages of organic farming than livestock and dairy farmers because of the availability of price premium and possible better profitability. Regarding compatibility, Wiegel found all farmers perceived organic farming as compatible with their values and long-term farming goals, including profitability, environmental benefits, animal welfare, health benefits, food safety, and less off-farm inputs (pp. 46-45). Noticeably, for organic livestock, dairy, and vegetable farmers, maximizing profits is secondary to other values, such as environmental concerns and animal welfare, but grain farmers prioritize profitability (Wiegel, 2009).

Wiegel (2009) also studied organic farming’s challenges from the standpoint of complexity. He distinguished the challenges of organic farming between different types of organic farmers in Missouri. For grain farmers, pest management is one of the greatest challenges, particularly for the complexity of weed control coupled with adverse climates (Wiegel, 2009). Besides, grain farmers perceived organic grain marketing highly complex
Table 2
Attributes of Innovation and Measurements

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Descriptions</th>
<th>Measurements</th>
</tr>
</thead>
</table>
| Relative advantage | “The degree to which an innovation is perceived as better than the idea it supersedes” (Rogers, 2003, p. 238). | • Economic factors
                      |                                                                               | • Comfort and time
                      |                                                                               | • Incentive payments
                      |                                                                               | • Immediacy of reward
                      |                                                                               | • Social status
| Compatibility      | “The degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 2003, p. 238) | • Goals
                      |                                                                               | • Ideological beliefs and values
                      |                                                                               | • Previous experiences
                      |                                                                               | • Personal needs
| Complexity         | “The degree to which an innovation is perceived as relatively difficult to understand and to use” (Rogers, 2003, p. 238) | • Ease of understanding
                      |                                                                               | • Ease of use
                      |                                                                               | • Availability of information
                      |                                                                               | • Challenges or difficulties
| Trialability       | “The degree to which an innovation may be experimented with on a limited basis” (Rogers, 2003, p. 239). | • Small-scale trial feasibility
                      |                                                                               | • Ease of experiment
| Observability      | “The degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 239) | • Demonstration
                      |                                                                               | • Visibility of results
                      |                                                                               | • Proximity of peers
                      |                                                                               | • Network of peers

Note. This table is based on Rogers (2003, pp. 238-239) and Wiegel (2009).

because they had difficulties in getting price information, find reputable buyers with fair contract conditions, find nearby cooperative elevators to take organic grain (Wiegel, 2009). In addition, grain farmers perceived knowledge and information to guide organic farming was not readily available (Wiegel, 2009). Record keeping and soil fertility were minor challenges reported by the grain farmers (Wiegel, 2009). Compared with organic grain farmers, Wiegel found vegetable
farmers faced more challenges in finding organic inputs, including organic seeds, organic fertilizers, and biological pesticides. In addition, vegetable farmers had to spend more time on detailed recording keeping and educating buyers than grain farmers (Wiegel, 2009). For livestock and dairy farmers, the major challenges were the difficulty of accessing organic processors and sourcing sufficient organic grains as feed (Wiegel, 2009).

A few scholars have examined farmers’ experienced benefits from organic farming. Wernick and Lockeretz (1977) and their follow-up studies (Lockeretz & Madden, 1987) researched the experienced benefits of organic farming adoption. In their 1977 study, Wernick and Lockeretz determined the leading benefits were 1) personal and family health, 2) livestock health, 3) concerns for the environment, 4) religion validation, and 5) philosophy validation (p. 22). In their 1987 study, health is still the leading benefit (Lockeretz & Madden, 1987). However, fewer farmers reported philosophical or religious benefits (Lockeretz & Madden, 1987). They found organic farmers seem to become more pragmatic for benefits, such as soil health, environment, and economics, but less ideological (Lockeretz & Madden, 1987).

Sullivan et al. (1996) compared the benefits of farming between organic farmers and conventional farmers. They found both organic and conventional farmers commonly perceived “independence,” “nature,” “being outdoor,” and “pride in the products” as benefits (p. 133). Organic farmers perceived benefits from organic farming include “living ethically,” “community,” and “satisfaction with their lives” (Sullivan et al., 1996, p. 133). In addition, Sullivan et al. found “the work itself” and “heritage and identity” are the benefits perceived more by conventional farmers, but less perceived by organic farmers (p. 133).

Cranfield et al. (2010) noted the benefits of organic farming might change with time. In their study, they also captured a somewhat change of benefits with the time of organic farming
adoption. Cranfield et al. found post-1999 converted organic farmers experienced more benefits than earlier organic farmers. Particularly in recent years, organic farmers reported more benefits on “human health,” “better crop quality,” “price premium” and “market growth” (p. 303).

**Types of Adopters**

DOI indicates innovativeness is an individual’s degree of earliness in adopting new ideas (Rogers, 2003). On the basis of innovativeness, adopters are categorized into “(1) innovators, (2) early adopters, (3) early majority, (4) later majority, and (5) laggards” (Rogers, 2003, p. 270) (Figure 2).

![Figure 2: Adopter Categorization on the Basis of Innovativeness (Rogers, 2003)](image)

Innovators are highly innovative and like to take risks; they are people who introduce innovation from the outside to the local social system (Rogers, 2003). Early adopters can influence other social members’ adoption decisions through interpersonal communication, because other people see early adopters as role models, who help them reduce uncertainties (Rogers, 2003, p. 283). Early majority tend to frequently contact opinion leaders (early adopters) about the innovation; they need more time to think about the innovation (Rogers, 2003, p. 284). Late majority are more skeptical about the usefulness of the innovation and adopt the innovation
because of social and economic pressures (Rogers, 2003, p. 284). Laggards are the least innovative; they are reluctant to adopt innovations because they are in favor of traditional values and past situations (Rogers, 2003, p. 284).

Padel (2001) compared the organic farmers’ socioeconomic characteristics, including education, income, farm size, and business orientation with the characteristics of different types of adopters described in the theory of DOI and found organic farmers generally fall into innovators and early adopters categories, with a few exceptional characteristics, such as age and farm size. Through her synthesis, Padel found organic farmers tend to have a better education background, younger age, more social connections outside of the local community, better opinion leadership, more urban living experience, less farming experience, lower social acceptance by the local community, more female farmers, and smaller farm size. Therefore, personal and farm characteristics appear to play a role in deciding organic farming adoption.

In terms of personal characteristics, Lockeretz (1997) found the organic farming population tended to have a better educational background, less experience in farming, more women, and entered farming as a career as an adult (compared to family legacy). Sullivan et al. (1996) and McCann et al. (1997) found organic farmers tend to have fewer years of farming experience or start farming as a new profession, younger age, less farming acreages, and more diverse crops than conventional farmers. On the West Coast, Anderson, Jolly, and Green (2005) found higher gross sales, more direct marking, a higher diversity of crops, smaller farm size, younger age, and more frequent computer usage significantly predicated farmers’ adoption of organic farming. Noticeably, gender and education were not significant predictors in Anderson et al.’s (2005) sample, inconsistent with Lockeretz’s (1997) findings from the Midwest. Anderson
et al.’s (2005) study sampled mostly vegetable growers in California; thus, their findings cannot represent organic adoption in the Midwest because prevalent crops are very different.

Motivation: Self-Determination Theory

Self-determination theory (SDT) is a motivational theory, from the discipline of psychology, proposed by Deci and Ryan (1985). Motivation is defined generally as “the psychological process that initiates, guides, and maintains human behavior” (Sichler, 2014, p. 1204). SDT provides a theoretical foundation to understand human motivation. SDT is based on different reasons or goals of action— intrinsic motivation and extrinsic motivation (Ryan & Deci, 2000). SDT suggests human behavior is not only motivated by external rewards, such as food and money, but also by an intrinsic psychological satisfaction (Deci & Ryan, 1985; Ryan & Deci, 2000). Extrinsic motivation “refers to doing something because it leads to a separable outcome” (Ryan & Deci, 2000, p. 55). Intrinsic motivation is “doing of an activity for its inherent satisfactions rather than for some separable consequence” (Ryan & Deci, 2000, p. 56).

Intrinsic motivation is instigated by individuals’ innate needs for competence, autonomy, and relatedness (Deci & Ryan, 1985; Ryan & Deci, 2000; 2002). In SDT, competence refers to “people’s feeling of effectiveness in exercising and expressing one’s capacities when interacting with the social environment” (Ryan & Deci, 2002, p. 7). Autonomy refers to “being the perceived origin or source of one’s own” (Ryan & Deci, 2002, p. 8). The need for autonomy means people have the needs to “act from personal interest and integrated values” (Ryan & Deci, 2002, p. 8). Relatedness refers to “feeling connected to others, to caring for and being cared for by those others, to having a sense of belongingness both with other individuals and with one’s community” (Ryan & Deci, 2002, p. 7).
SDT researchers also proposed a self-determination continuum (Deci & Ryan, 1985; Ryan & Deci, 2000; 2002). The continuum internalizes extrinsic motivation into intrinsic motivation through “external regulation” (e.g., a reward), “introjected regulation” (e.g., self-esteem or feeling of worth), “identified regulation” (e.g., goals or importance), and “integrated regulation” (e.g., personal beliefs and values) (Ryan & Deci, 2002, p. 16).

Many scholars have employed SDT to study farmers’ adoption of sustainable farming practices (including organic agriculture). Scholars found farmers’ intrinsic motivations are the dominant motivation for adopting organic farming or sustainable agricultural practices, including environmental/ecological concerns (e.g., land stewardship, biodiversity value), ethics/public interest (e.g., animal welfare, public health, rural community), and lifestyle choice (e.g., enjoyment, well-being, quality of life) (Brédif et al., 2017; Greiner et al., 2009; Kvakkestad et al., 2015; Mills et al., 2018). Extrinsic motivations, including financial incentives (e.g., organic price premiums), profit maximization, farm viability, and regulations (e.g., penalty) tend to be secondary motivations (Garini et al., 2017; Greiner et al., 2009; Kvakkestad et al., 2015; Mills et al., 2018).

Wernick and Lockeretz (1977) and Lockeretz et al. (1981) surveyed Midwestern organic farmers’ motivations. They found the majority of organic farmers were motivated by specific problems experienced in conventional farming, such as “livestock death,” “soil erosion,” high “chemical cost,” and “human health problems” (Wernick & Lockeretz, 1977, p. 21). Nearly half of the organic farmers were motivated by encouragement from other organic farmers, organic farming organizations, and organic fertilizer dealers. They also found 33% of organic farmers were motivated by ideological concerns, including dislike of agrochemicals, environmental concerns, and religious concerns. Wernick and Lockeretz concluded farmers adopted organic
farming generally because of practical reasons. They believed a typical scenario of organic farming adoption was farmers experienced a specific problem farming in the conventional system. Then, coupled with their ideological concerns, they take actions to make contact with organic proponents.

A later study by Duram (1999), identified the motivating factors underlying Colorado farmers’ decisions to adopt organic farming to include “diversity,” “self-challenges,” “on-farm changes,” “transformation of business approach,” and “farmland conservation” (p. 9). Duram (2000) further examined how different types of structural factors (economic, political, social, and ecological) influenced farmers’ decisions in Illinois. She found the ecology structure is the most prominent factor for organic farming adoption decisions because organic farmers value the ecosystem and have a deeper understanding of the natural environment. Economic structure can both negatively and positively influence organic farming adoption, but political structure generally impedes organic farming adoption (Duram, 2000). Social structures are composed of both family and socio-cultural influences. Family members could facilitate organic adoption by proving land and equipment, but they could also inhibit organic farming, if they advocated conventional agriculture (Duram, 2000). She noted that American cultures of “low food price,” “materialism,” and “expansion of suburbanization” all inhibited organic farming (Duram, 2000, p. 45). Although Duram began with external structural factors influenced organic adoption, her findings indicated personal values and beliefs fundamentally influence their perceptions of the structural factors. For this reason, studies on both structural and personal factors could help to understand organic farming adoption.

Outside the U.S., farmers’ motivation to adopt organic agriculture has also attracted many scholars’ research interests. In South Africa, a mixed-method study was completed by
Niemeyer and Lombard (2003). They found most organic farmers are in the younger age group and operate farms with a smaller size than average commercial. The major motivating factors for farmers to adopt organic farming are 1) environment protection and 2) soil fertility improvement. Minor motivations include 1) self-challenge and 2) higher economic return with lower input costs (Niemeyer & Lombard, 2003).

Italian scholars Canavari, Lombardi, and Cantore (2008), interviewed and surveyed both organic and conventional farmers. Canavari et al. (2008) analyzed how motivational factors influence farmers’ farming status and intention of adopting organic farming. They found organic farming adoption decisions are largely influenced by ideological motivations, including “environment protection,” “animal welfare,” and “health care” (Canavari et al., 2008, p. 3). “Farmers connection,” “management skills,” “attitude towards innovation,” “certification bureaucracy,” and “social pressure” also influence farmers’ decisions in organic farming (Canavari et al., 2008, pp. 3-4).

Canadian scholars, Cranfield et al. (2010), employed interviews and surveys with organic farmers. In their study, “health and safety” and “environmental concerns” were the leading motives for farmers to adopt organic farming; followed by “social needs and aspirations,” “need for change,” “profitability,” and “economic survival” (Cranfield et al., 2010, pp. 297-298). Their study indicated, although economic factors are important for farmers to adopt organic farming, non-economic factors are the dominant motivations.

**Behavior: The Theory of Planned Behavior**

In the realm of adoption research, the theory of planned behavior (TPB), a socio-psychological approach, has attracted the attention of social scientists and extension educators in the field of agriculture. TPB was developed by Ajzen (1985;1991), based on the theory of
reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). TPB explains and predicts how an individual will perform a certain behavior (Figure 3).

![Diagram of Theory of Planned Behavior (Ajzen, 1991)](image)

**Figure 3. Diagram of Theory of Planned Behavior (Ajzen, 1991)**

Both TPB and TRA show people’s behaviors are driven by the intention of performing the behavior. Intention is the “readiness of performing a behavior” (Fishbein & Ajzen, 2010, p. 39). A stronger behavioral intention will result in a higher likelihood of performing the behavior (Fishbein & Ajzen, 2010). In addition to the behavioral intention, TPB added a construct of behavioral control because Ajzen (1991) claimed people need necessary resources, skills, and opportunities to perform a behavior. The actual behavior control is “the resources and opportunities available to a person” (Ajzen, 1991, p. 188). When a person conceives a behavioral intention and is able to obtain sufficient resources and opportunities, the individual will perform this behavior.

According to TPB, intention is determined by 1) attitude toward the behavior, 2) subjective norm, and 3) perceived behavioral control (Ajzen, 1985; 1991). Attitude toward the behavior refers to “the degree to which a person has a favorable or unfavorable evaluation or
appraisal of the behavior in question”; subjective norm is “the perceived social pressure to perform or not to perform the behavior”; and degree of perceived behavioral control refers to “the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experiences as well as anticipated impediments and obstacles” (Ajzen, 1991, p. 188). Ajzen admitted the construct of behavioral control is not original to TPB and gave credit to Bandura’s (1977) work on self-efficacy. There is a conceptual similarity between perceived behavioral control and self-efficacy (Fishbein & Ajzen, 2010). Bandura (1991) defined self-efficacy as “people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives” (p. 257). Perceived behavioral control usually develops into actual behavioral control and can substitute for measurement of actual control of behavior (Ajzen, 1991). As a general rule, when an individual has a favorable attitude, perceives a social norm of engagement, and has good confidence in his/her ability, this individual will form an intention to engage the behavior (Ajzen, 1991; 2002). However, the actual behavior is contingent on resources and opportunities availability, and the individual’s actual control over the behavior (Ajzen, 1991; 2002). With actual behavioral control, the individual should achieve his/her behavioral intention to perform the behavior (Ajzen, 1991; 2002). Therefore, TPB provides a theoretical basis for studying the behavioral constraints of adoption behavior, namely the challenges for adopting organic farming. Although not all studies on organic farming adoption challenges directly employed TPB, these studies collectively provide empirical evidence for the behavioral constraints of organic farming adoption.

Wernick and Lockeretz (1977) surveyed early organic farmers and found they experienced major challenges from agronomic, management, financial, infrastructure, and social aspects (Table 3).
Table 3  
*Challenges of Organic Farming Adoption*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomic Challenges</td>
<td>Weed management</td>
</tr>
<tr>
<td></td>
<td>Yield loss</td>
</tr>
<tr>
<td></td>
<td>Pest management</td>
</tr>
<tr>
<td>Management Challenges</td>
<td>High labor requirement</td>
</tr>
<tr>
<td></td>
<td>Need for more expertise</td>
</tr>
<tr>
<td></td>
<td>Land access</td>
</tr>
<tr>
<td></td>
<td>Livestock integration</td>
</tr>
<tr>
<td>Financial Challenges</td>
<td>Capital access</td>
</tr>
<tr>
<td></td>
<td>Low profit</td>
</tr>
<tr>
<td>Infrastructure Challenges</td>
<td>Marketing for organic products</td>
</tr>
<tr>
<td></td>
<td>Lack of information</td>
</tr>
<tr>
<td>Social Challenges</td>
<td>Social unacceptance in the rural community</td>
</tr>
</tbody>
</table>

*Note.* Based on Wernick and Lockeretz (1977, p. 22).

Lockeretz and Madden (1987) conducted a follow-up study. They found the most critical challenge was still poor accessibility to the organic market. Weed control was also a leading challenge and became a greater concern for organic farmers. The need for more expertise became more evident than the 1977 study. Correspondingly, the lack of information ranked high in the list of challenges. Overall, the challenges identified from these two studies remained similar. Because the ‘lack of information’ challenge became more significant than previously, this reflects organic farming is an information/knowledge-based innovation. Farmers need to constantly update information and knowledge on organic farming operations and marketing after deciding to adopt organic farming (Padel, 2001). Thus, knowledge and information are the keys to successful organic farming.

Blobaum (1983) studied the challenges faced by farmers in the Midwest for organic farming adoption. He divided the inquiries on challenges into twofold. First, he identified barriers that hinder farmers from converting conventional farming to organic farming. The
barriers include: “1) lack of information about organic farming methods, 2) fear of radical yield drop, 3) concerns about weed control, and 4) concerns about landlord objections” (Blobaum, 1983, p. 3). Then, he focused on the disadvantages of organic farming after farmers started organic farming. Blobaum found 1) “weed control,” 2) “high labor requirements,” 3) “lack of access to special markets with price premium,” and 4) “social pressure” were the major challenges farmers met after adopting organic farming (p. 4). Many of the barriers and disadvantages of organic farming overlap with Wernick and Lockeretz’s (1977) findings of organic farming challenges.

Sullivan et al. (1996) compared the challenges of farming between organic farmers and conventional farmers. “Inadequate financial rewards” was a common challenge perceived by both organic and conventional farmers, but organic farmers reported financial challenge less often than conventional farmers (p. 135). Different from conventional farmers, organic farmers perceived equipment as a challenge (Sullivan et al., 1996). Sullivan et al. found more conventional farmers reported “stress associated with the unexpected (such as weather)” than organic farmers (p. 134).

Lockeretz’s (1997) study in the Northeast area of the U.S. also revealed challenges for organic farming. Top challenges include the unavailable or high cost of labor, insect/disease control, high production costs, inadequate information, and other people’s attitudes (Lockeretz, 1997). Compared to his earlier studies in the Midwest that mainly sampled grain farmers, this study sampled more vegetable and dairy farmers. Therefore, insect and disease pressure became higher concerns. The higher production costs are likely due to higher labor costs and additional investments in equipment specialized in organic production.
Duram (1999) identified three major challenges experienced by Colorado organic farmers: 1) access to stable organic market, 2) family tradition on conventional farming, and 3) lack of supportive information on organic operations. These three challenges could be categorized into infrastructure challenges and social challenges (Wernick & Lockeretz, 1977). During the following year, Duram (2000) identified structural challenges for organic farming adoption in Illinois. She found three types of structural challenges: 1) economic structural challenges, 2) political structural challenges, and 3) social structural challenges (Table 4).

### Table 4
**Structural Challenges for Organic Farming Adoption**

<table>
<thead>
<tr>
<th>Economic Structural Challenges</th>
<th>Political Structural Challenges</th>
<th>Social Structural Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lack of stable markets for all organic crops</td>
<td>• Unfavorable government policies towards organic farming</td>
<td>• Poor acceptance by conventional neighbor farmers</td>
</tr>
<tr>
<td>• Opposition from landlords</td>
<td>• No organic information available from state cooperative extension services</td>
<td>• Farmland aggregation</td>
</tr>
<tr>
<td>• Difficulties in getting a loan from local bankers</td>
<td>• Lack of organic farming research at a land-grant university</td>
<td>• American’s low-cost food culture</td>
</tr>
</tbody>
</table>

*Note.* Based on Duram (2000, p. 38).

Hanson et al. (2004) conducted focus group research in multiple regions of the U.S. to explore risks faced by organic farmers. They found organic farmers have experienced 1) production risks, 2) input risks, 3) organic marketplace risks, and 4) agricultural policy risks (Table 5).
Table 5
Risks Faced by Organic Farmers

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Weather and climatic risk</td>
<td>• Lack of organic input (organic pesticides, seeds</td>
<td>• Price premium became less stable</td>
<td>• Complexity of NOP</td>
</tr>
<tr>
<td></td>
<td>and manure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pest risk</td>
<td>• Lack of specialized organic equipment</td>
<td>• Competition with larger organic farms</td>
<td></td>
</tr>
<tr>
<td>• GMO contamination</td>
<td>• Lack of labor</td>
<td>• Competition with imported organic products</td>
<td>• NOP is inconsistent with previous state organic standards</td>
</tr>
<tr>
<td></td>
<td>• Lack of capital access</td>
<td>• Food retailer consolidation</td>
<td>• Cheap food policy</td>
</tr>
</tbody>
</table>

Note. This table is based on Hanson et al. (2004, pp. 222-225).

Cranfield et al. (2010) studied the challenges of organic farming adoption in Canada. They found the main challenges of organic farming are related to agricultural structures: lack of government support, difficulties in marketing, negative social pressure, and financing difficulties (p. 299). Pest management (including insects, disease, and weeds) is another major challenge faced by organic farmers (Cranfield et al., 2010).

Reaves and Rosenblum (2014) conducted a literature synthesis on the barriers to organic farming. They found the challenges to attracting new organic farmers include social, financial, knowledge, land access, market, transition, and information challenges; and the challenges towards optimizing organic farming are production, input service, markets, equipment, research, knowledge, and financial service (pp. 7-8). Reaves and Rosenblum found the barriers to attracting new organic farmers mostly overlap with the challenges to optimize organic farming, but the existing organic farmers showed more concern about agronomic and managerial challenges, and potential organic farmers seemed to perceive more structural barriers, consistent with Constance and Choi’s (2010) findings.

**Alternative Agriculture Paradigm**

Noting both large-scale industrialized agriculture and ecologically sustainable agriculture (e.g., organic agriculture) existed in the U.S., Beus and Dunlap (1990) identified the different beliefs and values underlying these two distinct farming trends. They introduced two competing concepts to clarify the differences: 1) conventional agriculture paradigm versus 2) alternative agriculture paradigm. This framework originates from rural and environmental sociology and has been used widely to study farmer's farming practice choice.

Paradigm, in a social science setting, refers to a “prominent worldview, model or frame of reference through individuals collectively, a society interprets the meaning of the external
world” (Beus & Dunlap, 1990, p. 592). Through in-depth interviews with agriculture professionals and theoretical discussions based on Dominant Social Paradigm (Pirages & Ehrlich, 1974) and New Environmental Paradigm (Dunlap & Van Liere, 1978; 1984), Beus and Dunlap (1990) identified six dimensions of difference between the paradigms: “(1) centralization versus decentralization, (2) dependence versus independence, (3) competition versus community, (4) domination of nature versus harmony with nature, (5) specialization versus diversity, and (6) exploitation versus restraint” (p. 598). They provided an exhaustive list (Table 6) showing the specific components for the alternative agricultural paradigm that provide practical guidance for researchers, who need to measure farmers’ beliefs and values about their farming orientations.

**Table 6**

*Dimensions of Alternative Agriculture Paradigm and the Components*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Decentralization</td>
<td>More local production and marketing; more farmers.</td>
</tr>
<tr>
<td>2) Independence</td>
<td>Smaller farming size; smaller machinery; less energy consumption; minimize off-farm input; greater farm self-sufficiency; emphasis on personal skills and local knowledge.</td>
</tr>
<tr>
<td>3) Community</td>
<td>Cooperation between farmers; essentials of small rural community to agriculture; farm work is rewarding; labor work is essential and meaningful; integration of life and business; emphasis on quality, performance, and beauty.</td>
</tr>
<tr>
<td>4) Harmony with nature</td>
<td>Humans are part of nature’s system; nature is highly valued; complete life cycle; imitating natural ecosystem; production is maintained by soil health; minimizing processed food.</td>
</tr>
<tr>
<td>5) Diversity</td>
<td>Broader gene pool; multiple crops in complementary rotations; integration of crops and livestock; locally adapted production.</td>
</tr>
<tr>
<td>6) Restraint</td>
<td>Consider all external costs; more attention to long-term outcomes; use renewable resources; conserve non-renewable resources; limited confidence in science and technology; consideration for future generations; simpler lifestyles; nonmaterialism.</td>
</tr>
</tbody>
</table>

*Note. This table is adapted from Beus and Dunlap (1990, p. 598).*
Beus and Dunlap (1990) emphasized the core of alternative agriculture is organic agriculture or farming with near-organic practices. Thus, their work is often cited in the organic farming adoption literature.

Sullivan et al. (1996) utilized an alternative agriculture paradigm to understand how organic farmers value their land and their attitudes towards nature. Sullivan et al. (1996) found organic farmers have a greater awareness and appreciation for natural resources. They are more supportive of living in harmony with nature. Organic farmers believe farmers do not have the right to damage the land, since they are more aware and concerned about farming’s environmental problems (McCann et al., 1997; Sullivan et al., 1996). McCann et al. (1997) took a close look at farmers’ economic orientation, and found both organic and conventional farmers are concerned about economic risks with farming. They found organic farmers are more concerned with long-term sustainability and are more willing to take some risks to gain future benefits, while conventional farmers have a greater concern for immediate benefits. Organic farmers’ economic concern is highly likely to be overridden by their land stewardship and human health value orientations (McCann et al., 1997). In addition, McCann et al. discovered differences in defining success between organic farmers and conventional farmers. They determined organic farmers defined success as improving “soil quality,” fulfill “personal satisfaction,” “community engagement,” “healthy products,” and “profitability”; whereas, conventional farmers defined success as “making a living,” “expanding the farm,” supporting “family,” and having a good “appearance of the farm” (p. 752). The differentiated definitions of success are consistent with Beus and Dunlap’s (1990) two agriculture paradigms.

Stofferahn (2009) utilized the paradigm to identify differences in farming orientation between organic farmers and conventional farmers. He found environmental-ethical concerns,
production goals towards independence and harmony, and farming orientations towards cooperation and decentralization, and values of diversity are factors to classify organic or conventional farmers (Stofferahn, 2009). This study also found farm structural characters (such as farmland size) cannot distinguish organic or conventional farming, and there was only one personal demographic variable—age—that possibly can classify organic or conventional farmers (Stofferahn, 2009). Again, these findings are inconsistent with earlier studies’ findings (Lockeretz, 1997; McCann et al., 1997; Sullivan et al., 1996).

**Education and Extension**

Organic farming is information and knowledge-based innovation (Constance & Choi, 2010; Padel, 2001; Wiegel, 2009). Across multiple studies, lack of information and knowledge has been constantly identified as a major challenge for organic farming adoption (Blobaum, 1983; Delate & Dewitt, 2004; Duram, 1999; 2000; Hanson et al., 2004; Lockeretz 1997; Reaves & Rosenblum, 2014; Wernick & Lockeretz, 1977; Wiegel, 2009). To fill the information gap, farmers have explored a number of educational strategies and resources.

First, organic farmers do not rely on traditional sources of information, such as extension educators, local cooperatives, and chemical sales representatives. Instead, they explore alternative sources of information to fill information gaps (Blobaum, 1983; Duram, 2000). Alternative information sources include other organic farmers, sustainable agriculture organizations, books, and magazines related to organic or sustainable farming, organic fertilizer companies, and farmers’ own on-farm experiments (Blobaum, 1983; Duram, 2000; Delate & Dewitt, 2004).

Another strategy has been to build a mutually supportive farmer-to-farmer network (Hanson et al., 2004). This mutual help strategy has been widely used by all types of organic
farmers (grain, vegetables, and livestock) (Wiegel, 2009). Organic farmers have formed local or regional organic networks through which they share “labor, machinery, ideas and information” (Hanson et al., 2004, p. 224). Together, they communicate with consumers and advocate favorable policies for organic farming (Hanson et al., 2004). Educational activities were achieved through local sustainable agriculture networks (Exner & Thompson, 2006; Hanson et al., 2004). Hassanein (1995) found local sustainable agriculture networks played a key role in generating and disseminating knowledge among farmers. Knowledge spread by the networks addresses farmers’ challenges related to financing, marketing, and training (Hassanein, 1995). Connected with SDT, the success of sustainable agriculture networks is attributed to meeting farmers’ needs for relatedness, competence, and autonomy. With the lenses of SDT, Triste et al. (2018) identified motivations for farmers to engage in sustainable agriculture networks, including sustainability (intrinsic autonomy needs), social contracts (intrinsic relatedness needs), knowledge (intrinsic competence needs), and business opportunities (extrinsic reward need).

Although organic farmers can obtain educational information through alternative information sources (books, magazines, and internet) and farmer-to-farmer networks and organizations, organic farmers still want to have more organic-specific extension education services provided by land grant universities (Constance & Choi, 2010; Delate & Dewitt, 2004; Duram, 2000; Reaves & Rosenblum, 2014; Rodriguez et al., 2009). To collect information for developing effective programs, a few studies have assessed farmers’ educational needs for organic farming from two perspectives: 1) the need for specific content topics and 2) preferred educational information delivery channels.

**Specific Content Topics**

Delate and Dewitt (2004) recognized Iowa organic farmers need more extension education on weed management, soil biology, composting, pest management, plant pathology,
organic grain marketing, economic analysis, and organic certification. Also, in Iowa, Polush et al. (2016) conducted a Delphi survey to assess Iowa sustainable and organic farmers’ on-farm research needs. They found that the farmers wanted more on-farm research about organic farming, mainly for comparative studies between organic and traditional agricultural production; insects and weed control strategies for organic farming; and soil amendments for organic farming (p. 4). Swisher and Monaghan (1995) studied organic vegetable farmers in Florida. They found these organic vegetable farmers want to make more educational efforts towards consumers about the benefits of organic farming. Farmers believe organic vegetables are a consumer-driven market and more organic food consumers will encourage conventional farmers to convert to organic farming (Swisher & Monaghan, 1995). Middendorf (2007) recognized information insufficiency related to organic farming and conducted educational content needs assessment of organic farmers in Kansas. He found organic farmers need more education about organic farming production, processing, and marketing (Table 7).

**Table 7**

*N eeds Assessment on Educational Content for Organic Farming*

<table>
<thead>
<tr>
<th>Topics on Production</th>
<th>Topics on Facilities</th>
<th>Topics on Marketing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed control</td>
<td>Local or regional organic grain cleaning and processing facilities</td>
<td>Organic crops marketing and certification</td>
</tr>
<tr>
<td>Cropping system design</td>
<td>Moisture levels and pests in on-farm grain storage</td>
<td>Consumer education</td>
</tr>
<tr>
<td>Soil health</td>
<td>Local or regional scale organic meat processing facilities</td>
<td>New market development</td>
</tr>
<tr>
<td>Organic biopesticides</td>
<td>Local or regional organic dairy processing facilities</td>
<td>Research on consumer trends</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td>Research and information on production costs and pricing</td>
</tr>
<tr>
<td>Organic inputs dealers</td>
<td></td>
<td>Supply and demand strategies</td>
</tr>
<tr>
<td>Lists of organic growers</td>
<td></td>
<td>Directory of organic producers and buyers</td>
</tr>
<tr>
<td>Listserv on organic farming</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension publications for organic agriculture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative fuels and energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant breeding for organic production</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* This table is based on Middendorf (2007, pp. 4-5).
Information and education delivery channels

Crawford et al. (2015) recognized an increasing need for accessing organic farming information for farmers in North Carolina. They examined the effectiveness of information delivery channels for farmers to learn about organic farming operations and marketing. Crawford et al. found farmer-to-farmer networking is the most effective information channel among organic farmers; farmers’ associations and non-profit organizations are the second most frequently effective channels for providing information and education to farmers. In addition, they found new organic farmers relied more on university resources than early adopters Organic farmers tend to separate extension education services from university resources and deem extension as the least effective information channel for organic farming (Crawford et al., 2015). This finding is consistent with an earlier study in Ohio where most organic farmers believed extension educators do not have adequate knowledge about organic agriculture (Agunga & Igodan, 2007). Thus, Agunga and Igodan recommended more training on organic farming for extension agents. Crawford et al. (2015) suggested extension personnel reshape their extension education services for organic farmers to facilitate peer-to-peer information sharing networks and create social events focused on organic farming issues. Cooreman et al. (2018) argued when farmers need to make adoption decisions, “farmers tend to be most influenced by proof of successful farming methods that are showed and explained by other farmers” (p. 92). According to Cooreman et al., peer learning among farmers involves engagement, communication, and interactive knowledge creation.

In recent years, more farmer-centered extension programs on organic farming have been developed and offered to the organic farming community. For instance, in the Pacific Northwest area, knowing interpersonal networking is the most effective education channel for organic farming. Extension specialists and researchers from Washington State University hosted a
symposium on dryland organic farming (Piaskowski et al., 2013). By bringing together organic farmers, organic industry representatives, researchers, and extension educators, the symposium managed to foster encouraging, supportive networks for all personnel who have an interest in organic farming (Piaskowski et al., 2013).

**Summary of Literature Review**

By reviewing the literature about motivating factors for organic farming adoption, there are multiple groups of variables that influence farmer’s decisions on organic farming adoption. The factors include personal demographics, farm structure characteristics, economic motivations, health motives, environmental motives, ideological motives, and long-term farming goals (Table 8).

**Table 8**  
*Summary of Motivating Factors for Organic Farming Adoption Decisions*

<table>
<thead>
<tr>
<th>Group</th>
<th>Variables</th>
<th>Impact</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal demographics</td>
<td>Age</td>
<td>-</td>
<td>Anderson et al. (2005); Duram (1999); McCann et al. (1997); Niemeyer &amp; Lombard (2003); Padel (2001); Sullivan et al. (1996)</td>
</tr>
<tr>
<td></td>
<td>Gender (female)</td>
<td>+</td>
<td>Lockeretz (1997); Padel (2001)</td>
</tr>
<tr>
<td></td>
<td>Education level</td>
<td>+</td>
<td>Duram (1999); Koesling &amp; Lien (2008); Lockeretz (1997); McCann et al. (1997); Padel (2001); Stock (2007)</td>
</tr>
<tr>
<td></td>
<td>Years of farming experience</td>
<td>-</td>
<td>Lockeretz (1997); McCann et al. (1997); Padel (2001); Sullivan et al. (1996)</td>
</tr>
<tr>
<td></td>
<td>Urban background</td>
<td>+</td>
<td>Koesling &amp; Lien (2008); Padel (2001); Stock (2007)</td>
</tr>
<tr>
<td>Farm structure</td>
<td>Farm size</td>
<td>-</td>
<td>Anderson et al. (2005); Beus &amp; Dunlap (1990); McCann et al. (1997); Niemeyer &amp; Lombard (2003); Sullivan et al. (1996)</td>
</tr>
<tr>
<td></td>
<td>Owning farmland</td>
<td>+</td>
<td>Blobaum (1983); Duram (2000); Reaves and Rosenblum (2014)</td>
</tr>
<tr>
<td></td>
<td>Livestock integration</td>
<td>+</td>
<td>Beus &amp; Dunlap (1990); Hanson et al. (2004)</td>
</tr>
<tr>
<td>Group</td>
<td>Variables</td>
<td>Impact</td>
<td>Authors</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------</td>
<td>--------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Economic motivation</td>
<td>• Organic price premium</td>
<td>+</td>
<td>Blobaum (1983); Cranfield et al. (2010); Fairweather (1999); Niemeyer &amp; Lombard (2003); Padel (2001); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Lower operation cost of organic farming</td>
<td>+</td>
<td>Niemeyer &amp; Lombard (2003); Padel (2001); Wiegel (2009); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Long-term farm viability</td>
<td>+</td>
<td>Cranfield et al. (2010); McCann et al. (1997); Padel (2001)</td>
</tr>
<tr>
<td></td>
<td>• Rural development</td>
<td>+</td>
<td>Darnhofer et al. (2005); Lobley, Butler, &amp; Reed (2009); Padel (2001)</td>
</tr>
<tr>
<td>Health motivation</td>
<td>• Concerns for personal and family’s health</td>
<td>+</td>
<td>Cranfield et al. (2010); Kaltoft (2001); Stock (2007); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• General concerns for consumers’ health</td>
<td>+</td>
<td>Cranfield et al. (2010); Henson &amp; Holliday (2010); McCann et al. (1997); Stock (2007); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Livestock health concerns</td>
<td>+</td>
<td>Cranfield et al. (2010); Lockeretz et al. (1981); Wernick &amp; Lockeretz (1977);</td>
</tr>
<tr>
<td>Ecological motivation</td>
<td>• Soil quality and soil health</td>
<td>+</td>
<td>Cranfield et al. (2010); Fairweather (1999); Lockeretz et al. (1981); McCann et al. (1997); Niemeyer &amp; Lombard (2003); Padel (2001); Stock (2007); Sullivan et al. (1996); Wernick and Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Value of biodiversity and ecosystem</td>
<td>+</td>
<td>Anderson et al. (2005); Duram (1999); Duram (2000); McCann et al. (1997); Stock (2007); Stofferahn, (2009); Sullivan et al. (1996); Wiegel (2009)</td>
</tr>
<tr>
<td>Ideological motivation</td>
<td>• Harmony with nature</td>
<td>+</td>
<td>Cranfield et al. (2010); McCann et al. (1997); Sullivan et al. (1996)</td>
</tr>
<tr>
<td></td>
<td>• Religion validation</td>
<td>+</td>
<td>Lockeretz &amp; Madden (1987); Stock (2007); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Independence</td>
<td>+</td>
<td>Beus &amp; Dunlap (1990); Stofferahn (2009)</td>
</tr>
<tr>
<td></td>
<td>• Self-Challenge</td>
<td>+</td>
<td>Cranfield et al. (2010); Duram (1999); Niemeyer &amp; Lombard (2003)</td>
</tr>
<tr>
<td>Long-term farming goals</td>
<td>• Profitability</td>
<td>-</td>
<td>Darnhofer et al. (2005); Fairweather (1999)</td>
</tr>
<tr>
<td></td>
<td>• Environmental stewardship</td>
<td>+</td>
<td>Beus and Dunlap (1990); Cranfield et al. (2010); Koesling &amp; Lien (2008); McCann et al. (1997); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Civic-mindedness</td>
<td>+</td>
<td>Beus &amp; Dunlap (1990); McCann et al. (1997); Sullivan et al. (1996)</td>
</tr>
</tbody>
</table>

*Note.* “+” indicates a positive impact on decisions for adopting organic farming. “-” indicates a negative impact on decisions for adopting organic farming.
Scholars have identified different areas of challenges, including information, production, marketing, finance, management, social pressure, land access, and policy challenges (Table 9).

**Table 9**  
*Summary of Challenges to Organic Farmers*

<table>
<thead>
<tr>
<th>Area</th>
<th>Specific Challenges</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information challenges</td>
<td>• Insufficient extension educational support for organic farming</td>
<td>Duram (1999); Duram (2000); Hanson et al. (2004); Lockeretz (1997); Reaves &amp; Rosenblum (2014); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Lack of production information</td>
<td>Reaves &amp; Rosenblum (2014); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Lack of marketing information</td>
<td>Constance &amp; Choi (2010); Reaves &amp; Rosenblum (2014); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Lack of organic input information</td>
<td>Hanson et al. (2004)</td>
</tr>
<tr>
<td></td>
<td>• Lack of organic research</td>
<td>Hanson et al. (2004); Reaves &amp; Rosenblum (2014)</td>
</tr>
<tr>
<td>Production challenges</td>
<td>• Weeds management</td>
<td>Blobaum (1983); Constance &amp; Choi (2010); Cranfield et al. (2010); Reaves &amp; Rosenblum (2014); Wernick &amp; Lockeretz (1977); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Pest/diseases management</td>
<td>Constance &amp; Choi (2010); Cranfield et al. (2010); Hanson et al. (2004); Lockeretz (1997); Reaves &amp; Rosenblum (2014); Wernick &amp; Lockeretz (1977); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Climate risks</td>
<td>Hanson et al. (2004); Wiegel (2009); Reaves &amp; Rosenblum (2014)</td>
</tr>
<tr>
<td>Marketing challenges</td>
<td>• Access to the organic market with price premium</td>
<td>Blobaum (1983); Constance &amp; Choi (2010); Cranfield et al. (2010); Duram (1999); Reaves &amp; Rosenblum (2014); Wiegel (2009)</td>
</tr>
<tr>
<td></td>
<td>• Lack of local organic marketing infrastructure (evaluators/storage)</td>
<td>Reaves &amp; Rosenblum (2014)</td>
</tr>
<tr>
<td></td>
<td>• Organic market stability</td>
<td>Duram (2000); Hanson et al. (2004)</td>
</tr>
<tr>
<td></td>
<td>• Transitional crop marketing</td>
<td>Reaves &amp; Rosenblum (2014)</td>
</tr>
<tr>
<td>Financial challenges</td>
<td>• Increased production cost</td>
<td>Constance &amp; Choi (2010); Lockeretz (1997); Reaves &amp; Rosenblum (2014)</td>
</tr>
<tr>
<td></td>
<td>• Capital access challenge</td>
<td>Cranfield et al. (2010); Duram (2000); Hanson et al. (2004)</td>
</tr>
</tbody>
</table>
Table 9 (continued)

<table>
<thead>
<tr>
<th>Area</th>
<th>Specific Challenges</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management challenges</td>
<td>• The complexity of record keeping for certification</td>
<td>Hanson et al. (2004)</td>
</tr>
<tr>
<td></td>
<td>• Labor challenges</td>
<td>Blobaum (1983); Hanson et al. (2004); Lockeretz (1997); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Machinery for organic production</td>
<td>Hanson et al. (2004); Reaves &amp; Rosenblum (2014); Sullivan et al. (1996)</td>
</tr>
<tr>
<td>Social norm challenges</td>
<td>• Social norms/pressure in the rural community</td>
<td>Blobaum (1983); Cranfield et al. (2010); Duram (1999); Duram (2000); Lockeretz (1997); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Cheap food culture in society</td>
<td>Duram (2000); Hanson et al. (2004)</td>
</tr>
<tr>
<td>Land access challenges</td>
<td>• Landlord objection</td>
<td>Blobaum (1983); Duram (2000)</td>
</tr>
<tr>
<td></td>
<td>• Limited land access</td>
<td>Wernick &amp; Lockeretz (1977); Duram (2000)</td>
</tr>
<tr>
<td>Policy challenges</td>
<td>• Lack of supportive policies</td>
<td>Duram (2000); Constance &amp; Choi (2010); Reaves &amp; Rosenblum (2014)</td>
</tr>
<tr>
<td></td>
<td>• Competition of imported organic crops</td>
<td>Hanson et al. (2004)</td>
</tr>
</tbody>
</table>

The literature has shown farmers experienced health, agroecological, ideological, economic, and social benefits from adopting organic farming (Table 10).

Table 10
Summary of Benefits Experienced by Organic Farmers

<table>
<thead>
<tr>
<th>Category</th>
<th>Specific Benefits</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health benefits</td>
<td>• Personal and family health</td>
<td>Cranfield et al. (2010); Lockeretz &amp; Madden (1987); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Livestock health</td>
<td>Lockeretz &amp; Madden (1987); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td>Agroecological benefits</td>
<td>• Crop quality</td>
<td>Cranfield et al. (2010)</td>
</tr>
<tr>
<td></td>
<td>• Environment &amp; Ecology</td>
<td>Lockeretz &amp; Madden (1987); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Resilience to the weather</td>
<td>Sullivan et al. (1996)</td>
</tr>
<tr>
<td>Ideological benefits</td>
<td>• Religion validation</td>
<td>Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Philosophy validation</td>
<td>Sullivan et al. (1996); Wernick &amp; Lockeretz (1977)</td>
</tr>
<tr>
<td></td>
<td>• Satisfaction with lives</td>
<td>Sullivan et al. (1996)</td>
</tr>
</tbody>
</table>
Table 10 (continued)

<table>
<thead>
<tr>
<th>Category</th>
<th>Specific Benefits</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic benefits</td>
<td>• Farm financial viability</td>
<td>Cranfield et al. (2010); Lockeretz &amp; Madden</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1987); Sullivan et al. (1996)</td>
</tr>
<tr>
<td>Social benefits</td>
<td>• Sense of community</td>
<td>Sullivan et al. (1996)</td>
</tr>
</tbody>
</table>
CHAPTER 3. MOTIVATIONS AND CHALLENGES FOR ADOPTION OF ORGANIC GRAIN PRODUCTION: A QUALITATIVE STUDY OF IOWA ORGANIC FARMERS

A manuscript prepared for submission to *Agriculture and Human Values*

Guang Han
Nancy Grudens-Schuck

Abstract

Organic grains are essential for the organic food industry. In the U.S., low adoption of organic grain farming has constrained further development of the organic sector. Organic agriculture stakeholders have appealed to producers to increase domestic organic grain production. The federal government has provided support for research and extension education regarding organic farming. In this context, there is a need for both agricultural educators and researchers to understand (1) the factors which motivate farmers to adopt organic grain farming and (2) what challenges hinder farmers’ adoption of organic grain farming. We conducted 17 on-farm interviews with organic grain farmers in Iowa. By applying multiple social-behavioral theories as part of the analysis and comparing interview results with the literature, we gained insight about how farmers formed adoption motivations. We also identified challenges to adoption that were associated with organic farming operation and management, and challenges associated with institutional structures, including market accessibility, information and inputs availability, and level of supports from government. Based on these findings, we provide recommendations for extension educational programs and future research.

Introduction

Organic grains are essential organic food ingredients for human consumption and animal feed; yet, the adoption of organic production practice for grain remains low. Major grain crops include corn, soybeans, oats, etc. For 2017, organic corn accounted for 0.29% of total corn...
harvested acreage in the U.S., 0.14% soybean production was organic, and 0.51% oat acreages were organic (USDA NASS 2017, pp.7, 98, 105). High demand for organic grain has led stakeholders, including government officials, organic food processors, and organic producer associations to appeal for increases in production of organic grain by U.S. farmers (Charles 2017; Greene et al. 2009; Reaves et al. 2019; Roseboro 2016). However, low adoption of organic grain production has raised additional questions regarding the interactions of motivations, barriers, and challenges that contribute to adoption. Studies conducted from the 1970s onward have examined farmers’ motivations for adopting organic farming of a range of crops in a variety of regions. Many studies also examined barriers, but documented experiences mainly for small-scale diversified organic farms (e.g., combined fruit, vegetable, and livestock). This study focused on the adoption of organic grain farming in the U.S. Midwest.

Demand

Organic grains underpin the vast majority of organic products. Consumers’ demand for organic foods continues to grow and requires a large supply of organic grains for food processing and animal feed (Willer and Lernoud 2018). However, demand has not been satisfied by U.S. organic grain production alone (Organic Trade Association 2019a). Charles (2017) and Greene et al. (2009) argued recurring shortages of organic grain are due to the low adoption of organic grain production by U.S. farmers. Roseboro (2016) reported organic food processors had been occasionally forced to cut their product lines, due to an insufficient supply of organic ingredients.

According to the National Organic Program (NOP) regulations, to obtain certification for organic meat, eggs, and dairy products, organic livestock producers must feed livestock with organic grains and hay (USDA AMS 2013). Digiacomo and King’s (2015) study showed that organic livestock farmers reported insufficient supplies of organic feed, as well as a lack of affordable grains, and consistent availability. Sierra et al. (2008) argued under-supply and poor
access to organic feed became barriers for conventional livestock producers entering the organic sector, and a causal factor for organic livestock producers who eventually deregistered from an organic certification program.

**Externality**

Low adoption also restricts the scope of positive impacts that organic farming may provide to the environment, economy, and society. In the U.S. Corn Belt, surface water that moves into the Mississippi River watershed is contaminated with phosphorus and nitrogen from agricultural fertilizers and sediment. As contaminants accumulate, they contribute incrementally to the hypoxic “dead zone” in the Gulf of Mexico (Helmers et al. 2007; Capel et al. 2018). In two separate studies, Cambardella et al. (2015) and Hole et al. (2005) showed organic farming systems could mitigate surface water pollution by reducing nitrate leaching and the amount of pesticide residue in the environment. Wider adoption of organic farming in the Corn Belt could help address these and other environmental issues.

Organic farming also has the potential to become an economically sound farming system that enhances profitability by lowering production costs, securing price premiums, and achieving yields comparable to conventional production systems (Delate et al. 2013; Nieberg and Offermann 2000; Posner et al. 2008). Organic farming can boost rural communities by increasing household income, generating employment, retaining output values in the local economy, and lowering county-level poverty rate (Darnhofer 2005; Marasteanu and Jaenicke 2019).

**Adoption, Motivations, and Challenges**

Organic livestock producers, food processors, and consumers together have called for increased domestic organic grain production (Alonzo 2016; Doering 2015; Roseboro 2016). However, it falls to the people who manage farms and decide on the production practices they
will use. Producers have complex motivations, needs, and situations for decisions they make for themselves, their farms, and their family situations.

Organic grain farming adoption across commodities requires farmers to make systemic changes in their operation (Duram 1999; Padel 2001). Organic farming generally prohibits synthetic chemicals in crop production, and farmers must learn new techniques, including cultivations, rotations, and biological control to minimize agronomic risks (Duram 1999; Gold 2007; Hanson et al. 2004). Farmers who intend to certify organic products for marketing purposes usually are required to go through a three-year transitional period. For some crops, and in some regions, the transition may increase farmers’ financial risks because their transitional products cannot access the value-added organic markets (Constance and Choi 2010; Duram 1999).

The federal government has progressively issued more supportive policies for organic agriculture in the Farm Bill legislation, from the 1985 Farm Bill to the 2018 Farm Bill (Greene et al. 2009; Organic Trade Association 2019b). The USDA allocated funding to support land-grant universities and agricultural non-profit organizations to develop and deliver extension education and research programs to promote organic farming and to address related issues (Maguire 2017; USDA NIFA 2019). To promote organic farming, Trout et al. (2006) recommended that outreach and extension programs should stimulate farmers’ learning to accelerate organic farming conversion. They suggest that as part of the learning process, agricultural extension professionals and organic agriculture specialists pinpoint farmers’ motivations for adoption and identify challenges that impede farmers’ adoption of organic grain farming.

Farmers’ decisions related to the adoption of organic grain farming are intricate because a farming system interacts with social, economic, institutional, and biophysical conditions.
Motivations for adopting organic farming broadly include economic incentives, environmental benefits, human and livestock health, and ideological as well as religious beliefs (Anderson et al. 2005; Canavari et al. 2008; Blobaum 1983; Cranfield et al. 2010; Darnhofer et al. 2005; Duram 1999; 2000; Fairweather 1999; Mccann et al. 1997; Niemeyer and Lombard 2003; Stofferahn 2009; Wernick and Lockeretz 1977; Wiegel 2009). Common barriers for adopting organic farming include lack of information, limited inputs, marketing problems, difficulties with weeds and pests control, constricted land tenure, unfavorable policies and negative social pressures (Blobaum 1983; Constance and Choi 2010; Cranfield et al. 2010; Delate and Dewitt 2004; Duram 1999; Duram 2000; Hanson et al. 2004; Lockeretz 1997; Reaves and Rosenblum 2014; Sullivan et al. 1996; Wernick and Lockeretz 1977; Wiegel 2009).

In the U.S., most existing studies on organic farming adoption sampled producers from a mixture of different commodity-types and heavily sampled producers of specialty crops (fruit and vegetables) and livestock, but fewer grain farmers (Anderson et al. 2005; Constance and Choi 2010; Cranfield et al. 2010; Duram 1999; Duram 2000; McCann et al. 1997; Stock 2007; Stofferahn, 2009). Lockeretz (1997) cautioned early that it would oversimplify the story to treat organic farmers of all commodity types as a single, unified group. Anderson et al. (2005) also recognized, given the large differences in growing conditions, management practices, and market structure, studies on fruit and vegetable producers cannot represent grain farmers. Moreover, studies focused on organic grain producers tend to become outdated, mainly conducted in the 1970s and 80s (Lockeretz and Madden 1987; Lockeretz et al. 1981; Wernick and Lockertz 1977). A study by Delate and Dewitt (2004) found that Iowa organic farmers continued to request the land-grant university increase its support to organic specialists and provide more accessible extension education services for organic farming.
In light of a gap in the literature, and information needed by agricultural extension educators and organic specialists for planning effective extension programs for promoting organic grain production, this study aimed to answer two research questions:

1. What are the motivations for farmers to adopt organic grain farming?
2. What are the challenges faced by farmers in adopting organic grain farming?

**Theoretical Framework**

To achieve the research objectives, we employed multiple sociological and behavioral theories to guide our inquiries: (a) diffusion of innovation, (b) theory of planned behavior, and (c) self-determination theory.

**Diffusion of Innovation**

The theory of diffusion of innovation (DOI) has served as a core theoretical framework for studying farmers’ adoption behaviors of organic farming (Mccann et al. 1997; Padel 2001; Stofferahn 2009; Wiegel 2009). A foremost framework, DOI is employed by agricultural and extension education services for promoting agricultural technology adoption and development worldwide (McIntyre et al. 2009). DOI indicates the adoption decision of innovation is determined by how people assess five attributes of innovation: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability (Rogers 2003). If farmers agree that organic farming provides relative advantages, is compatible with their values, beliefs, and prior experiences, easy to understand and practice, feasible to experiment on a small scale, and straightforward to observe, they will be more motivated to adopt organic production practices. Realistically, farmers will assess these five attributes differently, depending on personal factors and features of operation, providing a total measure of willingness for individuals.
Based on the timing of innovation adoption, Rogers (2003) categorized individuals into (1) innovators, (2) early adopters, (3) early majority, (4) later majority, and (5) non-adopters or laggards (p. 270). These labels are widely used to describe potential adopters across adoption studies. Rogers claimed the percentage of adopters in each category followed a normal distribution. The first 2.5% of adaptors are innovators. Given the 2017 adoption rate of organic farming for all crops and livestock in the U.S. was 0.89% (USDA NASS 2019, p. 61), American organic farmers may still be classified as innovators. Padel (2001) argued organic farmers generally fall into the “innovators” and “early adopters” categories whose characteristics are “venturesome,” “cosmopolites,” and “respectable” (Rogers 2003, p. 270).

A subset of scholars have stated that ecological farming management systems, such as organic farming, do not lend themselves to DOI because they are insufficiently discrete in the literature, and the majority of early focal technologies of DOI studies in agriculture were hybrid seeds, synthetic fertilizers, and chemicals associated with the Green Revolution during the 1960s (Padel 2001). However, Padel concluded DOI is still applicable to organic farming adoption, while both similarities and differences exist between the adoption of organic farming and conventional agricultural innovations. Both organic farming and conventional agricultural technologies rely on the “four elements” of diffusion — innovation, communication, time, and social system (Padel 2001; Rogers 2003). Organic farming likely emphasizes the following aspects: (a) a knowledge-based innovation, (b) its diffusion relies on inter-farmer and bottom-up communication, (c) takes a longer time to diffuse organic farming, and (d) may challenge the existing rural community values and social norms (Padel 2001).

Self-Determination Theory

A second framework is self-determination theory (SDT). Motivation is defined generally as “the psychological process that initiates, guides, and maintains human behavior” (Sichler
Many authors who describe farmer behavior rely on a general description of motivation. Knowing the structure of motivations can facilitate deciphering farmers’ interwoven decisions regarding decisions related to farming.

However, SDT is a formal theory based in psychology, and distinguishes motivations based on reasons and goals of action: intrinsic motivation and extrinsic motivation (Ryan and Deci 2000). Extrinsic motivation refers to “doing something because it leads to a separable outcome” (Ryan and Deci 2000, p. 55). Intrinsic motivation refers to “doing of an activity for its inherent satisfactions rather than for some separable consequence” (Ryan and Deci 2000, p. 56). SDT proposes a self-determination continuum that internalizes extrinsic motivations into intrinsic motivations through four regulation procedures: “external regulation” (e.g., a reward), “introjected regulation” (e.g., self-esteem or feeling of worth), “identified regulation” (e.g., goals or importance), and “integrated regulation” (e.g., personal beliefs and values) (Ryan and Deci 2002, p. 16).

The model has been used for a variety of adoption studies. When used in studies of agricultural producers, scholars have typically found farmers’ intrinsic motivations are the primary motivations for adopting sustainable farming practices, including land stewardship beliefs, biodiversity values, animal welfare ethics, public health concerns, and community resilience (Brédif et al. 2017; Kvakkestad et al. 2015; Mills et al. 2018). In comparison, extrinsic motivations tend to be secondary motivations of environmental farming behaviors, which include special financial incentives, profit maximization, farming viability, and regulatory compliance (Garini et al. 2017; Kvakkestad et al. 2015; Mills et al. 2018). These empirical examples guide differentiation of organic farmer’s motivations in this study.
Theory of Planned Behavior

The last framework is the theory of planned behavior (TPB). TPB states people’s behavioral intention to perform a behavior is motivated by attitudes toward the behavior and subjective norms, but controlled by ability (Ajzen 1991; Ajzen and Kruglanski 2019). Thus, TPB bridges the motivating factors and behavioral challenges for this study.

Attitude toward the behavior is “the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior” (Ajzen 1991, p. 188). Attitudes can be manifested by individuals’ perceptions regarding DOI’s five attributes of innovation (Zolait and Sulaiman 2008).

Subjective norm refers to “the perceived social pressure to perform or not to perform the behavior” (Ajzen 1991, p. 188). Subjective norm seems to connect well with the concept of “compatibility” in DOI. Rogers (2003) indicated if an innovation is not compatible with prevalent social norms in a social system, the innovation will not be rapidly adopted. The low adoption rate and slow growth of organic farming in the U.S. may be attributed to its “alternative agricultural paradigm,” conflicting with the American mainstream agricultural production paradigm in multiple dimensions (Beus and Dunlap 1990).

Behavioral control is “perceived ease or difficulty of performing the behavior” (Ajzen 1991, p. 188). Individuals with strong behavioral control are those who have the necessary resources, knowledge, skills, and opportunities to perform a behavior (Ajzen 1991). Conversely, a low level of behavioral control would impede the performance of a behavior (Ajzen and Kruglanski 2019). Based on TPB, scholars found farmers’ adoption behavior of organic farming is controlled by farmers’ knowledge and skills in organic farming; time availability for organic field operations; biophysical conditions of farmland; financial resources; institutional policies related to organic farming (Kaufmann et al. 2009; Läpple 2010; Läpple and Kelley 2013).
Methods

This research takes a qualitative approach to understanding farmers’ motivations for adopting organic grain farming and to identifying the challenges associated with their adoption process. Three reasons led to selecting a qualitative approach. Farmers’ motivations are complex and adoption challenges may continue to be emerging and shifting. Many studies are quantitative, but few are qualitative, so the complexity has not as often been captured. A qualitative inquiry was used to elicit in-depth, rich descriptions. We employed a qualitative study approach that focused on “meaning, understanding, and process” of organic grain farming adoption per Merriam (2009, p. 23). We collected qualitative data through semi-structured interviews with organic farmers. The lead author conducted seventeen semi-structured, on-site (in-person) interviews from November 2017 to March 2018, with protocols for human subjects approved by the Iowa State University Institutional Review Board (Appendix A and Appendix B). The interview guide included interview questions and probes (Appendix C) The interviews were audio-recorded and transcribed with the elimination of repeated words, filler words, and speech errors.

We employed a systematic analytical approach following the method-merits of Corbin and Strauss (2008) and Miles et al. (2014). The first cycle coding was an open coding process with constant comparisons; the second cycle coding was an axial coding process that explored the relationships between codes and categorized the codes into themes and sub-themes; final cycle coding was a selective coding process that unified central themes that answer the research questions (Miles et al. 2014). The coding process was performed using Nvivo 12, a qualitative data analysis software. The lead author presented the coding structure at local organic farmers’ meetings for feedback and incorporated observations to increase validity (Merriam 2009).
Sample and Participants Characteristics

This study was conducted in the state of Iowa, the largest state for both corn and soybean production in the U.S. (USDA NASS, 2019). Similar to the nation’s low adoption rate of organic farming, Iowa registered only 758 certified organic farms compared to a total of 86,104 farms (USDA NASS 2019). In Iowa, 0.21% corn production and 0.22% soybeans production were organic (USDA NASS 2017; 2018). The average size of Iowa’s organic farms (141 acres) is less than half of the state’s average farm size (355 acres) (USDA NASS 2017; 2019).

Both purposive and snowball sampling techniques were employed (Miles et al. 2014). The initial interviewees were recruited by using the listservs of two non-profit farmers organizations in Iowa: the Iowa Organic Association (IOA) and the Practical Farmers of Iowa (PFI). We selected farmers who operated organic grain operations, but may also have operated non-organic grain operations or other farming enterprises at the same time. The subsequent participants were recommended by the initial interview participants and were selected to increase diverse perspectives and personal characteristics, such as age, farm size, gender, and location.

The interview pool (Table 1) included sixteen male farmers and one female farmer, ages 35 or younger to 65 or older. Most interviewees held a college degree. At the time the interviews were conducted, fourteen farmers held organic certification, and three farmers were in the organic transition period. The participants’ organic grain operation size ranged from 80 acres to 1800 acres. Most participants owned at least a part of the farmland they operated except for three farmers, who leased all the land. Five farmers also managed livestock operations.
Table 1 Participant’s Demographics and Farm Structural Characteristics

<table>
<thead>
<tr>
<th>Coded farmer ID</th>
<th>Age group</th>
<th>1st year certified</th>
<th>Organic grain operation acres</th>
<th>Percent of land owned</th>
<th>Livestock operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>#01*</td>
<td>65 or older</td>
<td>2018</td>
<td>80</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>#02</td>
<td>55-64</td>
<td>2001</td>
<td>100</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>#03*</td>
<td>35 or younger</td>
<td>2018</td>
<td>80</td>
<td>0%</td>
<td>Yes</td>
</tr>
<tr>
<td>#04</td>
<td>65 or older</td>
<td>2015</td>
<td>153</td>
<td>0%</td>
<td>No</td>
</tr>
<tr>
<td>#05</td>
<td>65 or older</td>
<td>2017</td>
<td>137</td>
<td>80%</td>
<td>No</td>
</tr>
<tr>
<td>#06</td>
<td>45-54</td>
<td>1998</td>
<td>450</td>
<td>60%</td>
<td>Yes</td>
</tr>
<tr>
<td>#07</td>
<td>55-64</td>
<td>2009</td>
<td>228</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>#08</td>
<td>45-54</td>
<td>2014</td>
<td>250</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>#09*</td>
<td>35-44</td>
<td>2018</td>
<td>40</td>
<td>10%</td>
<td>No</td>
</tr>
<tr>
<td>#10</td>
<td>55-64</td>
<td>2008</td>
<td>130</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>#11</td>
<td>36-44</td>
<td>2000</td>
<td>372</td>
<td>40%</td>
<td>Yes</td>
</tr>
<tr>
<td>#12</td>
<td>65 or older</td>
<td>1998</td>
<td>260</td>
<td>40%</td>
<td>No</td>
</tr>
<tr>
<td>#13</td>
<td>35-44</td>
<td>2007</td>
<td>120</td>
<td>0%</td>
<td>No</td>
</tr>
<tr>
<td>#14</td>
<td>55-64</td>
<td>1998</td>
<td>1800</td>
<td>90%</td>
<td>No</td>
</tr>
<tr>
<td>#15</td>
<td>65 or older</td>
<td>1984</td>
<td>700</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>#16</td>
<td>55-64</td>
<td>1998</td>
<td>140</td>
<td>100%</td>
<td>Yes</td>
</tr>
<tr>
<td>#17</td>
<td>65 or older</td>
<td>2000</td>
<td>200</td>
<td>60%</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Note. * The farmers were in organic transition when the interviews were conducted in 2017, and they were certified in 2018.

Results

Motivations for Adopting Organic Grain Farming

Self, family, and consumer harm

An impetus for discontinuing conventional farming practices, and substituting organic production practices, was the claim that conventional practices caused harm. Different types of harm surfaced: harm to farmers, family members, farmworkers, and consumers. Fifteen farmers deemed personal health concerns as a motivation for adopting organic farming. Eight told stories
about themselves or family members who experienced health problems they attributed to exposure to synthetic agricultural chemicals used in conventional farming operations. Farmer #10 explained how health problems encountered during conventional farming led him to adopt organic farming:

There are several reasons why [I adopted organic]. The first one is my father got Parkinson’s disease. He later died from Parkinson’s disease. The insecticides that he used over the years for his farming practices—there is a direct link between those agricultural insecticides and pesticides, and development of Parkinson’s disease.

For many farmers with children living on the farm, their health concerns were geared towards their children’s well being. Farmer #09, who had three children, commented:

I don’t want to feed my kids poison. People fall all across the spectrum in terms of how they view the junk we put on our food, but I think we put poison on our food. I don’t want to feed this to my kids.

Some farmers extended their concerns beyond themselves and their families to include consumers. Farmer #07 explained how a personal chemical incident developed into a concern for consumers’ health.

I had one accident with 2,4-D [herbicide] one time. I got sick. I knew there were dangers and concerns about the handlers and what impact it would have on their health. Then, I just knew there’s a potential for leftover residue in the food products or feed products. Then that compounds the potential problems.

**Economic cushion**

Some farmers, who face economic issues while managing conventional farming systems, are economically motivated to adopt organic grain production because there is potential to
receive price premium. The concept of the price premium attracted seven farmers to adopt organic grain farming. When asked what first interested the farmers in organic farming, farmer #12 responded:

I think I heard about those $21 beans per bushel. At that time [in the 1990s], you could get $21 a bushel! I thought: man, maybe I should do that! You know, make some money. Maybe that was the real reason.

Organic farmers have a smaller farm size on average than conventional farmers (USDA NASS 2017; 2019). Small farms are often disadvantaged in competing with larger farms. Nine interviewees identified themselves as small scale farmers and believed organic farming could help their small farms perform better in the competition. Farmer #17 said:

I transitioned because we have a small farm and the goal was to make more money per acre so we could stay on our small farm. I got tired of all the games the chemical companies played. They were giving special prices to big farmers. They had some people that got way better, cheaper prices than we did [because] we were small.

Because of the sluggish conventional grain markets in the years prior to the study, six farmers indicated they had to look for alternative ways to stay in farming. Farmer #03 described his rationale for converting to organic farming:

I started farming conventionally in 2011 and 2012 when corn was worth $7 and beans worth $12 to $14. Progressively, it’s gotten worse and worse. I lost money instead of making money. I knew something else was going to have to happen in order for me to stay on the farm fully employed. So, I took the leap and started transitioning [to organic] some of my acres out of 400 acres.
Stewardship legacy and values

Land stewardship was determined a multifaceted motivation for adopting organic grain farming. Fifteen farmers noted they chose organic farming to accomplish better land stewardship goals.

Many of the farmers had adopted conservation practices before they started organic farming. Specifically, three farmers used no-till field management, and five farmers minimized the use of agricultural chemicals as a part of their conventional operations. Six farmers deemed land stewardship a family farm tradition. As farmer #06 said: “I feel I have a responsibility to leave it [the farm] better than I received.” Farmer #06’s father added: “I’m the second-generation farmer here. My dad before me, we have always been very conservation-minded.”

Farmers who considered conservation as a core tradition chose organic farming as a way to honor the conservation legacy and to achieve land stewardship goals. Farmer #01’s wife said: “It’s also part of our overall concern for the environment and treatment of the earth. And that’s honoring conservation issues.” Farmer #10 said: “Within the conventional farming system, we were employing a lot of practices to reduce the negative impacts. Now, on the organic side, I think we’re improving the environment quite a bit by the way that we farm.”

In addition to continuing conservation traditions, regarding soil health as a success of farming also suggests another perspective of land stewardship that motivates farmers to adopt organic farming. Seven farmers stated the success of their operation relied on soil health. They saw organic farming as a way to achieve soil health. Farmer #04 identified himself as “a firm believer of soil health,” and he said: “You have got to take care of your soil health and it can be done [in an organic farming system].”

The organic farmers do not see a conflict between pursuing profitability and preserving natural resources. On the contrary, most stated their farm’s prosperity relies on healthy soil.
Farmer #14 said: “I think maximizing our profit while preserving our natural resources, our soil. These two go hand-in-hand. Your soil life and your biology in the soil can affect your [soil] fertility.”

Four farmers indicated they had highly erodible land that had experienced serious soil loss from conventional farming management. They chose organic farming to better control erosion and to improve soil health. Farmer #05 described:

I call that my field from hell! The soil had been eroding from that top ground to the bottom ground. We put in oats the first year [of organic farming] and we stopped some of that erosion. We grew clover, that helped too. So, not only am I thinking about raising organic grain and getting a good price for it, but I’m also thinking about what it’s doing for the soil.

Religious beliefs also helped farmers form stewardship values and motivated some farmers to adopt organic farming. Four organic farmers identified themselves as Christian and associated their beliefs with choices regarding farming systems. These farmers stated organic farming was a way to express tenets of Christianity, follow God’s will, and trust in their faith. Farmer #11 explained:

I’m a Catholic, and so that’s important. So, this is God’s creation and we’re to be stewards and take the best care of it. That’s an important factor in organic farming. The soil is the way God designed. All this stuff to work is amazing, and sometimes we just have to trust. So I think that’s a strong influence.

**Mourning for the loss**

Another motivation for adopting organic farming is farmers’ mourning for the losses attributed to conventional farming practices. One of the losses is associated with biodiversity,
and the other loss connects to a sense of attachment to land, livestock, and social practices of an earlier era.

Seven farmers indicated they choose organic farming because they miss the farms with diversified ecology, such as high biodiversity. When asked about why they would like to convert farmland to organic, farmer #05 answered:

There would be more biodiversity. When I came to the farm, we had red-headed woodpeckers out here. We don’t have that anymore. We used to have jackrabbits. They’re gone. It’s hard for me to say, but I know that when you think about it on all these fields where they’ve used Roundup, they destroy every plant in the field except the corn and soybeans. Well, how many insects, how many birds counted on some of those weeds, and they weren’t weeds that necessarily are competitive with the crops.

Organic farmers believe more biodiversity will bring better ecosystem services and can solve many problems they have in crop production. For instance, Farmer #01 described: “There’s a great number of natural predatorial insects that will eat aphids; that will eat some of the nematodes in the soil. There are natural ways to combat the problems all farmers have.” Farmer #16 further explained: “So we see our health and our economy supported by biological diversity and that’s very compatible with our quality of life. We believe that biological diversity is the answer to our problems and that diversity will give us the process.”

Six interviewees indicated they cherish the memory of the “old way of farming” that provided them with a stronger attachment to the land, and they would like to bring back the greater sense of attachment. Farmer #01 said: [I] wanted to try to bring the farm back to the way it was when farmed a long, long time ago.” Farmer #02 used to lease his land to his brother-in-
law for conventional operation. He said: “While I was watching how he farmed, it just didn’t make sense that how he did that… They plant it. Co-op sprays it. They come back for harvesting. No attachment to the land at all!” When farmer #09 recalled the farm in his childhood, he said:

Without question, it’s in my blood to do things that are more closely connected to the land. When I grew up, I was raising pigs outdoors. It was row cultivating the corn instead of using chemicals. We were baling hay in the summer, putting them in for the winter to feed the animals. When I became an adult and I started to have a family, I realized the way we farm [conventionally] today pretty much leaves out all the fun stuff. It’s like all the things that I look back on and really cherish, and see that they were valuable in my development.

**Self-challenging**

Four farmers viewed organic farmers as a self-challenge opportunity. Farmer #12 made the organic adoption decision in the year 2000. He described his decision: “When the millennium came, so you went. But people have this feeling that it’s the millennium, I want to do something different. And that was what I did. I transitioned all of this farm [to organic]. So I did it in 2000.”

Being aware that organic farming would bring more challenges than conventional farming, farmer #08 said: “Everyone will tell you that’s so hard… Well, I guess I’m not afraid of hard.” Similarly, farmer #02 also said: “I always like to challenge myself. And so that’s what convinced me that even though just because not everybody in my neighborhood is farming organically, that doesn’t mean I shouldn’t do it.”

**Challenges for Farmers to Adopt Organic Grain Farming**

Farmers identified multiple challenges in the process of organic farming adoption. Five categories of challenges emerged from the interviews. Specifically, the challenges include (1)
operation and management; (2) marketing; (3) information and inputs; (4) social tension, and (5)
government programs.

**Challenges in operation and management**

Challenges in operation and management include (a) weed control, (b) time, labor, and weather; (c) no-till farming, and (d) cover crop management.

**Weed control**

Thirteen farmers indicated weed control was the most common problem raising organic grains. Conventional farming relied on synthetic herbicides, which are strictly prohibited in organic production. Weeds have been problematic for organic farmers, since the early days of organic farming, and are anticipated by farmers considering adoption. Farmer #07 said: “There are some really hard to control weeds…I knew there would be challenges there. But I didn’t realize how much trouble that would be. Particularly, the tough weeds, the Canada thistle, and the giant ragweed.”

**Time, labor and weather**

Because of high weed pressure, farmers tend to spend more time on field operation for weed control. However, effective weed control operations (e.g. field cultivation; tillage) must be completed under good weather conditions and require an intense labor force. Therefore, time, labor, and climatic conditions turn into composite constraints in the organic farm operation. In the interview, almost all (15) farmers mentioned time, labor, and climatic constraints in their organic farming adoption process. Farmer #3 said:

Time is probably number one. Like cultivating or whatever planting, they have to be done on a very timely basis for organic. If the weather doesn’t cooperate, you’re going to be stressed out. If I have two or three [more] people, yeah. I’ll just
go over there, but it’s hard to find people who can do the work that you want to be done.

Similarly, farmer #11 also said: “It’s much, much more time-consuming…You have to do things when the weather says to do and when the weeds are the right height and then you have to cultivate. It doesn’t matter if it’s Father’s Day or a holiday.”

**No-till farming**

Tillage practices are relied upon in organic farming systems for weed management. However, farmers also recognized that tillage can damage several aspects of soil health and can lead to erosion. Conventional conservation tillage or no-till systems, however, rely on herbicides application. Farmers who prefer to have an organic no-till system expressed they had little knowledge or experience regarding organic no-till systems. Farmer #10 said: “All those tillage operations that we were doing to control weeds make the soil compaction worse. I don’t think it’s a good idea to keep doing all this tillage to grow organic crops.” Farmer #01 has newly experimented with organic no-till farming. He said: “We are not sure if we’re going to be able to maintain organic no-till farming,” as he experienced technical issues with the system.

**Cover crop management**

Farmers use interseeding cover crops to improve soil organic matter content, manage weeds, to reduce nutrients and silt from leaving the farm. However, using interseeding cover crops introduces additional challenges for organic farming—cover crop termination. Herbicides, not allowed in organic systems, are used to suppress cover crops in conventional farming systems. Organic farmers use mechanical methods to terminate cover crops, but their use is considered to be more complicated. For instance, farmer #01 said: “We had some troubles killing the cover crops. We grew hairy vetch. It just came back. We crimped it twice and mowed it twice [until it died].” Farmer #15 also felt frustrated with cover crop management. He said:
“Every time I’ve tried [cover crops], it blew up my face. So I’m either not using the right crop or not doing something properly.”

**Ready access to organic markets**

**Local market infrastructure**

Most farmers (11) agreed that the marketing of certified organic corn and soybeans was satisfying because the demand for organic grain has grown, and there are more organic grain buyers and brokers than before. However, the location of the markets is an issue. Eleven farmers indicated they had to sell organic grains outside the state of Iowa. The top states where they sell are Minnesota, Illinois, Wisconsin, Nebraska, and Missouri. Farther market destinations are Oregon, Arkansas, Vermont, and New York. Lack of local organic market infrastructure (e.g. organic grain elevator, organic brokers) increases marketing costs. Farmer #01 said:

We have to pay a fee for semis [trucks]. We have to ship it somewhere. Maybe to Omaha or Chicago. We have that cost. So ten dollars all of a sudden come down to eight dollars. Just to sell it because we can’t put it in the elevator around here.

There’s no elevator [for organic].

Lack of local organic market infrastructure also impairs market efficiency. Farmer #05 shared a story:

I have this friend…took his organic grain and shipped to [an organic grain brokerage company in] Minnesota. Then he finds out his neighbor bought his organic grain for livestock from [the same company in] Minnesota. So the same grain went away and came back again. It could have been just 12 miles [between my friend and his neighbor].
Transitional crops

Because of the three-year organic transitional period, the transitional crops of the first two years are not eligible for marketing as organic grains, yet need to be marketed. The marketing of organic transnational grains appeared to be a challenge. In the interview, eight farmers mentioned they had difficulties in selling their organic transitional grains with a price premium. Most of the time, farmers ended up selling their transitional corn as conventional corn without any price premium and selling the transitional soybeans into the non-GMO soybean markets with a small amount of price premium. Farmer #08 said: “Well, the challenge is how to market all your crops during the transition. I sold them on the conventional market, to a local elevator, but it wasn’t easy. It was confusing.”

Rotation crops

Organic farmers commonly have extended crop rotations. To retain the certified organic status of the grain crop, the rotation crops must also be raised organically. However, marketing of rotation crops, including small grains (such as oats and wheat) and hay crops, are challenging in Iowa because the crops are considered minor crops, with small markets. Five farmers reported difficulties in selling hay as organic, and four farmers reported difficulties selling small grains as organic. Farmer #17 said: “Alfalfa is the hardest crop to sell, because of the freight. You just can’t get enough tons on a load to justify hauling it very far. So we sell most of our alfalfa at conventional prices.”

Information and inputs

Information availability related to organic farming has improved over the years. Farmer #17 said: “There was not much when we started in 2000, but there is a lot more now. They [information sources] are incredibly valuable.” However, some farmers reported information is lacking at the local level. Farmer #15 reported: “Getting local information…extension services
know nothing about organic. They don’t know. A lot of times, I’ll get a call from extension
[about organic farming questions].” Farmer #01’s wife said: “Other challenges are finding
resources, [such as] people really are knowledgeable about organic farming.” Farmer #01 added:
“We can’t find that much locally.”

The availability of organic input showed an improvement trend. Farmers indicated
organic seeds, fertilizers, and other inputs used to be less available to organic grain farmers in
Iowa, but have become more accessible as more organic input companies have begun doing
business in Iowa.

Nevertheless, machinery tailored to organic grain operations remains less available.
Organic farmers tend to purchase more types of implements than conventional farmers, such as
cultivators, and rotary hoes. Preferences for tractors and implements may also be smaller in size
to fit more diverse cropping systems. Finding the right type and size equipment for organic
farming is a moderate challenge for organic farmers. Farmer #02 said: “They don’t make small
size equipment I need. That was kind of irritating me because I had to go more to the European
equipment to find a size that was 13 feet.” Farmer #08 said: “We had a kind of a crop failure
trying to grow organic peas because we didn’t have the right equipment to harvest them.”

Besides sourcing the right equipment, farmers have had to learn the proper way to set up and
operate the equipment. Farmer #07 said: “One year, we had really good weed control when we
were raising beans. The others were not so good, mostly because of the cultivator. I just have to
learn how to set the cultivator better.”

Social tension

Besides the technical challenges, organic farmers reported enduring social rejection in the
local farming community. Even though most organic farmers exclaimed they are self-determined
in adopting organic farming, social rejection is a negative experience. Farmer #07’s wife said:
We’ve got made fun of for a long time. Because in this area, people said “What are you doing here? You’re going back to the horse and buggies?”… They laugh at us as much. So [my husband] just laughs with them because they couldn’t understand why you would do this.

Because herbicides have been widely used in conventional farming operations, the “clean field” has become a gold standard for successful farming in Iowa. Visually, the organic grain farming system, together with its rotation crops, is not as “clean.” An organic field with some weeds in the rows or along the edges of rows can be labeled as a “failure” in a farming community that is dominated by conventional farming systems. Such negative social pressures can complicate the decision of farmers considering adopting organic farming. Farmer #01’s wife shared a story about her relatives. She reported they did not try organic farming because “they didn’t want to be embarrassed by having weeds in the field because that would make them look like bad farmers.” Farmer #01 also said he had a friend who tried organic farming only in the fields behind his grain bins to hide the attempt from other neighbors’ views. Farmer #10 described how he managed his reaction to social pressure over time:

I look around, and all of the corn and soybean fields are completely free of weeds around me. And I’m the only farmer in our township who has weedy fields. It wears on your psychology and affects your self-esteem. It really affects you quite a bit. I finally got to this point where it just doesn’t bother [me] as much.

Social tensions between organic farmers and conventional farmers are often exacerbated with situations where pesticides drifted to organic crops. Three farmers mentioned they experienced pesticide drift incidents from neighboring conventional farming operations. Farmer #12, reported that a local pesticide applicator accidentally sprayed his organic grain transitional
field. This incident caused his organic certification to be postponed. Farmer #10 assumed the tension was two-way. On the one hand, organic farmers tend to worry about the risks of pesticides drifting from operations on conventional farms. On the other hand, conventional farmers may be concerned that organic farms introduce pathogens, weed seeds, or insects to their farms because organic farmers refuse to use chemicals to control outbreaks.

**Government programs**

The federal government has established subsidy programs, such as the Environmental Quality Incentives Program (EQIP) and Conservation Reserve Program (CRP), that encourage ecological farming practices (e.g. organic farming). However, government programs are complex, and rules for organic farmers may not be well understood by the local offices’ staff who administer the programs. Three farmers indicated their local government office staff are not knowledgeable enough about how the programs work with organic farming systems. Farmer #08 said:

> I had heard a little bit about this EQIP program and how it could potentially help you during the transition [to organic]. Unfortunately, my NRCS [Natural Resources Conservation Service] office staff was not knowledgeable about these programs and not helpful or timely in getting me signed up.

Two farmers criticized the complexity and redundancy of the programs’ paperwork. Farmer #12 said he had to hire a third-party consultant to complete the paperwork needed to sign up a government program. Farmers also criticized government programs for not being sufficiently flexible to accommodate organic farming. Farmer #09 said:

> I had Plan B, but I went back to Plan A because I have committed to this EQIP program. Farming in an organic rotation in itself is so complicated, and now I’ve
got commitments to a program which isn’t flexible, like a farmer needs to be. It’s really unjust.

Organic farmers tend to have diverse crops and may choose an innovative cropping system, such as intercropping. Organic farmers expected to insure all types of their organic crops. However, two organic farmers complained the crop insurance they had could not provide insurance policies for their rotation crops and inter-seeding crops based on organic prices. Farmer #15 said:

I do the cover crop for alfalfa and I put my wheat seeding, then harvest them.

They will insurance my corn and beans, but won’t do my seeding [crops]. Now to me, when we’re trying to control erosion, clean up water, make life better, why shouldn’t I be able to get federal crop insurance [for my seeding crops]?

**Discussion**

**Motivations Embedded into Theories**

This study discovered multiple motivations for farmers to adopt organic grain farming in Iowa. There are five major themes and twelve sub-themes of motivations that led farmers to adoption of organic grain farming (Table 2). With the aid of the theoretical framework (DOI and STD), sub-themes of motivation started to form logical chains and tell the following stories.
Table 2 Themes and Sub-themes of Motivations to Adopt Organic Grain Farming

<table>
<thead>
<tr>
<th>Themes</th>
<th>Sub-themes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self, family, and consumer harm</strong></td>
<td>Health problems related to chemicals</td>
</tr>
<tr>
<td><strong>Economic cushion</strong></td>
<td>Profitability</td>
</tr>
<tr>
<td><strong>Stewardship legacy and values</strong></td>
<td>Conservation tradition</td>
</tr>
<tr>
<td><strong>Mourning for the loss</strong></td>
<td>Values of biodiversity</td>
</tr>
<tr>
<td><strong>Self-challenging</strong></td>
<td>Self-challenge</td>
</tr>
</tbody>
</table>

**Problems lead to concerns and internalize into motivations**

*From personal health to public health*

Health problems experienced with agri-chemicals led some farmers to sequentially develop health concerns for themselves, their families, and consumers. These farmers integrated the experience into their decision-making process. With the lens of SDT’s self-determination continuum (Ryan and Deci 2000; 2002), this study found the internalization process of farmers’ adoption motivations. Farmers seemed to first seek an external reward—to avoid exposure of individuals and family members to toxic farming materials. The STD theory would label this as an extrinsic motivation because their decision to adopt organic farming is regulated by external rewards.

Furthermore, some of the farmers also extended their concerns about the effects of agri-chemicals to consumers and the general public’s health. They stated part of their logic for adopting organic farming was to protect consumers (others) from agri-chemicals and they cemented the belief that organic agriculture would improve humans’ health conditions.
Chemical-free working and living conditions expanded to a broad sense of enjoyment, value of healthy food, and a safe environment. This reasoning is more internal motivation than external. The sequence was evident from the data, but may be reversed in other studies. The self-other valuing, and its ability to tie together extrinsic and intrinsic motivations provide a strong anchor for an adoption rationale.

*From profitability to viability*

Many farmers were attracted by the organic price premium. Farmers wanted to garner the price premium to improve profitability. For most farmers, their goal was not to maximize profits but to achieve farm viability. To them, profitability is often a pathway to long-term farm viability. Most farmers who adopted organic farming have relatively small operation size and limited capital. As the conventional grain markets became sluggish, it was difficult for small farmers to compete with large farms. To stay in business, the farmers looked for alternative farming methods that could potentially bring more profits. The price premium of organic grains enabled farmers to generate more revenue and achieve their farms’ long-term viability. Along with the self-determination continuum of SDT, farmers initially looked for additional profitability (e.g., organic price premium) as an external reward of organic farming because they sensed the pressures to compete with larger farms and set the operation goals to stay with the small farm operation. Then, farmers developed a belief that organic farming could help them sustain the viability of their small family farms.

*Defined values and beliefs*

DOI recognized the compatibility with values and beliefs to motivate people’s adoption decisions. For organic grain farming adoption, farmers’ values and beliefs focused on three areas: land stewardship, biodiversity, and land attachment.
This study identified stewardship legacy and values as a theme of adoption motivations. Although many scholars also recognized farmers’ value on stewardship motivate adoption decisions of organic farming (Cranfield et al. 2010; Duram 2000; Mccann et al. 1997; Wiegel 2009), the literature seldom provided in-depth explanations. By identifying three sub-themes of stewardship and connecting them with the concept of compatibility in DOI (Rogers 2003), we were able to understand how farmers’ stewardship values formed as motivations to adopt organic farming.

Stewardship legacy and values manifest three types of values and beliefs. Farmers are motivated to adopt organic farming when they perceive compatibility with their values and beliefs. (1) Many farmers were taught conservation values from their family farms. They employed conservation practices to minimize natural resource degradation. When they discovered organic farming could improve natural resource management, many farmers embraced organic farming because they saw the practices would honor their conservation traditions. (2) Many of the farmers understood successful farming was tied to soil health. Healthier soil increased fertility, and contributed to higher productivity and crop quality. (3) Some farmers linked their Christian faith to valuing and stewardship of the land. They adopted organic farming because they saw organic farming practices were compatible with religious beliefs.

We also captured farmers’ emotional reactions resulting from losses of biodiversity, and strong senses of attachment to the land and to practices of prior chemical farming eras. Previous studies also found farmers’ value for biodiversity is a driver for adopting organic farming (Anderson et al. 2005; Duram 1999; Stofferahn 2009). In this study, many farmers believed an ideal farming system is composed of multiple crops, insects, livestock, wildlife animals, and
more. A framework common to the organic farming community states biodiversity could restore its systematic functionality and utilize ecosystem services to solve agronomic problems (Gurr et al. 2003). They believe industrialized monoculture and extensive use of chemicals have not only damaged biodiversity, but have also made farmers physically and emotionally more apart from the land. Since the average size of American farms has expanded, while the number of farmers continues to decrease (MacDonald et al. 2013), some farmers have changed their occupations, and left the land they lived and farmed. Farmers adopted organic farming because they see organic farming practices can make people better connect with the land.

**Venturesome characteristics**

Many farmers who adopted organic grain farming tend to be more self-challenge oriented. These farmers started organic farming when the majority of farmers were not well informed about organic farming. The farmers refused to follow the crowd or continue to do the same things as most other farmers. They adopted organic farming as an achievement that can distinguish themselves and they take pride in it. The farmers were not afraid of failures and challenges, even though they have borne with negative social pressure and faced technical difficulties. Such venturesome characteristics confirmed organic farmers are innovators categorized under DOI. According to SDT, farmers’ venturesome characteristics suggest farmers have a high level of autonomy, which implies their personal characteristics act as an intrinsic motivation to adopt organic farming.

**Evolving Challenges for Organic Grain Farming**

This study identified multiple challenges for producers who raise organic grains in Iowa. There are five main areas of challenges, to varying degrees, that impeded farmers’ adoption of organic grain farming (Table 3). From TPB’s behavioral control perspective (Ajzen 1991), our findings suggest farmers’ organic farming adoption behavior is controlled by farmers’ skills in
the area of organic farming operation and management, accessibility of organic grains market, availability of information and inputs relevant to organic farming, negative social pressures, and support through government programs. These challenges also empirically illustrate the complexity of organic agriculture’s farmed by DOI (Rogers 2003). By reconnecting the interview results with relevant literature, we discuss below how the challenges evolved and impeded farmers adopting organic grain farming.

**Table 3 Challenges of Organic Grain Farming Adoption in Iowa**

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation &amp; management</strong></td>
<td>Weed control, Time, labor, and weather, No-till systems, Cover crop management</td>
</tr>
<tr>
<td><strong>Organic markets</strong></td>
<td>Local market infrastructure, Transitional crops marketing, Rotation crops marketing</td>
</tr>
<tr>
<td><strong>Information &amp; inputs</strong></td>
<td>Local extension services, Machinery for organic</td>
</tr>
<tr>
<td><strong>Social tension</strong></td>
<td>Negative interactions with conventional farmers, Different standards for successful farming, Pesticide drift and uncontrolled pests</td>
</tr>
<tr>
<td><strong>Government programs</strong></td>
<td>Office staff lack of knowledge, Complexity of government programs, Inflexible government programs</td>
</tr>
</tbody>
</table>

**Weed control and its derivative problems for organic farming management**

Most of the operation and management challenges noted by grain farmers are related to weeds, a longstanding issue across years, regions, and commodities (Blobaum 1983; Constance and Choi 2010; Hanson et al. 2004; Reaves and Rosenblum 2014; Wiegel 2009). This study refined the observations. Weed control has been a two-fold problem for organic grain farmers. One is about the technical difficulties of weed control. Also, weed control has caused issues about labor and management over time. Herbicide application reduced the need for labor and simplified field management practices for conventional farmers. However, organic farmers must
retain a labor force, spend more time on-field operations, and seek multiple implements for diverse crops and point in the growing season, to successfully manage weed pressure. The effectiveness of weed control for organic operations is also more sensitive to weather conditions throughout the growing season. As climate change makes the Midwest wetter (Hatfield and Walthall 2014; Reidmiller et al. 2018), it creates more favorable conditions for weed growth, but allows for a shorter period of time for grain farmers to perform timely field cultivation.

In this study, unlike prior studies, neither pest control nor disease control was stated a noteworthy problem by organic grain farmers. This may be because previous studies focused on organic fruit and vegetable producers or livestock producers (Constance and Choi 2010; Cranfield et al. 2010; Hanson et al. 2004; Lockeretz 1997; Reaves and Rosenblum 2014; Wernick and Lockeretz 1977; Wiegel 2009). The production of fruit, vegetables, and livestock is generally more susceptible to pests and diseases than grain production.

Organic farmers commonly use mechanical methods to control weed and manage cover crops, such as tillage or cultivation. However, more frequent tillage operations in organic farming systems have been under criticized for contributing to soil compaction, crusting, erosion, and reducing soil organic matter content (Gruver and Wander 2019; Mäder and Berner 2011). Although crop rotations with small grains and hay crops somewhat offset tillage drawbacks, tillage operations are not aligned still with organic farmers’ values on natural resources conservation and soil health. Therefore, farmers are inclined to organic no-till farming systems. Research on organic no-till systems has been conducted (Delate et al. 2012; Delate et al. 2018), but the no-till techniques that fit Iowa’s landscape and climate are still being refined through on-farm research at the time of this study (Delate and Adcock 2019).
Farmers discussed cover crop management as a challenge. This was reported less in previous studies. With the federal government’s financial support, the use of cover crops in the U.S. became prevalent since the early 2000s (Groff 2015). From 2012 to 2017, cover crop usage surged in Iowa. The acres of cover crops increased 156% over these five years (Adams 2019). Farmers use cover crops for better soil and water conservation, such as reducing soil erosion and maintaining nitrate-nitrogen in the field (Groff 2015). Organic farmers use cover crops as a multifunctional management tool to suppress weeds, fix nitrogen, diverse the cropping system, and increase soil organic matter (Wayman et al. 2016). Roesch-McNally et al. (2017) found in the U.S. Midwest, there are structural obstacles and technical difficulties for farmers to use cover crops. Therefore, how to appropriately grow cover crops to better improve soil fertility and how to effectively terminate cover crops without herbicides drew organic grain farmers’ attention. Thus, they perceived this as a challenge.

Localized and specialized marketing difficulties

This article began by noting the high demand for organic grains, but for farmers, a key problem has been market access. Comparing with earlier literature (Blobaum 1983; Duram 1999; 2000; Hanson et al. 2004; Wernick and Lockeretz 1977), the challenges of marketing organic grain seemed to improve to some extent along with an increase in consumer demand. However, at the local level, Iowa’s organic grain market infrastructure (principally grain elevators) is less abundant than the infrastructure for conventional grain. Many farmers may contract to sell their grains to buyers from other states, but the cost of freight is part of the contract. Farmers may benefit from contracts with in-state organic grain buyers and brokers. In addition to offering attractive contacts, local organic grain brokers may better connect with the local organic livestock producers and organic food processors on behalf of grain producers.
The organic transition period poses financial risks because, during the transitional period, farmers are required to raise crops organically, but they cannot sell their crops as organic. This finding confirms earlier results from studies of financial challenge phases in organic farming (Constance and Choi 2010; Duram 1999; Reaves and Rosenblum 2014). To offset financial challenges, organic grain farmers in Iowa sell their transitional grains to non-GMO markets, although the price is not typically as high as the full organic price premium. Farmers also strategize their transition plan, based on risk preference, operation and management skills, availability of markets, and the biophysical conditions of the land.

Organic farmers grow hay crops (e.g. alfalfa and clover hay) and small grains (e.g. oats, wheat, barley, rye) as rotation crops help to break the growth cycles of weed, disease, and insects (Bullock 1992). Comparing with the main row crops (corn and soybean), the deeper and larger rooting system of hay crops and small grains increase soil microorganisms and improve soil organic matter content (Malik 2010). However, it can be a challenge for many Iowa organic farmers to market their organic hay and small grains they do not use on their farms (i.e. for livestock). In Iowa, most grain production is separate from producers who use hay—the organic dairy producers clustered in the northeastern and southeastern areas of the state. Organic farmers from other areas have difficulties in selling their hay to the organic livestock farmers because hay is particularly heavy and bulky with high freight costs.

Marketing small grains is a challenge in Iowa because the traditional market outlet of small grains has dropped as the consolidation and vertical integration of livestock production; yet, the new specialized market opportunities (food-grade small grains, cover crop seeds, and peer-to-peer exchanges network) is still under development (Sustainable Food Lab and PFI 2018). Many organic farmers target food companies as the market for their organic small grains.
But food-grade organic small grains require a higher quality standard that needs free of weeds, insects, and mold. Farmers often need to take extra steps, and sometimes need additional equipment, to harvest, clean, and store these small grains (Howell and Martens 2002).

**Local information gap**

Information deficiency was a major challenge for the early organic farmers across regions (Blobaum 1983; Hanson et al. 2004; Reaves and Rosenblum 2014; Wiegel 2009). Information gaps included marketing channels, farming techniques, input sources, and certification procedures. Nowadays, most organic farmers locate most information through multiple information channels, including the internet. However, many of these farmers expressed frustration with difficulties in locating relevant information at, and about, key resources at the local levels, such as within a county. One possible reason is due to county-level extension educators’ lack of knowledge and experience in organic (grain) farming. Even though many land-grant universities have established organic agriculture programs (such as Iowa State University Organic Agriculture Program), the number of organic experts is limited, and farmers remark that the local educators are unable to provide sufficient extension services to organic grain farmers in the state.

**Machinery lags behind inputs**

Previous studies found organic farmers cannot always locate inputs for organic farming, including organic seed, manure, organic pesticides, and specialized equipment for organic production (Constance and Choi 2010; Hanson et al. 2004; Reaves and Rosenblum 2014; Wernick and Lockeretz 1977; Wiegel 2009). Our findings suggest the availability of most organic inputs have improved because more organic input businesses have started to operate in Iowa. IOA (2018) compiled a directory of organic suppliers listing more than two hundred companies that sell organic inputs in Iowa. However, farmers still have difficulties in finding
machinery specialized in organic grain operation. Three reasons can cause this. (1) Organic farmers need to source a wider variety of specialized equipment to fit diverse cropping systems. (2) Organic farmers tend to be more sensitive to climatic conditions. Different types of equipment are needed to fit the changing weather conditions. (3) Organic farmers prefer to use smaller size equipment because organic farmers have smaller farming scales and are often divided into multiple plots for rotation purposes. But today’s major agricultural machinery manufacturers tend to make more large-scale farm equipment.

**Enduring social tension**

Organic farming has been poorly accepted in the American rural community (Cranfield et al. 2010; Duram 2000; Wernick and Lockeretz 1977). The interviews identified social tension between organic and conventional farmers. Farmers who adopted organic farming described social pressure from their neighbor farmers and extended family farmers, who have conventional farm operations. There are mainly two factors that lead to social tension. First, conventional farmers and organic farmers have different definitions of successful farming. Conventional farmers see large-scale, highly industrialized, clean monocultural fields as successful farming; whereas, organic farmers view success as smaller farming size, healthier soil, and more diverse crops (Beus and Dunlap 1990). The second factor is because farmers on both sides are worried that their counterpart will bring potentially harmful risks to their farms. Specifically, organic farmers are concerned about pesticide drift from conventional farms, and conventional farmers are worried about organic farms would bring weed seeds, pests, or pathogens to their farmland or file a lawsuit when pesticide drift occurs. Though TPB theorizes subjective norm positively motivates behavioral intention (Ajzen 1991; Ajzen and Kruglanski 2019), these findings suggest negative social tension towards organic agriculture discouraged farmers who may consider adopting organic grain farming.


Program access issues

Compared with earlier studies (Blobaum 1983; Duram 2000; Wernick and Lockeretz 1977), federal government policies towards organic farming have become more favorable through programs, including EQIP, certification cost-share program, and more friendly insurance provisions for organic crops (Greene et al. 2009). However, at the policy implementation stage, three problems are identified in this study. (1) Government office staff lack expertise to guide farmers on how to enroll their organic operations into different programs. (2) The programs’ application procedures require complicated and extensive paperwork beyond some farmers’ capabilities. (3) Some programs lack adequate flexibility that better accommodate diverse and innovative cropping systems for organic farming. The 2018 Farm Bill provides more incentives to organic farming conversion, more accommodating insurance policies, and expands funding to support organic farming research and extension education (Organic Trade Association 2019b). These identified problems may be eased with further implementation of the 2018 Farm Bill.

Conclusions

This study addressed the gaps in the literature that lack an understanding of the motivation and challenges of U.S. Midwest farmers in adopting organic grain farming by collecting empirical data from grain producers in farmers in Iowa through 17 personal interviews. The first part of this study identified five major factors (Table 1) that motivate farmers to adopt organic grain farming. This study updated the literature and provides new insights. First, farmers presented both extrinsic and intrinsic motivations to adopt organic grain farming, whereas earlier studies emphasize mainly intrinsic motivations. For selected elements, the combination of extrinsic and intrinsic motivations likely provides enduring drivers (e.g. from personal health to consumers’ health; from profitability to farm viability). Second, compatibility with three types of values and beliefs (land stewardship, biodiversity, and land attachment)
motivated farmers to adopt organic grain farming. Third, organic grain farmers presented innovators’ venturesome characteristics, including self-challenge oriented and inclined to risk-taking.

The second part of this study identified five areas of challenges (Table 2) that farmers reported hindered them from readily adopting or persisting in organic grain farming. Some findings confirmed earlier conclusions in the literature, and some were new or appeared specific to grain farming in Iowa. (1) *Weed control* remains a central challenge. Moreover, as farmers incorporate new practices that, in part, manage weeds (such as use of cover crops and organic no-till systems), they are faced with a series of challenges related to implementing these practices. (2) *Organic grain marketing* benefits from high demand and steady certification programs, but challenges remain in transitional marketing crops and rotational crops (small grains, and hay) in a region of specialization of row crops. (3) *Information access.* Farmers have improved access information to some extent, but continue to state frustration regarding insufficient interaction and information from local farm advisors, including extension educators, who are not knowledgeable about organic farming as they need and want. (4) *Machinery lags behind inputs.* Farmers can obtain organic inputs directly from the organic suppliers, but finding appropriate machinery, including the right type and size, remains a challenge. Farmers also need training on how to set up and operate machinery for organic grain operations. (6) *Social tension.* The social tension between conventional and organic farmers play itself out in (a) pesticide drift, and concerns among both organic and conventional farmers regarding potential lawsuits, (b) embarrassment related to high weed density in organic fields, and (c) concern by both types of producers that organic farmers would be seen as conduits for unwanted insect and disease problems. (7) *Federal government programs.* Farmers acknowledged there are more
government programs for organic agriculture than previously but they are complex and sometimes unrewarding.

This study yielded rich empirical data and provided in-depth answers to the two research questions proposed. The concept of transferability of findings replaces the idea of generalizability for a qualitative study like this. Findings will be applicable mainly to situations where organic grain operators are an audience, particularly in the Midwest, but likely also in other regions of the US and Canada where grains are raised. Given the exploratory nature of this study, we identified important constructs of farmers’ motivations. These constructs are recommended to be used for further quantitative research. It was noticed that organic farmers’ challenges continued to evolve as conditions change. Therefore, it is recommended more empirical studies are needed to examine the dynamics of challenges along with any significant changes in policies or environmental conditions that may occur in the future.

Acknowledgments

This project was funded through USDA-SARE #GNC16-221. This work was also supported by the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa, USA. Project No. 3813 sponsored by the Hatch Act and State of Iowa funds. The authors gratefully acknowledge the following persons and their organizations for their help with this research: Dr. Kathleen Delate, Dr. J. Arbuckle, Dr. Robert Martin, and Dr. David Peters at Iowa State University; Dr. Stefan Gailans from Practical Farmers of Iowa; Ms. Rosalyn Lehman from Iowa Organic Association.

References


CHAPTER 4. ADOPTION CHALLENGES, EXTENSION PROGRAM NEEDS, AND PROGRAM DELIVERY FORMATS FOR ORGANIC GRAIN PRODUCERS IN THE U.S. CORN BELT

A manuscript prepared for The Journal of Agricultural Education and Extension

Guang Han
Nancy Grudens-Schuck
J. Gordon Arbuckle
Robert A. Martin

Abstract

Purpose: This study investigated a range of impediments to farmers adopting organic grain farming and assessed farmers’ needs for extension programs regarding organic grain farming.

Methodology: We surveyed 258 organic grain farmers in Iowa. We analyzed the data with descriptive statistics, confirmatory factor analysis, and paired T-tests.

Findings: We identified seven areas of challenges related to organic grain farming adoption: organic farming operations, marketing, policy, finance, inputs and information, social pressures, and land tenure. Extension programs were needed in three areas: education, research, and technical services. Organic farmers stated preferences for peer events: field days, one-on-one mentors, and farmer-to-farmer workshops

Practical Implications: This research provides important information for extension educators and organic specialists for programming agricultural extension programs on organic grain farming.

Theoretical Implications: Results provide empirical evidence to support theoretical discussions on adoption of organic grain farming. This study reveals how adoption challenges shift along with institutional and environmental changes, drive farmers’ needs for extension programs, and reveal educational delivery formats derived from a common learning approach.
Originality: This study focuses on grain farmers; whereas, other organic farmer studies emphasized other commodities. Given the high demand for organic grain products, a closer look at organic grain farmers was warranted.

Keywords: Organic agriculture; adoption; extension education

Introduction

After more than two decades of double-digit annual growth, the U.S. has become the world’s largest organic market (Willer and Lernoud 2019). Organic food sales accounted for 5.7% of the national food market in 2018 (OTA 2019a). Despite a strong demand for organic food, the adoption rate for organic farming in the U.S. is low, with 0.72% of farmland under organic operations in 2018 (NASS 2019a; Willer and Lernoud 2019). Organic grains have a lower adoption rate: 0.29% of corn acreage and 0.14% of soybeans acreage are organic (NASS 2017; NASS 2019b). The low adoption of organic grain farming among American producers has led to recurring shortages of organic grain in the U.S. (Charles 2017; Greene et al. 2009). Organic food processors have cut product lines due to an insufficient supply of organic ingredients (Roseboro 2016). Organic livestock producers have experienced difficulties in sourcing organic feed and have had to “deregister” their organic certification (Digiacomo and King 2015; Sierra et al. 2008). The low adoption rate has also limited the positive environmental impacts of organic farming systems, including reduction of nitrate leaching, lower rates of soil erosion, and increased biodiversity (Cambardella, Delate, and Jaynes 2015). Stakeholders (including organic livestock producers, food processors, consumers, and scholars) have appealed to U.S. producers to increase organic grain operations to strengthen the organic sector and to achieve broader improvements in the environment (Charles 2017; Greene et al. 2009; Reaves, Healy, and Beach 2019; Roseboro 2016). However, the appeals have not measurably affected adoption rates.
To convert to organic production systems, farmers may confront multiple challenges that may, in the end, stall adoption. For decades, a critical limitation reported is a lack of educational support for organic farmers from the typical sources of information. Several studies have documented that many among agricultural input dealers, crop advisors, and extension educators have been unable or unwilling to provide adequate information on organic farming (Constance and Choi 2010; Delate and Dewitt 2004; Duram 1999; Hanson et al. 2004). Insufficient information and education about organic practices and marketing have been identified as major barriers for farmers interested in adopting organic farming systems (Delate and Dewitt 2004; Duram 1999, 2000; Hanson et al. 2004; Lockeretz 1997; Reaves and Rosenblum 2014). Middendorf (2007) recognized that organic farmers need more education about farm management practices for organic crop production, storage and processing of organic produce, and marketing organic commodities. Polush et al. (2016) found farmer-members of an Iowa grass-roots farmer organization wanted more on-farm research about organic farming, comparative studies between organic and conventional agricultural production, insects and weeds control strategies, and soil amendments for organic farming. A study by Delate and Dewitt (2004) found that Iowa organic farmers continued to request the land-grant university increase its support to organic specialists and provide more accessible extension education services for organic farming.

Besides a lack of information and education about organic farming, several other major challenges have also impeded farmers’ organic farming adoption. Production and management challenges have been consistently identified, including weed control; diseases and pest management; soil fertility; climatic risks; genetically-modified organism (GMO) contamination; and availability of organic inputs, labor, and machinery (Blobaum 1983; Constance and Choi
Previous studies have frequently reported marketing challenges. Typical marketing challenges include lack of access to the organic market with a price premium; instability of organic markets; and lack of market for transitional commodities (Blobaum 1983; Constance and Choi 2010; Cranfield, Henson, and Holliday 2010; Duram 1999, 2000; Hanson et al. 2004; Reaves and Rosenblum 2014; Wiegel 2009). Although many farmers attempt to reduce operation costs when they adopt organic farming, many have experienced an increase in the costs of organic farm management in the transitional phase, mainly due to more expensive inputs, and additional investment in equipment and facilities for organic operation (Constance and Choi 2010; Lockeretz 1997; Reaves and Rosenblum 2014).

The principles of organic farming reject many prevalent industrialized farming practices and are at odds with the conventional agriculture paradigm (Beus and Dunlap 1990). Organic agriculture may challenge existing rural community values and social norms, so organic farmers can face negative social pressures in the adoption process (Blobaum 1983; Cranfield, Henson, and Holliday 2010; Duram 1999, 2000; Lockeretz 1997). Farmers also perceive some policy challenges, including complex regulations associated with organic farming and unfavorable government policies towards organic farming (Duram 2000; Constance and Choi 2010; Reaves and Rosenblum 2014). Furthermore, farmers have identified land tenure as a barrier to organic farming adoption, since landlords, uninformed about organic agriculture, may object to tenants’ decisions to adopt organic farming (Blobaum 1983; Duram 2000).

Specific challenges can vary by operation type. For instance, organic grain farmers tend to face more challenges with weed control, but may experience fewer pest and disease problems, compared with fruit and vegetable producers (Wiegel 2009). Lockeretz (1997) warned that it is
an over-simplification to treat organic farmers as a “single undifferentiated mass” (12). For example, findings from studies on fruit and vegetable producers from the U.S. West Coast cannot be generalized to grain farmers in the U.S. Corn Belt (Anderson, Jolly, and Green 2005; Chase, Delate, and Hanlon 2019). However, most existing studies on organic farming adoption have focused on the challenges and educational needs of organic specialty crops and organic livestock producers (Anderson, Jolly, and Green 2005; Constance and Choi 2010; Cranfield, Henson, and Holliday 2010; Duram 1999, 2000; McCann et al. 1997; Stock 2007; Stofferahn 2009). Gaps exist in the literature regarding specific challenges of organic grain farming, organic farmers’ needs for extension programs, and extension program types preferred by organic farmers.

Reforms related to education for organic producers have been sporadic. In 2018, the U.S. federal government issued more favorable policies for organic agriculture in the 2018 Farm Bill and allocated additional funds to support land-grant universities and organizations to further develop and deliver extension education and research programs for supporting organic farming (NIFA 2019; OTA 2019b). Educational programs on sustainable agriculture or organic agriculture have been offered by farm organizations, as well as by extension prior to this time but have been deemed insufficient. Offered program formats include field days, pasture walks, farm tours, workshops, webinars (farminars), conferences, short courses, and peer mentoring (Delate and Dewitt 2004; IOA 2020; MOSES 2020; PFI 2020).

To develop effective programs, extension educators need to identify challenges associated with farmers’ adoption processes, develop programs to fit farmers’ needs, and facilitate behavioral changes (Seevers, Graham, and Conklin 2007). This study aimed to 1) identify the adoption challenges of organic grain farming and 2) assess organic grain farmers’
needs for extension programs. From an extension teaching and communication perspective, extension education programs should be delivered through highly effective communication channels (Rogers 2003; Seevers, Graham, and Conklin 2007). Thus, this study also aimed to identify program delivery formats preferred by organic grain farmers.

**Diffusion of Innovation and Extension Education**

Converting from conventional farming to organic farming represents a major change for farm operations (Padel, 2001). To understand farmers’ challenges to adopt organic grain farming, needs for extension programs, and preferred education delivery formats, we grounded our study in Rogers’ (2003) theory of diffusion of innovations (DOI) that can “explain the educational processes that led farmers to accept new ideas” (Seevers, Graham, and Conklin 2007, 133). Over the past half-century, “the DOI model has played a central role in extension theory and practice throughout the world” (Peshin, Vasanthakumar, and Kalra 2009, 2). In the U.S., the DOI has been widely utilized by land-grant universities to guide the provision of Cooperative Extension Services (CES) to farmers and has become the theoretical basis for a classic agricultural technology transfer model (National Research Council 2002; Rogers 2003).

The DOI theory has also been utilized to guide studies of organic farming adoption (Lillard, Parker, and Sundermeier 2013; McCann et al. 1997; Padel 2001; Stofferahn 2009; Wiegel 2009). The diffusion of innovation depends upon four elements: “innovation, communication, time, and a social system” (Rogers 2003, 11). However, different from traditional technology-based agricultural innovations, organic farming is a knowledge / information-based innovation that requires farmers to make systematic changes and may pose financial risks (Padel 2001). The adoption of organic farming may take a longer time at a slower pace. Padel, along with other scholars (Blobaum 1983; Duram 2000; Wiegel 2009), recognized
organic farmers rely on information sharing between farmers, peer learning, joining grass-roots organizations, and forming self-help social networks to achieve bottom-up communications.

The adoption rate of innovation is mainly determined by people’s perceptions of five innovation attributes: “(1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability” (Rogers 2003, 221). Wiegel (2009) examined how these five attributes shape farmers’ adoption behaviors of organic farming. Wiegel found the relative advantages (e.g., economic rewards) and compatibility (e.g., environmental values and previous experiences) motivate organic farming adoption decisions. Trialability (e.g., starting with small scale) and observability (e.g., visiting other organic farms) facilitate organic farming adoption processes. On the other hand, complexity includes various challenges and difficulties related to organic agriculture, which hinders farmers’ success in adopting organic farming.

Inspired by DOI, Seevers, Graham, and Conklin (2007) acknowledged that teaching in CES is a form of communication. Extension educators develop communication messages—educational content and topics based on a clientele’s needs and deliver the messages through effective communication channels and formats. Sanders and Maunder (1966) emphasized: “Extension must be directed toward satisfying the needs of people, and must be started at the population’s own level of understanding” (10). Therefore, effective extension teaching communication starts with assessing farmers’ needs, including identifying challenges farmers may encounter, needs for information and services, and effective communication channels.

Methods

We conducted this study in the state of Iowa, a national leading state for grain production. The adoption of organic grain farming in Iowa is also low with only 0.2% of corn and soybean production acreages being organic in 2016 (NASS 2017; 2018). A survey instrument was developed to conduct the study, approved by the Institutional Review Board at
Iowa State University. This instrument was based on the literature review and prior in-depth interviews with 17 organic grain farmers. The survey contained 28 items that measured challenges associated with organic grain farming using a five-point scale ranging from 1 (not a challenge) to 5 (serious challenge) (Table 1). Also provided were 13 items to measure farmers’ needs for different extension programs related to organic grain farming on a five-point scale ranging from 1 (not needed) to 5 (strongly needed) (Table 2). Finally, 6 items were developed that describe program delivery formats and asked farmers to rate the effectiveness of each program delivery format on a five-point scale ranging from 1 (ineffective) to 5 (highly effective) (Table 3).

We mailed surveys to 655 Iowa farmers with organic grain operations in September 2019 using the U.S. Department of Agriculture (USDA) Organic Integrity Database (2019) as the sampling frame. We received 258 complete survey reports for a response rate of 39.4%. The average age of respondents was 51 years—6.4 years younger than the average age of Iowa farmers (NASS 2019b). The average operation size was 311 acres—smaller than the state’s average farm operation size of 355 acres (NASS 2019b).

Survey data were analyzed with descriptive statistics, including mean, standard deviation, and percentage distributions. A confirmatory factor analysis (CFA) was conducted on the measurement scales of “challenges” and “needs for extension programs” to identify and verify the underlying factors of the challenges and program needs (Brown 2006). Because the survey item responses were ordinal data rather than continuous data, we chose Weighted Least Square Mean-Variance Adjusted (WLSMV) estimator in CFA, as suggested by Li (2016).

Factor scores were indexed by the weighted arithmetic means of item response and factor loadings of CFA. The weighted factor score approach recognizes the strength of factor loadings
while retaining the scale metric that allows for straightforward interpretation (DiStefano et al. 2009). Cronbach’s α gauged measurement reliability.

To examine the statistical differences between each challenge area and between each program need area, we employed multiple paired T-tests based on the composite scores of different challenge areas or program need areas. Although many composite score variables were not normally distributed, paired T-tests are highly robust against violations of normality (Wiedermann and Eye 2013). Multiple T-tests may inflate Type I error, but the effect size (Cohen’s d) is reported and the Bonferroni correction is used to minimize error (Garamszegi 2005). The adjusted significance level is set at 0.008 to compare the six pairs of challenge areas; the adjusted significance level is set at 0.025 to compare the two pairs of program need areas. Bivariate correlations were employed to explore the associations between challenge and of years of certified organic farming, and operational size of organic farming; the associations between program needs and years of certified organic farming, and operational size of organic farming. Descriptive statistics, paired T-tests, and correlations were conducted using SPSS 25, and CFA was performed using MPLUS 7.

**Results and findings**

**Challenges of Organic Grain Farming Adoption**

Table 1 presents the seven-factor CFA model, standardized factor loadings, and descriptive statistics. The CFA model resulted in a good model fit ($X^2$ (378, N=256)= 598.2, $p$ <.01, RMSEA=0.08, CFI=0.92, TLI=0.91) (Schumacker and Lomax 2010). All items are significantly loaded to the corresponding factors. The CFA confirmed farmers faced seven areas of challenges associated with organic grain farming.

Based on ranking the composite score means (Table 1), the seven areas of challenges are: 1) operational; 2) marketing; 3) policy; 4) financial; 5) input and information; 6) social pressures;
and 7) land tenure. Overall, the survey items reliably measured each challenge area (Cronbach’s $\alpha >$ or $\approx 0.7$), although items for policy challenges and financial challenges may still bear slightly weak reliability.

Table 1. Descriptive statistics and confirmatory factor analysis of organic grain farming challenges

<table>
<thead>
<tr>
<th>Factor (Area of challenges)</th>
<th>Items</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Somewhat to serious challenge (%)</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational challenges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weed control</td>
<td>252</td>
<td>3.83</td>
<td>1.11</td>
<td>84.9</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>High sensitivity to weather</td>
<td>252</td>
<td>3.40</td>
<td>1.27</td>
<td>71.9</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Soil fertility</td>
<td>251</td>
<td>3.00</td>
<td>1.14</td>
<td>66.1</td>
<td>0.63</td>
</tr>
<tr>
<td>*Mean=3.04</td>
<td>Insect control</td>
<td>252</td>
<td>2.93</td>
<td>1.08</td>
<td>62.3</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>Plant disease control</td>
<td>252</td>
<td>2.81</td>
<td>1.07</td>
<td>57.9</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>Difficult to farm organically on hilly ground</td>
<td>251</td>
<td>2.79</td>
<td>1.24</td>
<td>55.4</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Difficult to integrate no-till operation into organic farming</td>
<td>246</td>
<td>2.75</td>
<td>1.48</td>
<td>54.9</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>Cover crop management</td>
<td>252</td>
<td>2.62</td>
<td>1.05</td>
<td>51.2</td>
<td>0.65</td>
</tr>
<tr>
<td><strong>Marketing challenges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of organic small grain market</td>
<td>252</td>
<td>2.90</td>
<td>1.29</td>
<td>58.7</td>
<td>0.83</td>
</tr>
<tr>
<td>*Mean=2.73</td>
<td>Lack of transitional grain market</td>
<td>249</td>
<td>2.88</td>
<td>1.35</td>
<td>57.8</td>
<td>0.84</td>
</tr>
<tr>
<td><strong>Cronbach’s $\alpha=0.87$</strong></td>
<td>Lack of organic hay market</td>
<td>249</td>
<td>2.81</td>
<td>1.36</td>
<td>55.8</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Lack of local organic marketing infrastructure (e.g., elevators)</td>
<td>252</td>
<td>2.66</td>
<td>1.31</td>
<td>52.0</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>Lack of organic corn and soybean market</td>
<td>252</td>
<td>2.32</td>
<td>1.22</td>
<td>38.9</td>
<td>0.83</td>
</tr>
<tr>
<td><strong>Policy challenges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Mean=2.47</td>
<td>Complexities of certification process</td>
<td>252</td>
<td>3.02</td>
<td>1.16</td>
<td>65.1</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Cronbach’s $\alpha=0.69$</strong></td>
<td>Crop insurance policies are not favorable to organic farming</td>
<td>247</td>
<td>2.30</td>
<td>1.39</td>
<td>40.5</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>Complexities of governmental programs</td>
<td>248</td>
<td>2.29</td>
<td>1.23</td>
<td>41.1</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Financial challenges</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Mean=2.39</td>
<td>High financial risk in the transitional period</td>
<td>249</td>
<td>2.77</td>
<td>1.29</td>
<td>53.4</td>
<td>0.81</td>
</tr>
<tr>
<td><strong>Cronbach’s $\alpha=0.69$</strong></td>
<td>Obtain loans for organic farming enterprise</td>
<td>250</td>
<td>1.98</td>
<td>1.07</td>
<td>26.4</td>
<td>0.76</td>
</tr>
</tbody>
</table>
Table 1. (continued)

<table>
<thead>
<tr>
<th>Factor (Area of challenges)</th>
<th>Items</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Somewhat to serious challenge (%)</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input and information challenges</strong></td>
<td>Local extension agents lack expertise in organic farming</td>
<td>248</td>
<td>2.56</td>
<td>1.25</td>
<td>46.0</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Finding sufficient labor</td>
<td>253</td>
<td>2.52</td>
<td>1.30</td>
<td>48.2</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Finding organic inputs</td>
<td>252</td>
<td>2.31</td>
<td>1.03</td>
<td>40.9</td>
<td>0.69</td>
</tr>
<tr>
<td>*Mean=2.28</td>
<td>Finding the necessary machinery for organic farming</td>
<td>252</td>
<td>2.16</td>
<td>1.13</td>
<td>32.1</td>
<td>0.72</td>
</tr>
<tr>
<td>*Cronbach’s α=0.81</td>
<td>Insufficient educational programs for organic farming</td>
<td>253</td>
<td>2.13</td>
<td>0.95</td>
<td>31.2</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>Lack of skills to setup/operate machinery</td>
<td>252</td>
<td>1.95</td>
<td>1.01</td>
<td>24.2</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Social pressures</strong></td>
<td>Negative attitude against organic farming from other farmers</td>
<td>251</td>
<td>2.39</td>
<td>1.28</td>
<td>39.4</td>
<td>0.84</td>
</tr>
<tr>
<td>*Mean=2.19</td>
<td>Feelings of isolation in the local rural community</td>
<td>252</td>
<td>2.00</td>
<td>1.20</td>
<td>29.8</td>
<td>0.95</td>
</tr>
<tr>
<td>*Cronbach’s α=0.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Land tenure challenges</strong></td>
<td>Unstable land leasing agreement for organic operation</td>
<td>251</td>
<td>2.13</td>
<td>1.23</td>
<td>31.9</td>
<td>0.90</td>
</tr>
<tr>
<td>*Mean=2.16</td>
<td>Lack of owned land that I control</td>
<td>249</td>
<td>2.20</td>
<td>1.27</td>
<td>35.3</td>
<td>0.76</td>
</tr>
<tr>
<td>*Cronbach’s α=0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note.** Measurement scale: 1=not a challenge, 2=minor challenge, 3=somewhat challenge, 4=moderate challenge, 5=serious challenge. Model fit: $X^2 (378, N=256)= 598.2, p <.001$, RMSEA=0.08, CFI=0.92, TLI=0.91; Model is theoretically and empirically over-identified; All factor loadings were significant with $p<.001$; *Means were calculated based on weighted factor scores.

Across the different areas of challenges, operational challenges were the most highly rated. In the list of operational challenges, weed control was the number one challenge, with 84.9% of farmers rating it as at least somewhat challenging (Table 1). Seventy-two percent and 66% of farmers rated high sensitivity to weather and soil fertility as somewhat to serious challenges, respectively. The remaining operational challenges (including insect control, plant disease control, organic farming on hilly ground, no-till organic farming integration, and cover...
crop management) were less highly rated, but more than half of the farmers rated them at least somewhat challenging.

Operational challenges were rated significantly higher than marketing challenges \( (t (234) = 5.28, p < 0.001) \) with a small to intermediate effect size (Cohen’s \( d = 0.34 \)). However, four of the five organic grain marketing items were rated at least somewhat challenging by at least half of the respondents (Table 1). Fewer than 40% of the respondents considered the marketing of organic row crops (soybean and corn) to be at least somewhat challenging.

Marketing challenges were rated significantly higher than policy challenges \( (t (240) = 4.04, p < 0.001) \) with a small to intermediate effect size (Cohen’s \( d = 0.29 \)). A majority of organic farmers (65.1%) perceived the complex certification process as somewhat to seriously challenging, while most farmers (60%) perceived crop insurance policies and government programs as little to minor challenges (Table 1). Such variances on specific policy areas led to relatively weak reliability of the overall measurement of policy challenges.

Policy challenges were rated slightly higher than financial challenges, however there was no significantly statistic difference \( (t (243) = 1.11, p = 0.267) \) with a very small effect size (Cohen’s \( d = 0.07 \)). More than half of the farmers (53.4%) perceived high financial risk in the transitional period as somewhat to seriously challenging (Table 1). However, most farmers (74%) did not view obtaining loans for their organic farming enterprise as a considerable challenge. The slightly weak reliability of the financial challenge is due to discrepancy ratings on these two items.

Financial challenges were rated slightly higher than challenges with obtaining inputs and information. The difference was not statistically significant \( (t (240) = 2.09, p = 0.038) \), given the Bonferroni adjusted significance level (0.008), with a very small effect size (Cohen’s \( d = 0.13 \)).
Slightly less than half (46%) indicated local extension agents lacked expertise in organic farming was a sizeable challenge. Forty-eight percent of farmers also viewed labor shortage as a least somewhat challenge. A majority of farmers (≥ 60%) did not have difficulties finding organic inputs, necessary machinery, and setting up the machinery. About 30% of farmers considered finding sufficient educational programs for organic farming to be a substantial challenge.

The remaining two challenges were social pressures and land tenure. There was no statistical difference between social pressure challenges and input and information challenges ($t$(242) = 2.02, $p = 0.04$, Cohen’s $d = 0.12$). No statistical difference was detected between social pressure challenges and land tenure challenges ($t$(242) =0.45, $p = 0.65$, Cohen’s $d = 0.03$).

About 40% of organic farmers considered negative attitudes from other farmers as at least somewhat challenging, and 30% of farmers were challenged by a feeling of isolation in local communities. A majority of farmers (over 65%) did not encounter considerable challenges to obtain a stable land lease agreement or access to sufficient land.

The correlations between farmers’ years of certified organic farming and each area of challenges were very weak ($|r|<0.1$) with no statistical significance. Similarly, the correlations between operational size of organic farming and each challenge area were also weak ($|r|<0.12$) with no significance.

**Extension Programming Needs**

The three-factor CFA model of farmers’ needs for extension programs resulted in a good model fit ($X^2$ (62, N=250)= 261.9, $p < .001$, RMSEA=0.11, CFI=0.96, TLI=0.96) (Table 2). All items are significantly loaded on associated factors. The model categorized farmers’ needs for extension programs into three areas: education, research, and technical services. Items in all three program areas showed good measurement reliability (Cronbach’s $\alpha>0.8$). According to the means of factors, farmers rated educational programs as the top need (Factor Mean= 3.47).
followed by the need for research programs (Factor Mean= 3.20), and technical service programs (Factor Mean= 3.02). Based on the three paired T-tests, farmers rated needs for educational programs significantly higher than needs for research programs ($t (237) = 3.83, p < 0.001$) with a small to intermediate effect size (Cohen’s $d = 0.25$); farmers rated needs for research programs significantly higher than needs for technical service programs ($t (232) = 3.03, p = 0.003$) with a small effect size (Cohen’s $d = 0.20$).

**Table 2.** Descriptive statistics and confirmatory factor analysis of farmers’ needs for extension programs

<table>
<thead>
<tr>
<th>Factor (Area of programs)</th>
<th>Program</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Somewhat to strong need (%)</th>
<th>Factor loading (λ)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Educational programs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Mean=3.47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cronbach’s α=0.83</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational programs</td>
<td>Educate younger people about organic agriculture</td>
<td>248</td>
<td>3.80</td>
<td>1.04</td>
<td>87.5</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>Educate conventional farmers about organic agriculture</td>
<td>246</td>
<td>3.45</td>
<td>1.21</td>
<td>79.3</td>
<td>0.70</td>
</tr>
<tr>
<td>Research programs</td>
<td>More on-farm research projects related to organic farming</td>
<td>247</td>
<td>3.31</td>
<td>1.23</td>
<td>74</td>
<td>0.86</td>
</tr>
<tr>
<td>*Mean=3.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cronbach’s α=0.89</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research programs</td>
<td>More agronomic research on organic farming</td>
<td>246</td>
<td>3.24</td>
<td>1.27</td>
<td>72.8</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>More economic (market) research on organic farming</td>
<td>248</td>
<td>3.05</td>
<td>1.24</td>
<td>69</td>
<td>0.88</td>
</tr>
</tbody>
</table>
In terms of farmers’ needs for educational programs, educating young people about organic agriculture was the most prominent need, with 87.5% of organic farmers rating this item as somewhat, moderately, or strongly needed. In addition, nearly 80% of respondents indicated organic agriculture educational programs for conventional farmers were at least somewhat needed. Also, about 80% of organic farmers indicated educational programs focused on organic transition for beginning farmers were at least somewhat needed. Most organic farmers (75%) indicated at least they somewhat needed more winter educational programming.

Farmers conveyed three types of needs for research programs related to organic farming. Farmers tended to have equally weighted (1) needs for organic on-farm research, (2) agronomic research on organic farming, and (3) organic market research. Approximately 70% of farmers rated the three research areas as somewhat or a higher level of needs.

Farmers showed multiple needs for technical service programs. The top needed service is organic supplier lists with 78% of organic farmers rating this item as somewhat, moderately, or
strongly needed. Other technical service programs needed by farmers include more extension publications on organic topics, train extension field staff about organic farming, local yield data for organic grains, manuals for organic farming, and certification training. Sixty-four percent to 70% of respondents rated these services as being needed at a somewhat to strong degree.

The correlations between farmers’ years of certified organic farming and each program need area were very weak (|r|<0.1) and there was no statistical significance. Similarly, the correlations between operational size of organic farming and each program need area were also very weak (|r|<0.1) with no statistical significance.

Effectiveness of Extension Education Delivery Formats

Table 3 presents the descriptive statistics for farmers’ ratings of program delivery formats’ effectiveness. Most farmers (≥80%) rated field days, pasture walks, one-on-one mentors, and farmer-to-farmer workshops as moderately to highly effective education delivery formats (Mean>3) (Table 3). Slightly more than 60% of farmers rated workshops hosted by professors, extension, or consultants as moderately to highly effective with an overall rating mean=2.80. Most organic farmers (close to 60%) considered online education formats (including online videos and webinars) as less effective delivery formats (Mean≈2.3).

**Table 3.** Effectiveness of program delivery formats

<table>
<thead>
<tr>
<th>Program delivery format</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Moderately to highly effective (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field days (or pasture walks)</td>
<td>246</td>
<td>3.73</td>
<td>0.98</td>
<td>88.6</td>
</tr>
<tr>
<td>One-on-one mentors</td>
<td>238</td>
<td>3.52</td>
<td>1.10</td>
<td>81.1</td>
</tr>
<tr>
<td>Farmer-to-farmer workshops</td>
<td>231</td>
<td>3.39</td>
<td>1.11</td>
<td>80.1</td>
</tr>
<tr>
<td>Workshops by professors, extension or consultants</td>
<td>235</td>
<td>2.80</td>
<td>1.07</td>
<td>62.5</td>
</tr>
<tr>
<td>YouTube (or other) online videos</td>
<td>227</td>
<td>2.38</td>
<td>1.25</td>
<td>44.9</td>
</tr>
<tr>
<td>Webinars (“farminars”)</td>
<td>224</td>
<td>2.32</td>
<td>1.16</td>
<td>43.8</td>
</tr>
</tbody>
</table>

*Note.* Measurement scale: 1=ineffective; 2=slightly effective; 3=moderately effective; 4=effective; 5=highly effective.
Discussion

Long-Standing and Shifting Challenges

We identified seven areas of challenges associated with organic grain farming, which empirically illustrate the organic agriculture’s complexities conceptualized by Rogers (2003). Farmers rated challenges with organic farming operations, marketing, and policy significantly higher than challenges with finance, input and information, social pressures, and land tenure. As seen through the literature review, we found some challenges are long-standing, some new challenges emerged, and some challenges have shifted.

This study’s findings show operational challenges for organic grain farming led by agronomic problems, including managing weeds, soil fertility, insects, and plant diseases. These long-standing agronomic problems in organic farming systems were reported by previous studies (Blobaum 1983; Delate and Dewitt 2004; Duram 1999, 2000; Hanson et al., 2004), which noted organic farmers lacked effective tools to control agronomic risks, since chemical substances are strictly prohibited. Meanwhile, the findings also highlighted additional operational challenges not reported by previous studies. For instance, as adverse weather conditions occur more frequently with climate change (Hatfield and Walthall 2014), a considerable number of organic farmers recognized the sensitivity of organic farming towards climatic conditions. Some organic farmers also recognized the difficulties of implementing organic farming on hilly ground and incorporate no-till practices into organic farming systems. Shortcomings of traditional tillage-based organic farming have been discovered, including compaction of soil, loss of soil moisture, and increase higher risks of erosion (Gruver and Wander 2020). Finally, some organic farmers expressed difficulties in managing interseeded cover crops. Cover crops have been promoted by the Natural Resources Conservation Service (NRCS), extension, and nonprofits to provide overall better soil and water conservation, and soil quality (NRCS 2013). Besides the common
conservation benefits, organic farmers also use cover crops innovatively as a multifunctional management tool to suppress weeds, fix nitrogen, diverse the cropping system, and increase soil organic matters (Wayman et al. 2016). As farmers pursue innovative approaches to use cover crops, they may encounter both structural barriers and technical challenges of seeding and terminating cover crops (Roesch-McNally et al. 2017).

This study’s results showed the highest-rated marketing challenges for organic grain farming were led by a lack of markets for transitional grains, small grains, and hay crops. In the transitional period, farmers grow crops with organic management practices, but cannot access the organic premium market. Consistent with prior research, this finding suggests the existence of initial financial hardship in organic farming (Constance and Choi 2010; Duram 1999; Reaves and Rosenblum 2014). Many organic farmers tend to sell their organic small grains to food-grade organic grain markets to receive the most price premium (Reaves, Healy, and Beach 2019). However, to meet food-grade standards, farmers must take caution in harvesting and additional steps in cleaning and storing the grains (Howell and Martens 2002). The market for organic food-grade specialty grains is highly volatile, which requires farmers to develop long-term strategic plans and short-term responses to market trends (Reaves, Healy, and Beach 2019). Organic hay crops are usually marketed as feed for organic beef and dairy cows (Brodt, Klonsky, and Thrupp 2009). However, organic cow production is clustered in the northeastern area of Iowa, where it adjoins the state of Wisconsin. Therefore, the distance to the organic feed markets and high cost associated with transportation of hay crops may contribute to the challenge of organic hay marketing.

Unlike previous research indicating organic farmers had negative views of government policies (Duram 2000; Hanson et al. 2004), this study found a relatively small percentage of
farmers rated agricultural policies, including government programs and crop insurance, as a difficult challenge. The U.S. federal government has continued to expand support of organic agriculture through multiple Farm Bills, and government programs include environmental quality incentives program, organic certification cost-share program, and organic crop insurance policies (ERS 2019; OTA 2019b). However, this study indicates the complexity of organic certification remains a challenge. To become certified as an organic farm, farmers are required to keep meticulous records, including field history sheets, input records, field activity logs, harvest and storage records, and clean transport affidavits (AMS 2011). In addition, farmers may lack quality certification services and education, since Iowa currently has only one accredited certifier operated by the state government.

Consistent with prior reports by agricultural scientists (Caldwell et al. 2014), this study’s results show farmers also perceived financial risks of organic grain farming are mainly caused by low profitability during the transitional period, associated with difficulties in marketing traditional crops. Earlier studies (e.g., Duram 2000; Hanson et al. 2004) found it was difficult for organic farmers to obtain loans from local banks. However, in this study, most farmers did not report receiving loans for their organic enterprise as a substantial challenge. This may be because more and more bankers and financial institutions have gained a better understanding of organic agriculture’s market opportunities, and they no longer refuse to finance organic production (Nason 2011).

The land-grant university and non-profit farmer organizations in Iowa have invested significant efforts in research and education related to organic farming during the past two decades (Delate and Dewitt 2004). More organic agriculture enterprises, including organic seed companies, organic fertilizer dealers, and small machinery companies, have started businesses in
Iowa (IOA 2018). Given this context of an increasing presence of organic farms and supportive infrastructure, it is perhaps not surprising these results indicate the challenges for organic farmers to obtain information and inputs have been somewhat alleviated. (Blobaum 1983; Duram 1999, 2000; Hanson et al. 2004; Lockeretz 1997). However, this study indicates many farmers report insufficient local extension educators’ expertise in organic agriculture and a lack of education programs related to organic farming. They state this is a challenge to their operation. Delate and Dewitt (2004) and Franz et al.’s (2010) critique that the needs of organic farmers in Iowa are not satisfied by extension and land-grant education appears still applicable. The unmet demand could be improved by resource improvements as well as by professional development of extension field staff in organic production practices and farm management.

Negative social pressures used to be a prominent challenge for organic farmers (Blobaum 1983; Cranfield, Henson, and Holliday 2010; Duram 1999, 2000; Lockeretz 1997). This study’s survey shows social pressures towards organic farming is less pressing for this group of Iowa farmers. To the extent the U.S. organic food market has grown strongly for two decades, organic farmers are becoming more recognized by consumers (Greene et al. 2017). In addition to the efforts made by land grant universities and non-profit organizations to promote organic agriculture, American mainstream agricultural magazines, such as Successful Farming (e.g., April 13, 2018; April 05, 2016) and Progressive Farmer (e.g., Apr 21, 2017; Feb 18, 2016), have published more articles on organic farming. Besides the reduced external pressure, organic farmers tended to form a professional community by joining organic farmers’ organizations, attending organic farmers’ meetings, and hosting organic field days (IOA 2020). Farmers can obtain both social and technical support from the organic community, and they become less
frustrated by the negative social pressures from the conventional farmers (Piaskowski et al. 2013).

Results suggest land tenure is not a major challenge for most Iowa organic grain farmers. Although organic farmers have smaller farm sizes on average, most Iowa organic grain farmers do not think they lack sufficient land for their organic operations.

**Challenges Drive Program Needs**

We identified three major areas of extension programming needs: education, research, and technical services related to organic farming. After analyzing each area of programming needs, it was determined farmers’ needs for different programs are driven by various challenges.

**Needs for educational programs**

Organic farmers’ needs for educational programs are three dimensional. First, the highest-rated educational needs items focus on increasing the understanding of organic farming among younger people and conventional farmers suggesting current organic farmers want programs that will attract more future organic producers. There has been an overwhelming concern about the decline in the number of young people entering into farming operations in the U.S. and strongly in Iowa. Outreach efforts could help increase young people’s interests in organic agriculture and becoming a producer or a practitioner in the organic sector (Utsugi 2012), which helps cultivate future labor forces that organic farming always needs. At the same time, outreach efforts aimed at conventional farmers could help conventional farmers become more informed about the benefits and opportunities of organic agriculture and better understand organic farming methods (Bloom and Duram 2007).

A second dimension is to educate beginning organic farmers about organic transition. Beginning farmers frequently lack capital, technical skills, management experiences, marketing channels, land, and social support (Niewolny and Lillard 2010). Additionally, the organic
transition period often involves financial hardship, and steep learning curves in organic operation and marketing (Hanson et al. 2004). Iowa agricultural extension services established beginning farmers’ programs in Iowa, but mainly provide services for “financial management and planning,” “legal issues,” and “tax laws” (Beginning Farmer Center 2020). Niewolny and Lillard (2010) suggested building beginning farmer programs as an “alternative knowledge system” rather than only providing technical services. Therefore, by navigating to available resources, training skills of field management with agroecology, making whole farm plans, opening up market channels, beginning farmer programs on organic farming transition could help reduce many challenges and difficulties for beginning organic farmers (Niewolny and Lillard 2010).

Finally, the third dimension is to organize more organic educational activities during the winter season. Organic farming is labor-intensive and time-demanding during the growing season (Blobaum 1983; Lockeretz and Madden 1987). Therefore, moving more education events (such as workshops and conferences) to winter off-season could be more suitable for organic farmers’ year-round plans. Farmers’ three-dimensional needs for education present a hierarchical trend. This begins with a broader outreach to potential organic farmers, then help new organic farmers with their transitions, and finally consider the best time to provide educational services to existing organic farmers.

**Needs for research programs**

The results show a majority of organic farmers also have a need for more research programs. Congruent with Polush et al.’s (2016) findings, farmers want more organic farming research conducted in a real-world on-farm setting. Compared with research conducted at experimental stations, on-farm research has the advantage of involving more farmers into management systems, reflect actual physical conditions, and capture whole-farm changes (Anderson 1992). Anderson emphasized, “on-farm research is more appropriate for answering
some questions critical to developing more sustainable agricultural systems” (235). In addition, farmers also want more agronomic research efforts related to organic agriculture. More agronomic research on organic farming could help farmers find solutions for both long-standing agronomic problems (weeds, soil fertility, insects, and plant diseases) and emerging operational challenges with no-till farming and cover crop management.

The last research need is economic and marketing research on organic farming. Agricultural marketing research could help illuminate supply and demand details for different agricultural products and identify opportunities to sell products profitably in a competitive market (Chase, Delate, and Hanlon 2019; Crawford 1997). Therefore, more organic marketing research could help solve the identified market challenges in small grains, transitional crops, and hay, thereby reducing farmers’ financial pressure.

**Needs for technical services**

Respondents also indicated they would like access to various technical service programs to help overcome different challenges. The highest-rated needs were a list of organic suppliers, more extension personnel trained in organic agriculture, more extension publications about organic farming, organic farming manuals, and local organic grain yield information. To ease complex certification challenges, farmers need more training for organic certification.

While surveyed farmers indicated a need for multiple technical services, it is important to note some of these resources exist and are provided by local land grant universities, agricultural organizations, or government entities. For instance, the Iowa Organic Association (2018) has compiled an organic resource directory that contains organic seed dealers, organic fertilizer companies, organic pest management providers, equipment suppliers, organic grain buyers, labor crews, related government agencies, and farmers’ organizations. Numerous organic farming extension publications have been published by the organic agriculture specialist at Iowa State
University (Delate 2020a). The organic agriculture specialist has also collected long-term yield data to compare organic farming and conventional farming (Chase, Delate, and Hanlon 2019; Delate 2020b). The USDA (2015) has published a *National Organic Farming Handbook* that provides an overview of organic farming regulations, principles, and practices. This information is generally available for farmers to access. However, perhaps due to a lack of local extension services dedicated to organic agriculture, organic farmers may not be well informed about available resources, so more localized services are needed to adapt to their personalized operations.

**Social Learning, Peer Learning, and Mentoring**

The last result section of this study suggests organic farmers continue to prefer interactive educational delivery formats, such as field days, farmers-to-farmer workshops, and one-on-one mentoring. Behind the different delivery methods is a variety of learning approaches for farmers—social learning, peer learning, and mentoring.

It was no surprise to see field days was the top-rated delivery format. Field days have been used by agricultural scientists and extension educators for more than 100 years in the U.S. for promoting agricultural techniques and practices, and have been empirically proven as an effective method to influence farmers’ adoption decisions (Delate and Dewitt 2004; Singh et al. 2018). Field days are a collective learning process effective for introducing new ideas to farmers and helping farmers overcome fears of adoption by observing other farmers’ successes (Palis 2006). Field days provide a demonstration setting for farmers to observe how agricultural innovations are put into practice by other farmers, obtain information about both advantages and complexity of the innovation, and gain insights about the innovation is compatible with their own operation (Singh et al. 2018). Poorbaugh (1966) noted field days often develop into social learning. Rogers (2003) acknowledged social learning can be directly applied to the diffusion
process of innovation. Social learning has become a highlight of field days. Social learning during field days allows farmers to exchange ideas, learn multiple perspectives about the innovation, identify different criteria for adoption decisions, and model the practices (Singh et al. 2018).

In this study, farmers also rated farmer-to-farmer workshops highly, which feature peer-learning, an adult learning approach (Grudens-Schuck et al. 2003). Cooreman et al. (2018) argued when farmers need to make adoption decisions, “farmers tend to be most influenced by proof of successful farming methods that are showed and explained by other farmers” (92). According to Cooreman et al., peer learning among farmers involves three core processes: engagement, communication, and interactive knowledge creation. Many organic farmers like to join regional farmer-to-farmer sustainable agriculture networks through which they share knowledge and information (Exner and Thompson 2006; Hanson et al. 2004). Peer-learning played a crucial role in generating and disseminating knowledge to help farmers overcome challenges of adopting sustainable agriculture practices (Hassanein 1995). Farmer-to-farmer workshops would be highly effective when the audiences have similar experiences, and form workshops into informal, supportive forums where farmers share their experiences (Enshayan, Stinner, and Stinner 1992).

Another highly rated format is one-on-one mentorship, which is a skill training process for farmer mentees (Zeigler 2000). Meyer et al. (2011) explained farmers’ mentorships are “designed to provide on-call technical advice to a mentee starting a farm enterprise…. The mentor then acts as a consultant throughout one planning and growing season to help the mentee successfully implement his/her business plan” (2). Mentors can provide a wealth of information to a mentee, including how to “cut costs, invest wisely, grow high-quality products, access new
technology, and determine crop yields…” (Zeigler 2000, 290). The specific activities of mentorship programs have been organized differently across regions and organizations (Meyer et al. 2011; Zeigler 2000). In the Midwest, a Wisconsin-based organic agriculture organization, Midwest Organic Sustainable Education Service, has launched its farmer-to-farmer mentoring program in multiple Midwestern states, including Iowa. This program aims to help new organic farmers increase competence in organic transition, production, and marketing (MOSES 2020).

Although the workshops led by professors, extension, or consultants were ranked lower than the first three delivery formats discussed above, majority of farmers still accept this traditional expert-led workshop as a moderately effective delivery format. The expert-to-farmer model is more effective for authority innovation-decisions (e.g., agricultural regulations) (Rogers 2003). For instance, workshops on organic certification would be more effective if led by accredited certifiers rather than other farmers, because these certifiers can bring accurate information and authorized interpretation of legal provisions. The expert-to-farmer model is also more suitable for an agricultural innovation’s initial commercialization stage, which begins the entire diffusion process (Rogers 2003). Technical expertise is needed to ensure innovation is adopted in a correct way with desirable consequences. In the Midwest, workshops on using roller-crimper for organic no-till have been mainly led by experts from Rodale Institute and professors at Iowa State University and University of Wisconsin-Madison (Ends 2017). Farmers, who collaborated with the experts for on-farm experiments of this new system, also had opportunities to present during the workshops. The iterative interactions of expert-to-farmer and farmer-to-farmer create more learning opportunities for farmers and lead them to new management decisions (Morton 2011).
Conclusion, Recommendations, and Limitations

In conclusion, this study identifies seven areas of challenges, assesses three areas of extension programming needs, and finds out three highly effective program delivery formats preferred by farmers. Among the seven areas of challenges 1) operation, 2) marketing, 3) policy, 4) finance, 5) input and information, 6) social pressures, and 7) land tenure, the challenges of operation, marketing, and policy are more prominent than the other challenges. Many organic farming challenges remain long-standing, due to the nature of non-chemical alternative farming methods. Yet, some challenges emerged and shifted along with institutional and environmental changes. Farmers perceived needs for three programming areas (education, research, and technical services) driven by the challenges they have met. In general, organic farmers want more educational programs to cultivate new organic farmers and help new organic farmers with their transitions, more research to help overcome the specific agronomic and marketing problems that occurred on their farms, and more localized extension services to keep them informed. The three program delivery formats (field days, farmer-to-farmer workshops, and one-on-one mentors), respectively, represent three learning approaches that farmers prefer: social learning, peer learning, and mentoring. These three learning approaches can positively influence farmers’ adoption decisions and help them overcome challenges, while they also have their own features that can facilitate different learning scenarios. Social learning-based field day is good to introduce new ideas to farmers and help farmers overcome fears of adoption. Peer learning-focused farmer-to-farmer workshops are particularly effective when farmers share similar experiences. One-on-one mentors can be more beneficial for beginning organic farmers with no prior experience related to organic farming, who need to receive comprehensive skills training in organic farm operation and management. In summary, this study’s findings provide empirical
evidence that further supports the theoretical discussions on the complexities and diffusion process of organic farming adoption by Padel (2001) and Rogers (2003).

Based on these findings and discussions, we provide practical recommendations for developing effective organic grain farming extension programs in the future:

(1) Future organic grain operation education programs are recommended, starting from basic agronomic topics, including management of weeds, pests, and soil fertility, then extend to emerging issues: inter-seeded cover crop management, and organic no-till systems. A progressive educational process would help farmers better overcome the steep learning curves associated with organic grain farming.

(2) Because farmers have relatively strong needs for both on-farm research and education regarding organic grain farming, we recommend organic researchers and extension educators collaboratively develop more integrated programs of on-farm research and education at local levels, such as hosting more field days and farmer-to-farmer workshops at the on-farm research sites. Such collaborations among researchers, educators, and farmers can help local farmers solve the problems of their organic production, increase extension educators’ competence in organic agriculture, and create both peer-learning and social-learning opportunities for farmers.

(3) Build extension educators’ professional capacity in organic farming. Extension educators should have professional development opportunities in organic principles, practices, marketing, regulations, and available governmental programs. Extension educators can enroll in organic agriculture courses offered by nearby land grant universities.
(4) Integrate organic farming information and optimize network connections. Extension educators are recommended to collaborate with farmer organizations and researchers to aggregate information related to organic farming, such as market trends, new practices, pest risk forecasting, and suppliers. Such information may be presented as extension periodical publications that circulate among local farmers. Appropriate acknowledgments of the credits should be given to the farmer organizations in the partnership. In addition, extension educators can play a liaison role, connecting farmers, researchers, and policymakers, and interconnecting networks of different organizations to help organic farmers achieve effective bottom-up communication.

(5) Build support mechanisms for future organic farmers. We recommend organic specialists collaborate with youth development educators to incorporate organic agriculture into the 4-H youth development programs to raise young students’ awareness of organic agriculture. To better prepare for the future organic agricultural workforce, we recommend developing organic agricultural courses in vocational agricultural education programs.

The challenges, extension programming needs, and effective delivery formats identified by this study are based on Iowan organic farmers’ past and current experiences, contingent on interactions with social, institutional, economic, and environmental conditions related to organic farming. These findings and recommendations are limited by time and geography. As a further implementation of the 2018 Farm Bill in the coming years, constant changes of climates, as well as advances in organic farming research, the challenges, and program needs may change. Thus, future research should continue to monitor and examine these changes.
This paper was prepared in the midst of the 2020 COVID-19 pandemic. Social distancing made most educational programs go virtual. Many field days and in-person meetings were canceled or postponed due to safety concerns. As online education becomes more accessible, easier to use, and more experiential with the use of virtual and augmented reality technologies, online agricultural education has the potential to become more desirable and effective in the future. Many extension programs, and programs offered by organic and sustainable farmers organizations and nonprofits, were provided online formats for field days, farmer chats, webinars, and other regular programming digitally. It will remain to be seen whether the expanded capacity of educators and potential new audiences becoming accustomed to technologies change the types and preferences of offerings. Program evaluations and educational research could help develop more effective, online learning programs for organic farmers to fill present gaps.

Acknowledgments

This project was funded through USDA-SARE #GNC16-221. This work was also supported by the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa, USA. Project No. 3813 sponsored by the Hatch Act and State of Iowa funds. The authors gratefully acknowledge the following persons and their organizations for their help with this research: Dr. Kathleen Delate and Dr. David Peters at Iowa State University; Dr. Stefan Gailans from Practical Farmers of Iowa; Ms. Rosalyn Lehman from Iowa Organic Association; Dr. Beth Nelson from North Central Region Sustainable Agriculture Research and Education Program.

Disclosure Statement

No potential conflict of interest was reported by the author(s).
References


CHAPTER 5. MOTIVATIONS, GOALS, AND BENEFITS ASSOCIATED WITH ORGANIC GRAIN FARMING BY PRODUCERS IN THE IOWA, US

A manuscript prepared for submission to *Agricultural Systems*

Guang Han

J. Gordon Arbuckle

Nancy Grudens-Schuck

Abstract

The U.S. has the world’s largest organic food market. Low domestic production and low adoption rate of organic grain farming limits, however, overall development of the sector. Multiple organic stakeholders have called for better understanding of cognitive and motivational aspects of farmer’s decision-making to help policymakers, agricultural scientists, and extension practitioners effectively work with farmers to explore and adopt organic grain production. This paper aims to assess farmers’ adoption motivations, long-term goals, perceived benefits, and to examine congruence between initial motivations and long-term goals and current perceived benefits. We draw on findings from a larger, mixed-method study of organic grain farmers in Iowa U.S. We reported five highly rated motivations for farmers to adopt organic grain: 1) profitability, 2) personal safety, 3) natural resources stewardship, 4) consumers and public health, 5) honor and tradition. We found that organic farmers’ long-term goals are strongly orientated to both productivism and stewardship, and less strongly to oriented to civic-mindedness. The study assessed five areas of benefits associated with organic grain farming, in order of significance: 1) economic benefit, 2) addressed health concerns, 3) environmental natural resource, 4) values and beliefs validation, and 5) social benefit. We found that the benefits farmers experienced by adopting organic grain farming aligned most of their original adoption motivations and long-term goals, except for serving the motivation of consumer and public health concerns.
Introduction

America has become the world’s largest organic food market with organic food sales at more than $47.9 billion in 2018 (Haumann, 2019; OTA, 2019a). There has been continuous growth in organic food demand and sales since 1990 (Dimitri and Greene, 2002). Yet, one outstanding problem of the American organic industry is the low overall production of organic crops, and the low number of organic acres in production, particularly for organic grains. Among a wide range of organic production systems (e.g., grain, vegetable, fruit, floriculture, tobacco, cotton, and livestock), organic grain plays a crucial role in the organic food industry because organic grains provide raw materials for certified organic food products and are also important feed for organic livestock that produce organic meat, eggs, and dairy products (Reaves et al., 2019).

One way to increase overall production is to increase adoption of organic grain operations. However, organic grain farming adoption has stayed at a very low level: that of 0.29% of corn acreage and 0.14% of soybeans acreage were organic (NASS 2019; NASS 2017). Organic livestock producers, food processors, and consumers have called for increased domestic organic grain production (Alonzo, 2016; Doering, 2015; Roseboro, 2016). In this context, with the goal of promoting organic grain farming, it is necessary for agricultural scientists and extension practitioners to understand how to effectively work with farmers to explore options related to organic grain production. Understanding cognitive and motivational aspects of farmer’s decision-making processes is essential for policymakers, advocates, and others to develop and implement more effective policies to support farmers who would be willing explore organic farming production, leading to long term adoption (Abadi et al., 2020; Mills et al., 2018).

Although the total number of organic farms is still a fraction (0.89%) of the two million American farms (USDA 2019, p. 61), more farmers have chosen to adopt organic farming
practices. The number of America’s organic farms averagely increased by 4.8% annually from 2012 to 2017 (USDA 2019, p.61). Organic farming has brought more opportunities for farmers to increase their farm enterprise profitability by accessing organic price premiums and by lowering production costs (Nemes, 2009). Regions with high organic agricultural production in the U.S. lead to a more robust county-level economy, reduce the local poverty rate, and higher median household income (Marasteanu and Jaenicke, 2016). Organic farming systems also deliver environmental benefits that include reducing nitrate leaching, soil erosion, and pesticides, while increasing soil organic matter content and improving biodiversity (Cambardella et al., 2015; Delate et al., 2013; Pimentel et al., 2005; Tuomisto et al., 2012). The benefits associated with organic agriculture have been identified by agricultural scientists and economists but are less commonly reported by farmers. Benefits report from farmers’ perspective make unique contributions to the literature because farmers often respond based on their subjective judgments when making decisions (Barnard and Nix, 1979). Discordance between the farmers’ subjective judgment of objective reality may lead to unfavorable decisions for the farming enterprise (Agarwal, 2017). Adding the knowledge of farmers’ perceived benefits brought by organic grain farming to the literature would further accumulate the evidence of the advantages that organic agriculture may deliver to farmers.

Farmers’ motivations for adopting organic farming have been studied both in the U.S. and outside of the U.S. Unlike substantial organic subsidies provided by many European countries (E.U. Commission Agriculture and Rural Development, 2019; Lohr and Salomonsson, 2000), the U.S. federal government provides few direct subsidies to organic farmers. Farmers’ decisions to adopt organic farming cannot be solely explained by economic principles (Dessart et al., 2019). Common motivations reported for adoption of organic farming practices include
economic incentives, stewardship values, human and livestock health considerations, ideological rationales, and religious beliefs (Canavari et al., 2008; Cranfield et al., 2010; Darnhofer et al., 2005; Duram, 1999; 2000; Lockeretz et al., 1981; Padel, 2001; Peterson et al., 2012; Stofferahn, 2009; Wiegel, 2009). In the U.S., over the past twenty years, most studies on organic farming adoption have not specifically focused on organic grain farming except for Peterson et al. (2012). Peterson et al. chose a quantitative approach to their investigation that pre-determined farmers’ motivations into three unidimensional variables: maximizing profitability, environmental stewardship, and lifestyle. However, most qualitative studies emphasize that farmers’ motivations are multidimensional and complex. Therefore, there is a need for empirical studies on grain farmers using multifaceted methods.

Wit and Verhoog (2007) argue that organic agriculture is based on the values sought by stakeholders, especially for both producers and consumers. Agricultural economists recognized the importance of values and goals on farmers’ decision-making process early on (e.g., Gasson, 1973; Johnson et al., 1961). Gasson defined farmers’ goals as the “ends or states in which the individual desires to be or things he wishes to accomplish” (p. 524). Gasson defined value as “a conception of the desirable referring to any aspect of a situation, object or event that has a preferential implication of being good or bad, right or wrong” (p. 524). Gasson pointed out that value is more permanent and harder to change than goals, and that values provide guidance for farmers to pursue specific goals. More recently, because of the conceptual proximity between long-term goals and values, social scientists have integrated farmers’ values and goals into a comprehensive concept such as “set of values and goals,” “management styles,” “farmers’ identifies,” and “farming orientations”; and they made efforts to identify the typologies of farmers’ goals and values (Brodt et al., 2006, p. 91; Duesberg et al. 2013, p.158; Pereira et al.,
2016, p.1.; McGuire et al. 2015, p.146). Across the studies, farmers’ values and long-term goals are commonly involved with profitability, environment and natural resources conservation, and social interactions. Farmers’ organic farming adoption decisions are also inevitably influenced by their value orientations (Stofferahn, 2009). An understanding of the values and long-term goals of farmers who have adopted organic grain farming would help policymakers develop policies to strengthen the organic agriculture sector.

The U.S. federal government has gradually improved policies for organic farming production, economics, research, marketing, and education. The 1990 Farm Bill authorized the United States Department of Agriculture (USDA) to develop a National Organic Program (N.O.P.) that stipulated the requirements of agricultural production aspects for products to qualify as organic certification and regulated rules for organic marketing (Duram, 2000; Greene et al., 2009). The 2008 Farm Bill supported organic agriculture in three areas: 1) funding for organic agriculture research and economic data collection; 2) establishing the Environmental Quality Incentives Program (EQIP) that financially helped farmers with organic conversion costs; 3) and establishing organic certification cost-share program (Greene et al. 2009). The 2014 Farm Bill increased the support for organic farming research, marketing, and education, and incorporated provisions for organic farming into the regular federal crop insurance systems (Greene, 2017). The 2018 Farm Bill further encouraged organic farming by providing more incentives for organic farming conversion, more accommodating insurance policies, the extension of certification cost-share programs, and expanded funding to support organic farming research and extension education (OTA, 2019b). USDA established an Organic Agriculture Research and Extension Initiative to sponsor land-grant universities and agricultural
organizations to develop and deliver extension education and research programs to boost organic farming and address issues related to organic agriculture (USDA NIFA 2019).

In light of persistent information needs of extension practitioners and policymakers and the gaps in the literature such as farmers’ motivations to adopt organic grain, perceived benefits associated with organic grain farming, and long-term farming goals, this paper aims to answer the following questions: 1) What motivated farmers to adopt organic grain farming? 2) What long-term goals did farmers seek to accomplish through adoption? 3) What current benefits, and at what levels, have farmers perceived as a result of adopting organic grain farming? Finally, 4) To what extent do farmers’ original adoption motivations and long-term goals align with current benefits from organic grain adoption?

**Theories and Conceptualization**

We examined issues related to the adoption organic grain farming by combining aspects of self-determination theory (SDT) from Ryan and Deci (2000), farming goal orientations proposed by McGuire et al. (2015); and theory of diffusion of innovations (DOI) of Rogers (2003).

A central focus of both DOI and SDT frameworks is motivation. Rogers’ (2003) DOI encouraged researchers to increase their understanding the role of motivation in individuals’ adoption process of an innovation. We conceptualized farmers’ motivations of organic grain farming as their reasons to make the decisions in adopting organic grain farming.

The SDT framework complements Rogers. The SDT proposes a continuum of motivation with intrinsic motivation and extrinsic motivation at the poles (Ryan and Deci 2000). Extrinsic motivation refers to “doing something because it leads to a separable outcome” (Ryan and Deci 2000, p. 55). Intrinsic motivation refers to “doing of an activity for its inherent satisfaction” (Ryan and Deci 2000, p. 56). According to Brédif et al. (2017), Kvakkestad et al. (2015) and
Mills et al. (2018), the intrinsic motivation of farmers to adopt agroecological farming methods (such as organic farming) includes environmental concerns about land stewardship and biodiversity; animal welfare, public health and public interest of rural communities; lifestyle choices for enjoyment, happiness and quality of life. Extrinsic motivations commonly include financial incentives, profit maximization, farm viability, and regulations (Garini et al. 2017; Greiner et al. 2009; Kvakkestad et al. 2015; Mills et al. 2018).

The three-goal orientations are another major focus of research into behavior change among farmers based on McGuire et al. (2015). McGuire et al. argue that farming is an activity that couples with 1) economic conditions, 2) biophysical situations, and 3) social interactions. Farmers with productivism goal orientations prioritize their own farms’ profitability and achieve maximum outputs; farmers with stewardship goals prioritize long-term value of the land resource and take actions to minimize the disturbance to the natural resources including soil, water, and biodiversity; and farmers with civic-mindedness prioritize community leadership and responsibilities of helping neighbors and other farmers in the community (McGuire et al., 2015). Civic-mindedness in agriculture also contributes to shaping a closer relationship between food producers and consumers by producing safe, nutritious, healthy food to consumers (DeLind, 2002; Lyson, 2004; 2005). The three long-term goal orientations are competing, but not mutually exclusive, and so individuals can hold the three value orientations simultaneously but prioritize differently (McGuire et al., 2015). Similar to the three-goal orientations, Brodt et al. (2006) also found that farmers have three goal-driven management styles labeled with: production maximizers, environmental stewards, and networking entrepreneurs. Both Brodt et al. and McGuire et al. acknowledged that farmers’ long-term goals have a more fundamental impact on their decisions of the adoption of agri-environmental practices.
The DOI framework has been frequently employed to examine the adoption of organic agriculture (Kroma, 2006; Padel, 2001; Rogers, 2003; Simin and Janković, 2014). However, Padel (2001) and others propose differences in key areas of the adoption processes, especially in areas associated with communication processes. The nature of organic agriculture is considered to be different and more complex because it requires decisions that affect the whole farm versus single technologies (such as bulk tank adoption on dairy farms) do not affect as many aspects of the farm; organic agriculture is also considered to be a knowledge-based ecological innovation that emphasizes sustainability (Padel, 2001; Simin and Janković, 2014). Padel (2001) found the diffusion of organic farming to be reliant on inter-farmer and bottom-up communication rather than the top-down external change agent-based communication; it takes a longer time to be diffused in a rural community. Others consider that organic farming changes the social relationship between farming communities and the environment (e.g., from conqueror to steward) (Simin and Janković, 2014; Sullivan et al., 1996), which may challenge existing rural community values and social norms (Padel, 2001).

The DOI theory argued individuals’ adoption process goes through five stages: “knowledge”, “persuasion”, “decision”, “implementation”, and “confirmation” (Rogers, 2003, p. 168). Individuals’ knowledge or awareness of innovation is influenced by their “socioeconomic characteristics, personalities, communication behavior” (Rogers, 2003, p. 170). At the persuasion stage, the individual mentally applies the innovation to the situation and evaluates the innovation according to these five attributes—relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). Then, the individual forms a favorable/unfavorable attitude towards the innovation, based on evaluation of the attributes. If the individual decides to adopt the innovation, he/she will implement the innovation in a real-world setting (Rogers, 2003).
The concept of “confirmation” is an important step in the adoption process, and comes last in the process (Rogers, 2003). In the confirmation stage, innovation adopters observe the consequences of adopting innovation and make comparisons with their original motivations and goals. After farmers following the initial adoption of a new practice or technology, farmers assess the fit of that practice within their goals for their overall farm enterprise for a period of time. If, over time, the outcomes associated with the practice are congruent with farming objectives, they “confirm” adoption through continued use of the innovation. For organic farmers, this confirmation stage might be once their farm operations are fully engaged in organic agricultural production and they identify themselves as organic farmers. Organic farmers’ adoption decisions will be reinforced if farmers perceive benefits of organic grain farming that align their original motivations and long-term goals (Fig. 1). Otherwise, farmers may choose to drop (deregister) organic farming if their motivations and long-term goals are not well reflected on the potential benefits.

![Diagram](image)

**Fig.1.** A conceptual model illustrates the relationship between farmers' long-term goals, motivations, and benefits of organic grain farming.

We defined the benefits of organic grain farming as the positive consequences brought by the adoption of organic grain farming. Wernick and Lockeretz’s (1977) original, and follow-up study (Lockeretz and Madden, 1987), researched farmers’ perceived benefits of organic farming adoption. In the 1977 study, leading benefits were 1) personal and family health, 2) livestock
health, 3) concerns for the environment, 4) religion validation, and 5) philosophy validation (p. 22). In the 1987 study, health was still the leading benefit. However, fewer farmers reported philosophical or religious benefits (Lockeretz and Madden, 1987). Sullivan et al. (1996) compared the benefits of farming between organic farmers and conventional farmers. They found both organic and conventional farmers commonly reported: “independence,” “nature,” “being outdoors,” and “pride in the product” as benefits (p. 133). Organic farmers reported the following benefits from organic farming: “living ethically,” “community,” and “satisfaction with their lives” (Sullivan et al., 1996, p. 133). Cranfield et al. (2010) provided findings on benefits to Canadian organic farmers: “human health,” “better crop quality,” “reduced chemical exposure,” “improved food quality,” and “market growth” (p. 303).

**Materials and Methods**

**Study Site**

The U.S. has agricultural regions with diverse growing conditions; hence, there are benefits to restricting a study to a relatively homogenous area (Duram, 1999; Lockeretz, 1997). The study was conducted in the state of Iowa, which is a national leading state for grain production. Iowa has 55,875 square miles of land, and over 85% land is used for agricultural production (Iowa Farm Bureau, 2017). Iowa has the largest acreage devoted to both corn and soybean production in the U.S. (NASS, 2019). To increase organic grain farming, the role of Iowa is crucial. However, similar to the nation’s situation, the adoption rate of organic in Iowa is rather low. In 2017, there were 758 certified organic farms in Iowa, compared to a total of 86,104 farms in the state (NASS, 2019). Of the certified organic farms, about 67% had organic grain operation, and the rest were farms only raising organic specialty crops or livestock (NASS, 2017). In Iowa, 0.21% corn production and 0.22% soybeans production were organic (NASS,
The average size of Iowa’s organic farms (141 acres) was less than half of the state’s average farm size (355 acres) (USDA NASS, 2017; 2019).

Overall Approach

Farmers’ decisions to adopt organic farming are complex, so many scholars have employed mixed methods to understand organic farming adoption (Canavari et al., 2008; Duram, 1999; McCann et al., 1997; Sullivan et al., 1996). This paper draws on survey data from a larger research project that we conducted and that was funded by a U.S. federal grant. The design followed a sequential mixed-method design that employed interviews and a survey. This study was mainly retrospective in nature; in other words, farmers reported memories of past impressions and events. We conducted semi-structured interviews with 17 organic grain farmers in Iowa by using purposive and snowball sampling. We applied coding techniques from Miles et al. (2014) to analyze the qualitative interview data. The interview explored farmers’ motivations and benefits of organic grain farming adoption. The larger-scale survey was conducted next, based on the variables and psychometric measurements determined by interview responses and the research literature.

Survey Construction

Measurement of motivation

We determined based on the interviews that five dimensions of farmer’s motivations most heavily contributed to the adoption of organic grain farming:

1) Natural resources stewardship: Farmers chose organic grain farming to achieve better natural resources stewardship.

2) Profitability: Farmers adopted organic grain farming because of possible improved profitability and farm viability.
3) Honor and tradition: Farmers adopted organic grain farming to honor their ideological and religious values and traditions.

4) Personal safety: Farmers chose organic grain farming to improve the safety of working and living conditions.

5) Consumers’ and public health: Farmers chose organic grain farming because they want to provide consumers healthy food to improve the public health.

Based on the qualitative analysis, we developed 14 quantitative survey items to measure farmers’ motivations (Table 1). With the survey, farmers were asked to indicate their level of agreement with each item statement using five-point Likert-scale ranging from 1 (strongly disagree) to 5 (strongly agree).

<table>
<thead>
<tr>
<th>Motivation dimension</th>
<th>Quotation</th>
<th>Measurement Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Resources Stewardship (NRS)</td>
<td>“There would be more biodiversity.”</td>
<td>To address my concerns about biodiversity loss</td>
</tr>
<tr>
<td></td>
<td>“You got to take care of your soil health and it can be done in organic.”</td>
<td>To improve soil health</td>
</tr>
<tr>
<td></td>
<td>“Farm in a way that you are not degrading the land or the water or the environment.”</td>
<td>To improve the water quality in my watershed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To address my concerns with environmental degradation</td>
</tr>
<tr>
<td>Profitability (PRF)</td>
<td>“Getting that premium on the certified organic is a huge part.”</td>
<td>To capture additional profit from organic price premium</td>
</tr>
<tr>
<td></td>
<td>“We have a small farm and the goal was to make more money per acre so we could stay on our small farm.”</td>
<td>To earn enough income to sustain the farm operation</td>
</tr>
</tbody>
</table>
Table 1 (continued)

<table>
<thead>
<tr>
<th>Motivation dimension</th>
<th>Quotation</th>
<th>Measurement Item</th>
</tr>
</thead>
</table>
| Honor and tradition (HOR) | • “Try to bring the farm back to the way it was farmed long-long time ago.”  
• “That is honoring conservation issues.”  
• “We have always been very conservation-minded.”  
• “This [land] is God's creation and we're to be stewards and take the best care of it in organic farming.”  
• “We have to be synergistic and harmonious with nature.” | To go back to the traditional way of farming before chemicals were widely used  
To honor the family farm’s tradition of conservation  
To honor religious beliefs  
To farm in harmony with nature |
| Personal Safety (P.S.) | • “Raise my family and to have them be healthy and on the farm.”  
• “I have had one accident with 2,4-D [chemical herbicide] and I got sick.”  
• “I just had a feeling that using the chemicals was the wrong way of harm, I do not need that exposure.” | To create a safer environment for my family  
To minimize exposure to toxic chemicals |
| Consumers and Public Health (CPH) | • “It [chemical residues] seems like that could have compounding affects negatively on people's health.”  
• “People want good food that they are putting in their bodies. They don't want chemical residues and they don't want to harm their bodies because our food.” | To address concerns about public health associated with agriculture and food systems  
To meet consumer demand for healthy food |

Measurement of benefits

The interviews yielded five areas of benefits associated with organic grain farming.

1) Economic benefit: Organic grain farming brought additional economic benefits and improved the viability of the farm.

2) Environmental natural resource benefit: Organic grain farming improved the farm’s environment and natural resources.
3) Social benefit: Farmers experienced more positive social interactions after adopting organic grain farming.

4) Validation of values and beliefs benefit address health concerns: Farmers reported that engaging in organic grain farming validated beliefs and values.

5) Addressed health concerns: Organic grain farming practices addressed farmers’ concern about human health.

The survey contains 14 quantitative items, in total, to measure farmers’ perceptions on five-area benefits associated with organic grain farming (Table 2). We asked farmers to indicate the beneficial level that they perceived on a five-point scale ranging from 1 (no benefit at all) to 5 (very high level of benefit).

Table 2

The area, quotation, and measurement item of benefits associated with organic grain farming

<table>
<thead>
<tr>
<th>Benefit area</th>
<th>Quotation</th>
<th>Measurement items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Benefit (BF_ECN)</td>
<td>• “We have made more [money] in one little field with organic.”</td>
<td>- Improve my farm’s profitability</td>
</tr>
<tr>
<td></td>
<td>• “The benefits are the economics, it is much better, especially for a small operation so the return on investment is higher.”</td>
<td>- Achieve my farm’s long-term viability</td>
</tr>
<tr>
<td>Natural Resource Benefit (BF_NR)</td>
<td>• “I’ve been able to observe the soil health out there.”</td>
<td>- Improve soil health</td>
</tr>
<tr>
<td></td>
<td>• “We had lots of bees, butterflies, and bumblebees.”</td>
<td>- Improve biodiversity</td>
</tr>
<tr>
<td></td>
<td>• “It was the most unbelievable beautiful field. Look at all the butterflies, all the beautiful flowers.”</td>
<td>- Bring more beauty to my farm</td>
</tr>
</tbody>
</table>


Table 2 (continued)

<table>
<thead>
<tr>
<th>Benefit area</th>
<th>Quotation</th>
<th>Measurement items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Benefit (BF_SOC)</td>
<td>“I mean that was an unexpected surprise that how much enjoyment I would get from a getting to know these folks [organic farmers], and attending conferences and seminars and field days and I enjoy that interaction.”</td>
<td>- Enjoyment from social interaction with other organic farmers</td>
</tr>
<tr>
<td></td>
<td>“With organic, we get more things as a family than you would in commercially. They [the kids] can come help me when the fields.”</td>
<td>- More quality time with family</td>
</tr>
<tr>
<td></td>
<td>“‘Man, you have really nice crops.’ They [other farmers] have said that.”</td>
<td>- Being recognized as a good farmer by other farmers</td>
</tr>
<tr>
<td></td>
<td>“People that came and visited [our farm] they would comment about how good it felt.”</td>
<td>- Being appreciated by consumers/ general public</td>
</tr>
<tr>
<td>Validation of Values and beliefs Benefit (BF_VAL)</td>
<td>“This is very satisfying to know that you are minimizing any disruption in their livelihood because I try to think of it as a win-win for both of us and nature.”</td>
<td>- Validation of my environmental/ land stewardship values</td>
</tr>
<tr>
<td></td>
<td>“It increases your faith in God.”</td>
<td>- Validation of my religious beliefs</td>
</tr>
<tr>
<td></td>
<td>“You become more personally attached to it [the land], so it totally changes your view towards the soil.”</td>
<td>- Validation of my other ideological beliefs and values</td>
</tr>
<tr>
<td>Addressed Health Concerns Benefit (BF_HLT)</td>
<td>“I think obviously that the food products and the feed products that produce food and animal products are better. I'm just confident that they are better, they're healthier for people.”</td>
<td>- Validation of my values about healthier food production</td>
</tr>
<tr>
<td></td>
<td>“I think it is healthier for the operators, for our farm family.”</td>
<td>- Create a healthier environment for my family</td>
</tr>
<tr>
<td></td>
<td>“I like to go and not have to worry about breathing in the chemical dust from insecticides, seed treatments.”</td>
<td></td>
</tr>
</tbody>
</table>

Measurement of long-term farming goals

We developed the measurement of long-term farming goals based on McGuire et al. (2013) and McGuire et al. (2015). We conceptualized three long-term goal orientations: productivism, civic-mindedness, and stewardship, and devised eight items as the measurements. Farmers were asked to rate the level of priority of the given goals on a five-point scale (from 1= not a priority to 5= essential priority) (Table 3).
Table 3
Long-term goals

<table>
<thead>
<tr>
<th>Long-term goal orientation</th>
<th>Measurement items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivism (LTG_PD)</td>
<td>Maximizing production yields of my farm operation</td>
</tr>
<tr>
<td></td>
<td>Maximizing profit for my farm operation</td>
</tr>
<tr>
<td>Civic-mindedness (LTG.CV)</td>
<td>Producing healthy food for consumers</td>
</tr>
<tr>
<td></td>
<td>Being a leader in the farming community</td>
</tr>
<tr>
<td></td>
<td>Sharing knowledge and experience with other farmers</td>
</tr>
<tr>
<td>Stewardship (LTG_SD)</td>
<td>Ensuring the land I farm is in a better shape for future generations</td>
</tr>
<tr>
<td></td>
<td>Improving soil health on my farm</td>
</tr>
<tr>
<td></td>
<td>Protecting watersheds where my farm is located</td>
</tr>
</tbody>
</table>

Sample and Data Collection

The USDA Organic Integrity Database provided the sampling frame to study certified organic grain farmers in Iowa. The USDA established the Organic Integrity Database to record all certified organic farms that sold more than $5,000 in organic products per year (USDA AMS, 2019a). Based on the database as of 3/14/2019, there were 672 certified organic farmers who operated organic grain operations and 655 farmers who had a valid mailing address. We mailed surveys to 655 Iowa organic grain farmers in September 2019. We received 258 completed surveys, yielding a response rate of 39.4%. The average age of respondents was 51 years, which is 6.4 years younger than the average age of Iowa farmers (USDA NASS, 2019). The average operation size was 311 acres, which is smaller than the state’s average farm operation size of 355 acres (USDA NASS, 2019). Additional personal and farm characteristics are shown in Table 4.

Table 4
Respondents’ personal and farm characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistics/category</th>
<th>Value/percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>96.9%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2.1%</td>
</tr>
<tr>
<td>Age</td>
<td>Mean</td>
<td>50.7</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>14.6</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>87</td>
</tr>
</tbody>
</table>
Table 4 (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Statistics/category</th>
<th>Value/percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education background (Edu)</td>
<td>Less than high school</td>
<td>49.6%</td>
</tr>
<tr>
<td></td>
<td>High school or GED</td>
<td>16.0%</td>
</tr>
<tr>
<td></td>
<td>2-year college</td>
<td>9.4%</td>
</tr>
<tr>
<td></td>
<td>4-year college</td>
<td>16.0%</td>
</tr>
<tr>
<td></td>
<td>Graduate education</td>
<td>9.0%</td>
</tr>
<tr>
<td>Years have been farming (Yr_FR)</td>
<td>Mean</td>
<td>26.5</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>15.1</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>69</td>
</tr>
<tr>
<td>Years organic farming (Yr_OG)</td>
<td>Mean</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>45</td>
</tr>
<tr>
<td>Years living in an urban area (Yr_URB)</td>
<td>Mean</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>14.1</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>75</td>
</tr>
<tr>
<td>Acres of organic farming operation (Acr_OG)</td>
<td>Mean</td>
<td>191.7</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>485.2</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>5800</td>
</tr>
<tr>
<td>Acres of total farming operation (Acr_TO)</td>
<td>Mean</td>
<td>311.6</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>839.5</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>9430</td>
</tr>
<tr>
<td>Percentage of farmland ownership (%) (Own)</td>
<td>Mean</td>
<td>70.1</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>97.5</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>37.1</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>100</td>
</tr>
<tr>
<td>Percentage of operated farmland is highly erodible (%) (Erod)</td>
<td>Mean</td>
<td>28.3</td>
</tr>
</tbody>
</table>
Data Analysis

The data were first analyzed with a series of confirmatory factor analyses (CFA) on 14 measurements of motivation, 14 measurements of benefits, and 9 measurements of long-term farming goals. CFA can “identify latent factors that account for the variation and covariation among a set of indicators” (Brown, 2006, p. 40). Confirmatory factor analysis is preferred over exploratory factor analysis (EFA) and principal components analysis (PCA) when theory and prior knowledge about measures have been collected, and CFA can provide more statistical information such as model fit, construct validity, and measurement reliability (Brown, 2006; Harrington 2009). We employed Weighted Least Square Mean and Variance Adjusted (WLSMV) as the model estimator given our survey data is ordinal rather than continuous, suggested by Li (2016).

By performing CFA, we calculated factor scores based on weighted arithmetic means for item response and factor loadings of CFA. The weighted factor score approach recognizes the strength of factor loadings while retaining the scale metric that allows for straightforward interpretation (DiStefano et al. 2009). Multiple paired-samples T-tests were performed to further examine the statistical difference between the mean of factor scores. Multiple T-tests may inflate Type I error, so we used Bonferroni correction to minimize the error (Howell, 2009). The results of CFA answered the first three research questions.

The second stage of data analysis was to perform five multiple linear regression models. For each regression model, the dependent variable was one of five benefit factors score variables respectively, and independent variables include the five-motivation factor score variables and three long-term farming goal factor score variables. We also included respondents’ personal and farm characteristic variables as control variables of the regression models.
Results and Interpretation

Factor Analysis of Motivation

Table 5 shows the result of CFA of farmers’ motivation to adopt organic grain farming. Based on the model fit criteria provided by Schumacker and Lomax (2010), the five-factor CFA model resulted a good model fit ($X^2 (68, n=257) = 173.21, p < .001$, RMSEA = 0.08, CFI = 0.97, TLI = 0.97). As we proposed, four items significantly loaded on the motivation of natural resources stewardship; two items significantly loaded on farmers’ motivation of profitability; five items significantly loaded on the motivation of honor and tradition; two items significantly loaded on the motivation of personal safety; two items significantly loaded on the motivation of consumers and public health. All items retained in the model since Harrington (2008) suggested items with a standardized factor loading larger than 0.45 is sufficiently high to be included in factors used in modeling. According to Hair et al.’s (2010) rules on measurement evaluation, all five motivation factors had good test reliability supported by internal consistency (Cronbach’s $\alpha > 0.7$) and construct reliability ($\rho_C > 0.8$). All the average variance extracted (AVE) values greater than 0.5 indicates a good construct convergent validity. The square root values of all five factor’s AVE were larger than the correlations between the factors, which demonstrated a good construct discriminant validity. In summary, the five-factor motivation CFA model was a good model to represent the factor construction of farmers’ motivation variables. Thus, factor scores derived from this CFA model are valid for subsequent analyses.

Based on means of factor scores, ranking of the identified motivations are motivation of profitability ($M = 4.45; SD = 0.62$); motivation of personal safety ($M = 4.38; SD = 0.76$); motivation of natural resources stewardship ($M = 3.99; SD = 0.67$); motivation of consumers and public health ($M = 3.98; SD = 0.81$); and motivation of honor and tradition ($M = 3.59; SD = 0.76$). Four paired-samples T-tests were performed to further examine the statistical difference
between means of the four motivation factor scores with a Bonferroni adjusted significance level at 0.0125. The rating on motivation of profitability was not significantly different from motivation of personal safety \( (t(255) = 1.16, p = 0.25) \) with very small effect size (Cohen's \( \text{d}=0.07)\); motivation of personal safety was rated significantly higher than motivation of natural resources stewardship \( (t(242) = 9.43, p < 0.001) \) with medium effect size (Cohen's \( \text{d}=0.61)\); motivation of natural resources stewardship was not rated significantly higher than motivation of consumers and public health \( (t(241) = 0.67, p =0.51) \) with very small effect size (Cohen's \( \text{d}=0.04)\); motivation of consumers and public health was rated significantly higher than motivation of honor and tradition \( (t(250) = 8.72, p < 0.001) \) with medium effect size (Cohen’s \( \text{d}=0.55)\).

**Table 5**

Factor analysis of motivation

<table>
<thead>
<tr>
<th>Factors</th>
<th>Measurement Item/ factor statistics</th>
<th>Mean</th>
<th>SD</th>
<th>Factor loading</th>
<th>AVE</th>
<th>( pC )</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT_NRS</td>
<td>To address my concerns about biodiversity loss</td>
<td>3.52</td>
<td>0.88</td>
<td>0.67</td>
<td>0.64</td>
<td>0.88</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>To improve soil health</td>
<td>4.47</td>
<td>0.72</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To improve the water quality in my watershed</td>
<td>4.16</td>
<td>0.84</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To address my concerns with environmental degradation</td>
<td>3.72</td>
<td>0.89</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT_PRF</td>
<td>To capture additional profit from organic price premium</td>
<td>4.40</td>
<td>0.68</td>
<td>0.89</td>
<td>0.79</td>
<td>0.88</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>To earn enough income to sustain my farm operation</td>
<td>4.49</td>
<td>0.69</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5 (continued)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Measurement Item/ factor statistics</th>
<th>Mean</th>
<th>SD</th>
<th>Factor loading</th>
<th>AVE</th>
<th>ρC</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT_HOR</td>
<td>To go back to the traditional way of farming before chemicals were widely used</td>
<td>3.64</td>
<td>1.07</td>
<td>0.51</td>
<td>0.53</td>
<td>0.82</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>To honor my family farm’s tradition of conservation</td>
<td>3.49</td>
<td>0.91</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To honor my religious beliefs</td>
<td>3.14</td>
<td>1.08</td>
<td>0.70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To farm in harmony with nature</td>
<td>3.98</td>
<td>0.98</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT_PS</td>
<td>To create a safer environment for my family</td>
<td>4.29</td>
<td>0.82</td>
<td>0.91</td>
<td>0.79</td>
<td>0.88</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>To minimize my exposure to toxic chemical</td>
<td>4.47</td>
<td>0.81</td>
<td>0.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT_CPH</td>
<td>To address my concern about public health associated with our agriculture and food system</td>
<td>3.96</td>
<td>0.95</td>
<td>0.91</td>
<td>0.69</td>
<td>0.81</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>To meet consumer demand for healthy food</td>
<td>4.00</td>
<td>0.84</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Model fit: $X^2$ (68, $n=257$) = 173.21, $p < .001$, RMSEA=0.08, CFI=0.97, TLI=0.97; The model was theoretically and empirically over-identified; Factor loadings were standardized; All factor loadings were significant at $p<.01$; MT_NRS: Motivation of Natural Resources Stewardship; MT_PRF: Motivation of Profitability; MT_HOR: Motivation of Honor and tradition; MT_PS: Motivation of Personal Safety; MT_CPH: Motivation of Consumers and Public Health.

Factor Analysis of Long-Term Farming Goals

The next CFA analyzed farmers’ long-term farming goals (Table 6). The three-factor CFA model resulted a good model fit ($X^2$ (18, $n=251$) = 155.60, $p < .001$, RMSEA=0.17, CFI=0.95, TLI=0.93). Two items significantly loaded on the productivism goal orientation, three items significantly loaded on civic-mindedness goal orientation, and three items significantly loaded on stewardship goal orientation.
Productivism had good construct reliability ($\rho_C = 0.78$), a marginally acceptable internal consistency (Cronbach’s $\alpha = 0.69$), a good construct convergent validity (AVE = 0.64), and a good construct discriminant validity (square root value of AVE is larger than correlations between the long-term goal factors). Civic-mindedness had a good construct reliability ($\rho_C = 0.85$), a good internal consistency (Cronbach’s $\alpha = 0.76$), a potentially good construct convergent validity (AVE = 0.65), and a good construct discriminant validity. Stewardship had a good construct reliability ($\rho_C = 0.91$), a good internal consistency (Cronbach’s $\alpha = 0.86$), a good construct convergent validity (AVE = 0.77), and a good construct discriminant validity. In summary, the CFA with three-factor long-term farming goals was a good model.

Based on means of factor scores, ranking of the farmers’ long-term farming goals are: productivism goal orientation (M = 3.92; SD = 0.76), stewardship goal orientation (M = 3.72; SD = 0.81), and civic-mindedness goal orientation (M = 3.17; SD = 0.87). Through two paired-samples T-tests, we examined the statistical difference between the mean of three long-term goal factor scores with a Bonferroni adjusted significance level at 0.025. Productivism goal orientation was rated significantly higher from stewardship goal orientation ($t(249) = 3.35, p = 0.001$) with small effect size (Cohen’s d=0.21); stewardship goal orientation was rated significantly higher than civic-mindedness goal orientation ($t(248) = 11.8, p < 0.001$) with nearly large effect size (Cohen’s d=0.75).
### Table 6
Factor analysis of long-term farming goals

<table>
<thead>
<tr>
<th>Factor</th>
<th>Measurement Item/ factor statistics</th>
<th>Mean</th>
<th>SD</th>
<th>Factor loading</th>
<th>AVE</th>
<th>ρC</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTG_PD</td>
<td>Maximizing production yields of my farm operation</td>
<td>3.67</td>
<td>0.96</td>
<td>0.80</td>
<td>0.64</td>
<td>0.78</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>Maximizing profit for my farm operation</td>
<td>4.18</td>
<td>0.77</td>
<td>0.80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTG.CV</td>
<td>Producing healthy food for consumers</td>
<td>3.85</td>
<td>0.97</td>
<td>0.85</td>
<td>0.65</td>
<td>0.85</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Sharing knowledge and experience with other farmers</td>
<td>3.02</td>
<td>1.08</td>
<td>0.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Being a leader in the farming community</td>
<td>2.53</td>
<td>1.18</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTG_SD</td>
<td>Ensuring the land I farm is in better shape for future generations</td>
<td>3.74</td>
<td>0.92</td>
<td>0.89</td>
<td>0.77</td>
<td>0.91</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td>Improving soil health on my farm</td>
<td>3.93</td>
<td>0.84</td>
<td>0.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Protecting watersheds where my farm is located</td>
<td>3.45</td>
<td>1.01</td>
<td>0.77</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Model fit: $X^2 (18, n=251) = 155.60, p < .001, \text{RMSEA}=0.17, \text{CFI}=0.95, \text{TLI}=0.93$; The model was theoretically and empirically over-identified; Factor loadings were standardized; All factor loadings were significant at $p<.01$; LTG_PD: Long-Term Goal of Productivism; LTG_CV: Long-Term Goal of Civic-Mindedness; LTG_SD: Long-Term Goal of Stewardship.

**Factor Analysis of Benefits**

The next result shows CFA of farmers’ experienced benefits associated with organic grain farming (Table 7). The five-factor CFA model resulted a good model fit ($X^2 (68, n=255) = 365.37, p < .001, \text{RMSEA}=0.13, \text{CFI}=0.95, \text{TLI}=0.94$). From the table, we found two factors significantly loaded on economic benefit; three factors significantly loaded on environmental natural resource benefit; four factors significantly loaded on social benefit; three factors significantly loaded on validation of values benefit; two factors significantly loaded on addressed health concerns benefit. All five benefit factors had a good internal consistency (Cronbach’s $\alpha > 0.7$) and construct reliability ($\rho C > 0.8$). All five benefit factors had good construct convergent
validity (AVE > 0.5). All five benefits factor also had a good construct discriminant validity by comparing square root values of AVES and correlations between the benefit factors. In general, the five-factor benefit CFA model was a good model to represent the factor construction of farmers’ experienced benefit variables. We proceeded with factor scores based on this CFA model for the subsequent analyses.

Based on means of factor scores, ranking of the experienced benefits associated with organic grain farming are: economic benefit (M = 4.02; SD = 0.77); addressed health concerns benefit (M = 3.94; SD = 0.93); environmental natural resource benefit (M = 3.66; SD = 0.87); values and beliefs validation benefit (M = 3.17; SD = 1.00); social benefit (M = 2.99; SD = 0.88). Through four paired-samples T-tests, we examined the statistical difference between the mean of four benefit factor scores with a Bonferroni adjusted significance level at 0.0125. Economic benefit was not rated significantly different from addressed health concerns benefit (t(245) = 1.10, p = 0.28); addressed health concerns benefit was rated significantly higher than environmental natural resource benefit (t(245) = 6.17, p < 0.001); environmental natural resource benefit was rated significantly higher than values and beliefs validation benefit (t(242) = 9.19, p < 0.001); values and beliefs validation benefit was rated significantly higher than social benefit (t(241) = 3.36, p = 0.001).
Table 7
Factor analysis of benefits

<table>
<thead>
<tr>
<th>Factor</th>
<th>Measurement Item/ factor statistics</th>
<th>Mean</th>
<th>SD</th>
<th>Factor loading</th>
<th>AVE</th>
<th>ρC</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF_ECN</td>
<td>Improve my farm’s profitability</td>
<td>4.10</td>
<td>0.80</td>
<td>0.88</td>
<td>0.77</td>
<td>0.87</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Achieve my farm’s long-term viability</td>
<td>3.93</td>
<td>0.89</td>
<td>0.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF_NR</td>
<td>Improve soil health (^a)</td>
<td>4.04</td>
<td>0.87</td>
<td>0.85</td>
<td>0.75</td>
<td>0.90</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Improve biodiversity (^a)</td>
<td>3.82</td>
<td>0.92</td>
<td>0.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bring more beauty to my farm</td>
<td>3.08</td>
<td>1.22</td>
<td>0.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF_SOC</td>
<td>Enjoyment from social interaction with other organic farmers</td>
<td>3.29</td>
<td>1.03</td>
<td>0.80</td>
<td>0.59</td>
<td>0.85</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>More quality time with family</td>
<td>3.06</td>
<td>1.19</td>
<td>0.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Being recognized as a good farmer by other farmers (^b)</td>
<td>2.69</td>
<td>1.14</td>
<td>0.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Being appreciated by consumers/ general public (^b)</td>
<td>2.97</td>
<td>1.11</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF_VAL</td>
<td>Validation of my environmental/ land stewardship values</td>
<td>3.62</td>
<td>1.04</td>
<td>0.94</td>
<td>0.65</td>
<td>0.85</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td>Validation of my religious beliefs (^b)</td>
<td>2.70</td>
<td>1.38</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Validation of my other ideological beliefs and values (^b)</td>
<td>3.02</td>
<td>1.24</td>
<td>0.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BF_HLT</td>
<td>Validation of my values about healthier food production</td>
<td>3.78</td>
<td>1.03</td>
<td>0.96</td>
<td>0.82</td>
<td>0.90</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>Create a healthier environment for my family</td>
<td>4.14</td>
<td>0.94</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Model fit: $X^2 (68, n=255) = 365.37, p <.001, RMSEA=0.13, CFI=0.95, TLI=0.94$; The model was theoretically and empirically over-identified; Factor loadings were standardized; All factor loadings were significant at $p<.01$; BF_ECN: Economic benefit; BF_NR: Environmental natural resource benefit; BF_SOC: Social benefit; BF_VAL: Values and beliefs validation benefit; BF_HLT: Addressed health concerns benefit.

Regression Models

To examine congruence between initial motivations and long-term goals and current perceived benefits, we conducted multiple regression analyses. After the CFAs, the dataset
contains a small proportion of missing values (3.9%). But the listwise deletion would largely reduce the sample size for regression models. Therefore, we imputed the missing value with the Monte Carlo Markov Chain (MCMC) method (Schumacker and Lomax, 2010). We first examined the assumptions of multiple linear regulation models based on ordinary least squares (OLS) estimation. Total acres of farm operation and acres of organic operation have a high correlation ($r = 0.83, p < .001$); farmers’ age and the number of years has been farming also have a high correlation ($r = 0.80, p < .001$). The high correlations led to a potential multicollinearity problem (VIF>4). So, we retained the variables of age and acres of organic operation in the regression models. We examined residual normality with Predicted Probability (P-P) plots. No violation was detected across all models. All models’ Durbin Watson values were in the range between 1 to 3, so the independent residuals assumption was met. No outlier was found by examining Cook’s Distance (Cook’s D <1). Scatterplots of standardized residual value against standardized predict value of the models showed somewhat heteroscedasticity. The regular regression models have potential risks to violate homoscedasticity for OLS estimation. Thus, we chose a Heteroskedasticity-Robust Regression using the HC3 method that weights each squared OLS residual (Hayes and Cai, 2007). This estimation method is arguably more accurate than the weighted least squares (WLS) estimation when the form of heteroskedasticity is unknown (Hayes and Cai, 2007) (Table 8).
### Table 8
Five regression models for benefits

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 Economic benefit</th>
<th>Model 2 Environmental natural resource benefit</th>
<th>Model 3 Social benefit</th>
<th>Model 4 Values and beliefs validation benefit</th>
<th>Model 5 Addressed health concerns benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (SE)</td>
<td>Std. b</td>
<td>B (SE)</td>
<td>B (SE)</td>
<td>B (SE)</td>
</tr>
<tr>
<td>MT_PRF</td>
<td>.334 (.130)</td>
<td>.254**</td>
<td>- .103 (.104)</td>
<td>.071</td>
<td>- .117 (.073)</td>
</tr>
<tr>
<td>MT_PS</td>
<td>.021 (.133)</td>
<td>.020</td>
<td>.172 (.115)</td>
<td>.147</td>
<td>.196 (.089)</td>
</tr>
<tr>
<td>MT_NRS</td>
<td>.035 (.073)</td>
<td>.036</td>
<td>.316 (.100)</td>
<td>.300**</td>
<td>.074 (.079)</td>
</tr>
<tr>
<td>MT_CPH</td>
<td>-.032 (.094)</td>
<td>-.032</td>
<td>-.180 (.105)</td>
<td>-.163</td>
<td>-.088 (.096)</td>
</tr>
<tr>
<td>MT_HOR</td>
<td>.046 (.086)</td>
<td>.045</td>
<td>.198 (.091)</td>
<td>.176*</td>
<td>.243 (.096)</td>
</tr>
<tr>
<td>LTG_PD</td>
<td>.202 (.080)</td>
<td>.205*</td>
<td>.278 (.071)</td>
<td>.257**</td>
<td>.244 (.065)</td>
</tr>
<tr>
<td>LTG_CV</td>
<td>-.100 (.082)</td>
<td>-.106</td>
<td>-.006 (.074)</td>
<td>-.005</td>
<td>-.310 (.068)</td>
</tr>
<tr>
<td>LTG_SD</td>
<td>.182 (.080)</td>
<td>.172*</td>
<td>.244 (.085)</td>
<td>.211**</td>
<td>-.020 (.084)</td>
</tr>
<tr>
<td>Gender</td>
<td>.032 (.433)</td>
<td>.007</td>
<td>.252 (.362)</td>
<td>.049</td>
<td>-.258 (.359)</td>
</tr>
<tr>
<td>Age</td>
<td>.002 (.004)</td>
<td>.037</td>
<td>-.001 (.004)</td>
<td>-.018</td>
<td>-.001 (.004)</td>
</tr>
<tr>
<td>Edu</td>
<td>.073 (.053)</td>
<td>.121</td>
<td>.084 (.044)</td>
<td>.127</td>
<td>.008 (.041)</td>
</tr>
<tr>
<td>Yr_OG</td>
<td>-.009 (.007)</td>
<td>-.096</td>
<td>-.002 (.006)</td>
<td>-.019</td>
<td>-.002 (.006)</td>
</tr>
<tr>
<td>Yr_URB</td>
<td>-.005 (.004)</td>
<td>-.078</td>
<td>-.001 (.004)</td>
<td>-.017</td>
<td>-.002 (.004)</td>
</tr>
<tr>
<td>Acr_OG</td>
<td>.000 (.000)</td>
<td>.089</td>
<td>.000 (.000)</td>
<td>.012</td>
<td>.000 (.000)</td>
</tr>
<tr>
<td>Own</td>
<td>.000 (.002)</td>
<td>.018</td>
<td>.000 (.002)</td>
<td>.051</td>
<td>-.001 (.002)</td>
</tr>
<tr>
<td>Erod</td>
<td>.000 (.002)</td>
<td>.003</td>
<td>.000 (.002)</td>
<td>-.016</td>
<td>.001 (.002)</td>
</tr>
</tbody>
</table>

**Note.** *p < 0.05; **p < 0.01; n = 258; MT_PRF: Motivation of Profitability; MT_PS: Motivation of Personal Safety; MT_NRS: Motivation of Natural Resources Stewardship; MT_CPH: Motivation of Consumers and Public Health; MT_HOR: Motivation of Honor and Tradition; LTG_PD: Long-Term Goal of Productivism; LTG_CV: Long-Term Goal of Civic-mindedness; LTG_SD: Long-Term Goal of Stewardship; Edu: Education background; Yr_OG: Years organic farming; Yr_URB: Years living in an urban area; Acr_OG: Acres of organic farming operation; Own: Percentage of farmland ownership (%); Erod: Percentage of operated farmland is highly erodible (%).
Model 1: Economic benefit is significant \((F (16, 241) = 2.76, p <.001)\). The model explains 18.6% of the variance in economic benefits \((R^2=0.186)\) (Table 8). Three of the independent variables were significant predictors. For each additional standardized unit of profitability motivation, farmers’ experienced economic benefit will increase 0.25 standardized units. For each additional standardized unit of productivism goal orientation, farmers’ experienced economic benefit will increase 0.21 standardized unit. For each additional standardized unit of stewardship goal orientation, farmer’s experienced economic benefit will increase 0.17 standardized unit. The results of this model indicate the economic benefit of organic grain farming aligned farmers’ initial profitability motivation, productivism goal orientation, and stewardship goal orientation.

Model 2: Environmental natural resource benefit is significant \((F (16, 241) = 10.33, p < .01)\) (Table 8). The model explains 38.9% of the variance in environmental natural resource benefits \((R^2=0.389)\). Four of the independent variables were significant predictors. For each additional standardized unit of natural resources stewardship motivation, farmers’ experienced environmental natural resource benefit will increase 0.30 standardized unit. For each additional standardized unit of honor and tradition motivation, farmers’ experienced environmental natural resource benefit will increase 0.18 standardized unit. For each additional standardized unit of productivism goal orientation, farmer’s experienced environmental natural resource benefit will increase 0.26 standardized unit. For each additional standardized unit of stewardship goal orientation, the environmental natural resource benefit will increase 0.21 standardized unit. The model results indicate the environmental natural resource benefit that aligned with the natural resources stewardship motivation, honor and tradition motivation, productivism goal orientation, and stewardship goal orientation.
The third model, social benefit model, is significant \((F(16, 241) = 9.54, p < .001)\), and explains 35.6% \((R^2=0.356)\) of the variance in social benefit (Table 8). Four predictor variables were significant. For each additional standardized unit for the personal safety motivation, farmer’s experienced social benefit will increase 0.18 standardized unit. For each additional standardized unit for the honor and tradition motivation, farmer’s experienced social benefit will increase 0.23 standardized unit. For each additional standardized unit of productivism goal orientation, farmers’ experienced social benefit will increase 0.24 standardized unit. For each additional standardized unit of civic-mindedness goal orientation, farmer’s experienced social benefit will increase 0.31 standardized unit. This model shows the social benefit aligned with initial personal safety motivation, honor and tradition motivation, productivism goal orientation, and civic-mindedness goal orientation.

Model 4: Values and beliefs validation benefit is significant \((F(16, 241) = 12.28, p < .01)\). The model explains 41.7% \((R^2=0.417)\) of the variance in the values and beliefs validation benefits variable (Table 8). Three significant predictors were found in this model. For each additional natural resources stewardship motivation, farmers’ experienced values and beliefs validation benefit will increase 0.29 standardized unit. For each additional honor and tradition motivation, farmer’s experienced values and beliefs validation benefit will increase 0.37 standardized unit. For each additional standardized unit of education background level, farmer’s experienced values and beliefs validation benefit will increase 0.11 standardized unit. The results of this model show the benefit of values and beliefs validation farmers perceived aligns with farmers’ motivations of natural resources stewardship and the honor and tradition motivation. In addition, the model also supports the claim that farmers’ education level can positively affect the values and beliefs validations that they can perceive.
Model 5: Addressed health concerns benefit is significant ($F(16, 241) = 11.20, p < .001$). The model explains 40.4% of the variance in the environmental natural resource benefits ($R^2=0.404$). In this model, two predictor variables were significant. For each additional personal safety motivation, the benefit of addressed health concerns will increase 0.29 standardized unit. For each additional stewardship goal orientation, farmer’s experienced addressed health concerns benefit will increase 0.15 standardized unit.

The results show farmers perceived a benefit of addressed health concerns that aligned with farmers’ personal safety motivation, productivism goal orientation, and stewardship goal orientation.

**Discussion and Implications**

Results of the first CFA on motivations confirmed farmer’s motivations to adopt organic grain farming are five-dimensional. The five motivation factors were all rated as at least somewhat important. Through the paired t-tests, we found the highest-rated motivations were profitability and personal safety; the second-highest-rated were natural resources stewardship and consumer and public health; the least rated motivation was honor and tradition. Those motivations largely confirmed the motivation categories found in early studies.

We gained new insights with the application of SDT. According to the literature about farmer’s motivations to adopt agroecological or conservational farming practices (Brédif et al., 2017; Garini et al. 2017; Greiner et al., 2009; Kvakkestad et al., 2015; Mills et al., 2018), the motivations of profitability and personal safety are extrinsic motivations, while farmers’ motivations related to natural resources stewardship, consumers and public health, and honor and tradition are intrinsic motivations. A general statement claims that farmers adopt agroecological or conservational farming practices on the basis of intrinsic motivations (Garini et al. 2017; Greiner et al. 2009; Kvakkestad et al. 2015; Mills et al. 2018), and this is considered to be
virtuous but perhaps limited in the business world. However, our findings contradict this overall belief. Our findings allow us to state that Iowa farmers who adopted organic grain farming were motivated by both extrinsic motivations and intrinsic motivations, but extrinsic motivations were in a more leading position than intrinsic motivations. Constance and Choi (2010) and Darnhofer et al. (2005) labeled organic farmers whose dominant motivations were economic incentives as “pragmatic organic” farmers. Also, their motivation of personal safety is considered to be instrumental in nature according to the SDT framework, including reduced pesticide exposure and minimized chemical injury risks (Garini et al., 2017). Meanwhile, it is also worth recognizing the importance of intrinsic motivations of organic grain farming adoption (natural resources stewardship, consumers and public health, and honor and tradition). Kvakkestad et al. and Mills et al. argue that intrinsic motivations have both wider meanings for farmers and have a greater impact on the continuity of behavior than extrinsic motivations. Further studies on deregistering organic could incorporate surveying farmers’ initial motivations of organic farming adoption using our validated scales and examine how intrinsic and extrinsic motivations affect their deregistering decisions.

Knowing the types and rankings of motivations for farmers to adopt organic grain farming, policymakers and agricultural extension practitioners can strategically design effective policies and programs to encourage more farmers to raise organic grains in the U.S. Thus, in the long run, improve the supply of organic animal feed and ingredients, strengthen the entire American organic sectors, and have a wider impact on environment and human health.

The second part of this paper was to understand long-term farming goals of Iowa farmers who adopted organic grain operation. The results indicate productivism and stewardship were farmers’ two primary goal orientations, and civic-mindedness was farmers’ secondary goal
orientation. Farmer’s roles as a “steward” and “conqueror” of the land have co-existed for more than two hundred years in the U.S. (Sullivan et al., 1996, p. 126). Farmers have internalized the conflicting roles; “Farmers see themselves as stewards who take care of the soil, and also frontiersmen with a responsibility to manipulate and control the soil” (Sullivan et al., 1996, p. 127). Some farmers may choose to sacrifice some profit for better environmental stewardship or vice versa (Chouinard et al., 2008). Organic farmers tend to see their farming profitability as reliant on better environmental stewardship because of the nature of organic farming practices (Kirschenmann, 2010).

The civic-mindedness goal orientation was rated lower than the other two goal orientations. Organic farming has historically been poorly accepted in rural communities dominated by conventional agriculture (Cranfield et al., 2010; Duram, 1999; 2000). Farmers who choose organic farming were less accepted as a leader’s role in the local farming community as their farm operations are alternative rather than mainstream. However, organic grain farmers have a higher priority in producing healthy food for consumers, which is a way of serving the broader community, and a type of civic-mindedness with respect to consumers’ health. This finding confirms that health reasons propel civic agriculture argued by Lyson (2004; 2005). Schoolman (2020) further argued that farmers’ civic-engagement activities are not only driven by the desire to address local issues but also inspired by societal and global issues that reflect their “genuine feelings of human obligation” (p.4). Further research may be needed to further compare the types of civic-mindedness between organic farmers and conventional farmers.

Results of the final CFA on benefits confirmed that farmers report benefits associated with organic grain farming. The results of four paired t-tests suggest that the primary benefits of organic grain farming were economic benefit and addressed health concerns benefit; the
secondary benefit was environmental natural resource benefit; the tertiary benefit was values and beliefs validation benefit; the quaternary benefit was social benefit. This finding indicates that farmers have experienced significant economic benefits associated with organic agriculture. This finding is consist with the results of economic analysis on organic grain farming system in Iowa by Chase et al. (2019a; 2019b). They found organic grain farming systems have an overall strong profitability, which is attributed to higher market prices and lower production costs. In addition, by restricting use of pesticides and synthesized agrochemicals, organic agriculture also minimizes risks of toxic agrochemicals exposure for farm operators, families, and consumers and reduces the risk of allergic diseases (Mie et al., 2017). Those environmental benefits such as soil health and biodiversity have been reported by Cambardella et al. (2015) and Delate et al. (2015). Farmers reported they experienced values and beliefs validation benefits. This indicates through organic grain farming, farmers have validated or strengthened their environmental values, religious beliefs, or other ideologies. The last benefit reported by farmers is the social benefit. Organic farmers often encountered social pressure from the neighboring conventional farmers in their local communities, which is not a benefit, but a stressor (Cranfield et al., 2010; Duram, 1999; 2000). However, as more farmers adopted organic farming or became interested in organic agriculture, organic farmers form or join regional farmer-to-farmer sustainable agriculture networks and organizations through which they shared knowledge, exchanged technical information, and obtained emotional supports (Exner and Thompson, 2006; Hanson et al. 2004; Hassanein, 1995; Piaskowski et al., 2013). The sustainable agriculture networks and organizations have fostered a sense of community with positive social interactions.

The last part of this paper examines if farmers’ initial adoption motivations and long-term goals aligned with the benefits they perceived from current organic grain farming by running five
regression models. By incorporating control variables (both personal demographics and farm characteristics) into the models, the analyses captured the control variables’ impacts (if any) on how farmers perceive benefits associated with organic grain farming. Farmers’ perceptions of benefits were not contingent on gender, age, number of years farming, number of years living in an urban area, acres of organic operation, percentage of farmland ownership, or percentage of highly erodible farmland. Only educational background had a positive effect on one type benefit: values and beliefs validation. Rogers (2003) asserted educational background influenced individuals’ judgment of the desirable or undesirable impacts of an innovation. People with higher education backgrounds usually have a stronger ability to cope with ideological changes (Sterling, 2004). Therefore, in the process of adopting organic agriculture, more educated farmers are more likely to associate the consequences of their adoption with ideological reasoning.

From the results across the models, for motivations, we found that farmers’ profitability motivation can be addressed by the perception of economic benefit; personal safety as a motivation can be gratified by the addressed health concerns benefit and social benefit; natural resources stewardship motivation can be satisfied by environmental natural resource benefit and values and beliefs validation benefit; honor and tradition as a motivation can be fulfilled by social benefit and values and beliefs validation benefit. Most motivations for adoption aligned with the benefits farmers perceived at the time of the survey. In addition, the findings also show that farmers’ extrinsic motivations helped farmers perceive the instrumental benefits directly corresponding to the extrinsic motivations, while intrinsic motivations made farmers perceived a wider range of benefits than they expected. This finding further supports our earlier argument
that intrinsic motivations are indispensable as they have more meanings for farmers and have a greater impact on the continuity of behavior because more types of benefits can be perceived.

It is worth noting that farmers’ motivation of consumers and public health is not a statically significant predictor for any type of benefit, despite the original occurrence of this finding in the qualitative results of the study. This may be because it is hard for farmers to tell if there is an improvement with consumers and public health conditions. Although organic grain farmers were generally confident about healthiness of the food they produced, they cannot judge or observe any changes in consumers and the public’s health conditions. Rogers (2003) argued observability of results of an innovation are critical to the adoption decisions. This may be especially important for grain farmers, who do not typically market directly to consumers, and cannot observe the situation. It is unknown how the lack of aligned benefit would have on adoption at this time, and this may pose a potential risk for some farmers to deregister organic grain farming in the future. Further studies may be warranted. Policymakers are advised to be aware of this potential risk and possibly develop policy interventions to minimize the risk based on the future studies.

For long-term farming goals, across the models, we found that both productivism goal orientation and stewardship goal orientation were positively associated with economic benefit and environmental natural resource benefit. This finding supported our earlier claim we made earlier that farming profitability does not appear to conflict with environmental stewardship for organic grain farmers. The two-goal orientations can synergize to make farmers perceive more economic benefit and environmental natural resource benefit. At the same time, productivism goal orientation was a significant predictor for the social benefit, stewardship goal orientation was a significant predictor for the addressed health concern benefit, and civic-mindedness was a
significant predictor for social benefit. Such findings indicate all three long-term farming goals have at least one aligned benefit associated with organic grain farming adoption.

**Conclusions**

This paper studied Iowa farmers’ motivations to adopt organic grain farming, their long-term farming goals, and the benefits they perceived by operating an organic grain farm. Through a mixed-method study, using semi-structured interviews and a mailed quantitative survey, we identified five-dimension motivations: 1) profitability, 2) personal safety, 3) natural resources stewardship, 4) consumers and public health, 5) honor and tradition. We found that organic farmers’ long-term goals are strongly orientated to both 1) productivism and 2) stewardship, and less strongly to oriented to 3) civic-mindedness. We assessed five areas of benefits associated with organic grain farming, in order: 1) economic benefit, 2) addressed health concerns, 3) environmental natural resource, 4) values and beliefs validation, and 5) social benefit. We found that benefits reported by farmers were generally aligned with their original adoption motivations and long-term goals. Specifically, an economic benefit aligned with farmers’ motivation of profitability, productivism goal orientation, and stewardship goal orientation. An environmental natural resource benefit aligned with farmers’ motivation of providing natural resources stewardship, motivation of honor and tradition, a productivism goal orientation, and a stewardship goal orientation. A social benefit aligned with farmers’ motivation of personal safety, motivation of honor and tradition, productivism goal orientation, and civic-mindedness goal orientation. A values and beliefs validation benefit aligned with farmers’ motivation of natural resources stewardship and motivation of honor and tradition. The values and beliefs validation benefit were also boosted by farmers’ higher education background. Addressed health concerns benefit aligned with farmers’ motivation of personal safety, and stewardship goal
orientation. Markedly, no benefit aligned with farmers’ motivation of protecting consumers and public health.

This study’s research population included organic grain farmers who were listed on a certification registry at the time of data collection (September 2019). Farmers who since deregistered may have different perceptions. Therefore, our findings and conclusions can only be applied to certified organic farmers. Future studies on how deregistered organic farmers’ perceptions of benefits differ from the rest of certified organic farmers may need to be conducted to fill this knowledge gap.

Acknowledgments

This project was funded through USDA-SARE #GNC16-221. This work was also supported by the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa, USA. Project No. 3813 sponsored by the Hatch Act and State of Iowa funds. The authors gratefully acknowledge the following persons and their organizations for their help with this research: Dr. Kathleen Delate, Dr. Robert Martin, and Dr. David Peters at Iowa State University; Dr. Stefan Gailans from Practical Farmers of Iowa; Ms. Rosalyn Lehman from Iowa Organic Association; Dr. Beth Nelson from North Central Region Sustainable Agriculture Research and Education Program.

References


Agarwal, S., 2017. Subjective Beliefs and Decision Making under Uncertainty in the Field. Iowa State University, Ames, IA. https://lib.dr.iastate.edu/etd/15241


Chouinard, H.H., Paterson, T., Wandschneider, P.R., Ohler, A.M., 2008. Will farmers trade profits for stewardship? Heterogeneous motivations for farm practice selection. Land Econ. 84, 66–82. https://doi.org/10.3368/le.84.1.66


Duesberg, S., O’Connor, D., Dhubháin, Aine N., 2013. To plant or not to plant-Irish farmers’ goals and values with regard to afforestation. Land Use Policy 32, 155–164. https://doi.org/10.1016/j.landusepol.2012.10.021


CHAPTER 6. GENERAL CONCLUSIONS

The purpose of this dissertation was to increase the understanding of factors that influence farmers’ decisions to adopt organic grain farming, and to assess education and extension supports, and to fill the gap in the body of knowledge. This dissertation features three journal articles. The first journal article, chapter three, utilized in-depth interviews to explore factors that motivate farmers to adopt organic grain farming and identify the challenges that hinder farmers’ adoption of organic grain farming. The second journal article, chapter four, employed survey data to quantify the challenges, assess organic grain farmers’ needs for extension programs, and rate program delivery formats. The third journal article, chapter five, used quantitative data to examine the relationships between farmers’ perceived benefits of organic grain farming, their original adoption motivations, and long-term goals.

Conclusions and Implications

Interplay of Extrinsic and Intrinsic Motivations

This study found an interplay of extrinsic and intrinsic motivations involved with the process of farmers adopting organic grain farming. The categories included 1) profitability, 2) personal health concerns, 3) natural resources stewardship, 4) consumers and public health, and 5) honor and tradition. Consistent with SDT, the findings suggested profitability and personal health concerns, coded as extrinsic motivations, played a leading role in attracting farmers to organic grain farming. This finding of a key role of extrinsic motivations appears to conflict with several previous studies, which concluded that farmers’ motivations to adopt agroecological or conservational farming practices were more comprehensively led by intrinsic motivations rather than extrinsic motivations. This difference in our findings may reveal several points. It may be farmers’ decisions to adopt single conservation practices (e.g., no-till) are different from the
decisions to convert a holistic farming system (organic farming system). The difference may also reflect experiences of the Iowa grain farming community with low prices and a willingness to embrace alternative avenues of production.

Intrinsic motivations (including natural resources stewardship, concerns for consumers and public health, and honor and tradition) are also valuable, in part, because they are anticipated to have more enduring impacts on farmers’ adoption behaviors because the intrinsic motivations are in accordance with farmers’ values and beliefs. Extrinsic motivations can be internalized into intrinsic motivations, that provide wider meanings for farmers and have a greater impact on the continuity of organic grain farming.

**Long-Standing and Shifts in Challenges**

This study identified seven areas of challenges that hindered farmers’ adoption of organic grain farming: 1) operation, 2) marketing, 3) policy, 4) finance, 5) input and information, 6) social pressures, and 7) land tenure. Many organic farming challenges remain long-standing, likely due to the nature of non-chemical alternative farming methods. Yet, some challenges shifted along with institutional and environmental changes. (1) Weed pressure and control remained a central challenge for organic farming operations. Moreover, as farmers incorporated new practices such as use of cover crops and organic no-till systems, they were faced with a series of challenges related to implementing these new practices. (2) Organic grain marketing benefited from high demand and steady certification programs, but challenges remained in transitional marketing crops and rotational crops (small grains and hay) in a region of specialization of row crops. (3) Farmers had improved access to information to some extent, but continued to state frustration that local farm advisors, including extension educators, were not as knowledgeable as they needed and wanted at the county and regional levels. (4) Machinery
lagged inputs. Farmers were able to obtain organic inputs directly from the organic suppliers, but finding appropriate machinery, including the right type and size, remained a challenge. Farmers also needed training on how to set up and operate machinery for organic grain operations. (6)

Social tension. The social tension between conventional and organic farmers was reported to play itself out in three ways in Iowa: (a) pesticide drift, and concerns among both organic and conventional farmers regarding potential lawsuits; (b) embarrassment related to weeds in organic fields; and (c) concern by both types of producers that organic farmers would be seen (even if unproven) as conduits for unwanted insect and disease problems. (7) Farmers acknowledged the existence of more government programs for organic agriculture than previously, but they made an appeal for more straightforward application procedures, more flexible program plans, and greater assistance to support application to organic grain production.

Programming Needs and Delivery Formats

Farmers reported needs for three programming areas: education, research, and technical services. Organic farmers wanted educational programs to 1) cultivate future organic farmers and needed workforce; 2) help beginning farmers to establish organic farms or with their organic transitions; 3) accommodate existing organic farmers’ year-round plans. Farmers needed more research to help overcome the specific agronomic and marketing problems occurring on their farms. Farmers needed more localized technical services including organic certification, organic suppliers, well-trained organic agricultural extension staff, and more extension publications about organic farming.

Farmers rated three program delivery formats (field days, farmer-to-farmer workshops, and one-on-one mentors) as highly effective. These three delivery formats share a foundation of two-way communication in the adult learning process. Field days create a social learning context
where farmers learn by demonstration, observation, and experiential activities. Farmer-to-farmer workshops feature peer-learning among farmers that involve engagement, communication, and interactive knowledge creation. One-on-one mentorship provides beginning organic farmers with comprehensive skills training in organic transition, production, and marketing. These three learning approaches can be used to design more programs intended to influence farmers’ adoption decisions and help them overcome challenges.

**Aligned Benefits**

Farmers reported they had experienced many benefits by adopting organic grain farming, that included: 1) economic returns, 2) addressed health concerns, 3) improved environment and natural resource, 4) validation of values and beliefs, and 5) social benefits. The first three benefits reported by farmers confirm the economic, environmental, and human health advantages of organic agriculture claimed by scientists, and directly align with their motivations of profitability, personal health concern, and natural resources stewardship. Validation of values and beliefs as a perceived benefit aligns with farmers’ motivation of honor and tradition. The social benefit was not originally expected by farmers when they made the adoption decision. But this benefit aligns with a civic-mindedness goal orientation. Organic farmers form or join regional farmer-to-farmer sustainable agriculture networks or organizations through which they share knowledge, exchange technical information, and obtain social support. The sustainable agriculture networks and organizations have fostered a stronger sense of organic farming community where organic farmers can experience more positive social interactions. Although those benefits associated with organic grain farming have mostly aligned with farmers’ original adoption motivations and long-term goals, no identified benefit was found to address farmers’
motivation of consumers and public health. A lack of alignment between the motivation and reported benefit may pose a risk of deregistering organic in the future

**Recommendations**

Based on the findings from this study, I provide the following recommendations for extension educators, organic agriculture specialists, and policy-makers.

1. **Strategize educational topics.** To progressively help farmers overcome the learning curves they potentially face, it is recommended future organic grain farming education programs prioritize basic agronomic strategies, including weed control and soil fertility. Then, expand the educational topics to emerging issues, including cover crop management, organic no-till systems, and climate change adaptation practices.

2. **Integrate educational programs into on-farm research projects and enhance social learning.** Because farmers have relatively strong preferences for both on-farm research and education regarding organic grain farming, I recommend organic researchers and extension educators continue to collaboratively develop more integrated programs of on-farm research and education at local levels. Share the latest findings of on-farm research by hosting field days and farmer-to-farmer workshops. Such collaborations among researchers, educators, and farmers can help local farmers solve the problems of their organic production, increase extension educators’ competence in organic agriculture, and create both peer-learning and social-learning opportunities for farmers.

3. **Integrate organic farming information and optimize network connections.** Extension educators are recommended to collaborate more with farmer organizations and researchers to aggregate information related to organic farming, such as market trends, new practices, pest risk forecasting, and suppliers. Such information may be presented
as extension periodical publications that circulate among local farmers. In addition, extension educators can play a liaison role, connecting farmers, researchers, and policy-makers, and interconnecting networks of different organizations to help organic farmers achieve effective bottom-up communication.

(4) Provide supports or programs that may reduce social tension between organic farmers and conventional farmers. This study recommends organic specialists utilize mainstream agricultural communication outlets, such as rural newspapers and farm magazines, and provide more publications about general rules and principles of organic farming. Helping local conventional farmers become more informed about this growing alternative farming system may change their stereotypes for organic farmers and lessen conflicts caused by different farm operational methods.

(5) Create professional development opportunities to build extension educators’ professional capacity in organic farming. Extension educators should have professional development opportunities in organic principles, practices, marketing, regulations, and available governmental programs. Extension educators can enroll in organic agriculture courses offered by land grant universities or as part of professional associations, such as National Association of County Agricultural Agents and eXtension.

(6) Reach out to future organic farmers. This study recommends organic specialists collaborate with youth development educators to incorporate organic agriculture into the 4-H youth development programs to raise young students’ awareness of organic agriculture. To better prepare for the future organic agricultural workforce, this study recommends developing organic agricultural courses in vocational agricultural education programs. I also recommend incorporating organic agriculture topics into the beginning
farmers programs to help farmers build a knowledge system and explore options of organic agriculture.

(7) Strengthen the organic market. This study recommends that organic specialists and extension educators develop more programs focused on organic crop marketing by inviting organic grain brokers and experienced farmers to share their experiences and strategies related to organic grain marketing. I also recommend policy-makers establish marketing assistance programs for transitional crops to reduce farmers’ financial difficulty during the transitional period.

(8) Economic research is needed before launching the assistance programs. This study recommends agricultural economists conduct more market research to identify weaknesses in the regional supply chain of organic grains and develop responding programs to strengthen the supply chain. Also, to create more demand for organic rotational crops (small grains and hay crops), this study suggests the USDA fund more research on organic product development with usage of small grains and hay crops as raw materials.
REFERENCES


https://shop.fibl.org/CHen/mwdownloads/download/link/id/1093/?ref=1

https://shop.fibl.org/chen/mwdownloads/download/link/id/1202
APPENDIX A. INSTITUTIONAL REVIEW BOARD DOCUMENTATION

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
2420 Lincoln Way, Suite 202
Ames, Iowa 50014
515 294-4566

Date: 3/27/2017
To: Guang Han
220 Curtiss Hall

CC: Dr. Nancy Grudens-Schuck
217 Curtiss Hall
Dr. Robert Martin
201 Curtiss Hall

From: Office for Responsible Research

Title: Factors driving grain producers to convert to organic farming systems

IRB ID: 16-191

Study Review Date: 3/27/2017

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:
- You do not need to submit an application for annual continuing review.
- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. Only the IRB or designees may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.

Please be aware that approval from other entities may also be needed. For example, access to data from private records (e.g., student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.
APPENDIX B. INFORMED CONSENT DOCUMENT

Title of Study: Factors driving grain producers to convert to organic farming systems

Investigators: Guang Han (Principal Investigator) Nancy Grudens-Schuck (Supervising Faculty) Robert Martin (Supervising Faculty)

This form describes a research project. It has information to help you decide whether or not you wish to participate. Research studies include only people who choose to take part—your participation is completely voluntary. Please discuss any questions you have about the study or about this form with the project staff before deciding to participate.

This study is funded by United States Department of Agriculture Sustainable Agriculture Research and Education Program.

Introduction

The purpose of this study is to collect information for developing more effective educational programs for both current organic farmers and potential organic farmers. To achieve this goal, we need to understand how farmers make decisions regarding organic farming.

You are being invited to participate in this study because you are/have been a USDA-certified organic grain (including soybean, corn, and small grains) producer in the state of Iowa. You should not participate if you are only vegetable producer or livestock producer.

Description of Procedures

If you agree to participate, you will be asked to take part in an interview at a location of your choice. The interview is one on one and face to face interview.

The interview will ask a series of questions regarding why and how you started organic farming. The interview will also ask you about the educational needs for organic farming. There will be seven categories inquiries.

- Background (Age, education, farm size)
- Advantage of organic farming (Benefits)
- Compatibility of organic farming (Comfort)
- Complexity of organic farming (Complex)
- Trialability of organic farming (Try)
- Observability of organic farming (Nearby people’s influence)
- Educational needs assessment

Each category inquiry will let you make 2 to 5 statements or answer questions. Follow up questions will be asked as need. The estimated length of the interview will last one and a half hour to two hours. We will take a short break in the middle of our interview. This interview will be audio recorded and notes will be taken by the interviewee. The interview...
audio record will be transcribed into a text file. To protect your privacy, your name and your farm’s name will be replaced by a two digits ID in the transcription. All your identifiable information will be removed in the research reports. Your audio record will be transcribed by the research team or through a professional audio transcription service. Therefore, the research team and the professional transcribers will have the access to the audio files. After transcription, only members of the research team have the access to the files and data. All the electronic files including audio files and transcriptions will be saved in CyBox, Iowa State University’s secure cloud-based storage system, which is protected by password. The field note and audio recorder will be locked in an office at Iowa State University.

Risks or Discomforts

Potential risks of participation include discomfort when talking about personal beliefs and decisions related to farming. However, we will use two digits ID to replace your name to take away an identifying marker of you. There are also potential physical risks when the interview proceeds more than one hour, but these risks would not pro the everyday risks of working on a farm. The interview will take a break in the middle to reduce the discomfort.

Benefits

Findings from this project will help educators develop more effective educational programs and service to both current and potential organic farmers. Agricultural organizations, extension agents, and educators will learn about how to motivate conventional farmer’s convert to organic farming and what educational needs organic farmers have. In addition, through attending effective and compelling educational programs, farmers will have more knowledge about economic, environmental, and social benefits of organic farming. In the long term, this project will help to increase the number of organic grain producers, and eventually combine with other trends to decrease the dependency on imported organic grain. Then livestock producers can source steady and affordable local organic feed. More job opportunities will be created with the expanding domestic organic agriculture production. More organic farming acreage will bring more benefits to the environment and natural resources because of less chemical use and the increase of biodiversity.

Costs and Compensation

You will not have any costs from participating in this study. You will be compensated for $40 dollars for participating in this study. You will need to complete a form (Iowa State University Research Participant Receipt Form) to receive payment (check/cash). Please know that payments may be subject to tax withholding requirements, which vary depending upon whether you are a legal resident of the U.S. or another country. If required, taxes will be withheld from the payment you receive. Information regarding documentation required for participant compensation may be obtained from the Controller’s Department: 294-2555 or http://www.controller.iastate.edu. Completion of all study procedures cannot be required to receive compensation.
Participant Rights

Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. You can skip any questions that you do not wish to answer.

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Confidentiality

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: The interview will conducted on participant’s location at his/her convenience. In addition to the investigator and the consented participant, no third person will be on site during the interview. The interview will be recorded by a digital audio recorder. The file will be transferred into a passcode protected external hard drive. The audio file will be transcribed into transcription. In transcription, your name will be coded into a two digits ID number. Your farm’s name and specific location will not be released along with any report. Including consent form, field note, audio recorder, external hard drive, and everything belonged to this project will be stored in a lockable cabinet located in an office at Iowa State University.

Questions

You are encouraged to ask questions at any time during this study. For further information about the study, you can contact Guang Han guanghan@iastate.edu 321-609-1327
Dr. Nancy Grudens-Schuck ngs@iastate.edu 515-294-0894
Dr. Robert Martin drmartin@iastate.edu 515-294-0896

Consent and Authorization Provisions

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant’s Name (printed) ______________________________

Participant’s Signature ______________________________ Date __________________
APPENDIX C. INTERVIEW PROTOCOL

Project: Factors driving grain producers to convert to organic farming systems
PI: Guang Han
Organization: Iowa State University
Grantor: USDA-SARE

Date: ________________________________
Time: ________________________________
Place: ___________________________________

Research questions:
1. What factors are driving organic grain farmers to convert to organic farming?
2. What barriers have farmers met?
3. How farmers overcome the barriers?
4. What educational services do farmers need?

Welcome Statement

Hello! My name is Guang Han. I am a graduate student in Sustainable Agriculture at Iowa State University. I want to thank you for accepting my interview today. I will be the interviewer for today’s interview. I invited you to take part in this interview because you are an organic grain producer. I need your input for our research study: Factors driving grain producers to convert to organic farming systems. This project funded by USDA SARE program.

The purpose of this study is to understand why and how farmers adopt organic farming, identify drivers and barriers of organic farming adoption, and collect information to improve educational programs for both current organic farmers and potential organic farmers.

As a consented participant, you are asked to accept an interview from me. The interview will take about one hour to one and a half hour. I will be taking notes during the interview and an audio recorder will record the interview. Again, as the consent form indicated you have the right to skip any question you do not like to answer, and you have the right to discontinue this interview at any point. We will do our best to protect your privacy. Your name will be coded into a two-digit ID number. Your farm’s name and specific location will not be released along with any report. Please let me know if you are ready to start our interview.

Note.
  ○ are the probes
<table>
<thead>
<tr>
<th>Questions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warm up</strong></td>
<td></td>
</tr>
<tr>
<td>- Can you briefly tell me about yourself and your farm operation?</td>
<td></td>
</tr>
<tr>
<td><strong>1. Can you tell me about why and how you started organic farming? (Please elaborate focused on your organic grain operation.)</strong></td>
<td></td>
</tr>
<tr>
<td>o What first got you interested in organic grain operation?</td>
<td></td>
</tr>
<tr>
<td>o Were you able to observe organic farming practices on another farmers’ land before you converted to organic?</td>
<td></td>
</tr>
<tr>
<td>o Do you have friends or neighbors who are involved in organic farming?</td>
<td></td>
</tr>
<tr>
<td><strong>2. What is your farming philosophy?  Such as farm goals, personal beliefs or values related to your farm operation decisions.</strong></td>
<td></td>
</tr>
<tr>
<td>o Has there been any change regarding your philosophy and goals before and after implementing organic farming?</td>
<td></td>
</tr>
<tr>
<td><strong>3. Please describe the process of transition to organic farming. (Please elaborate your answer focused on organic grain operation).</strong></td>
<td></td>
</tr>
<tr>
<td>o What were the challenges to getting into organic farming for you?</td>
<td></td>
</tr>
<tr>
<td>o What barriers/challenges did you experience before your transition?</td>
<td></td>
</tr>
<tr>
<td>o What barriers/challenges did you meet after your transition?</td>
<td></td>
</tr>
<tr>
<td><strong>4. Please describe how you overcame those difficulties/challenges.</strong></td>
<td></td>
</tr>
<tr>
<td>o What changes have you made for organic operation?</td>
<td></td>
</tr>
<tr>
<td>o What are the facilitators helped you?</td>
<td></td>
</tr>
<tr>
<td>o Any learning curves? Please describe how to overcome the learning curve.</td>
<td></td>
</tr>
</tbody>
</table>
5. Considering your farm operation, what are the benefits of organic farming compared to conventional farming? (Please elaborate your answer focused on organic grain operation.)

- How has organic grain changed the profitability of your farm?
- How has organic farming changed your costs of production?
- How has organic conversion changed the way other farmers look at you?
- How has organic conversion changed your community (For both residential and professional)?
- How has organic farming changed your farm’s agroecology/environment such as soil and water?
- How has organic farming changed your health or your family health condition?
- How has conversion to organic affected the time you spend farming?
- How has organic farming changed your level of comfort in farming?
- Among those benefits, what benefits you were expected? What benefits did you not expect to see?

6. Please describe how you knew organic farming was going to work for you. (Please elaborate your answer focused on organic grain operation.)

- Did you first try organic practices on a small scale before using them farm-wide?
- Do you find it easy to experiment with new organic techniques? Why or why not?
- Did you have experience with organic farming methods before conversion? If so, can you please describe that experience?

7. What programs have you participated in to help with your organic grain operation?

- How has the program helped your farming?
- What financial help have you received for the organic transition?
- How has the financial help programs influenced your decisions?
8. Where and how do you obtain information regarding organic farming practices and markets?
   - How do you sell your organic grain?
   - Do you sell to a local buyer within the state? Or you need to haul your grain to another state, how far away usually?

9. How valuable and accessible are the organic educational programs to you? Some programs such as ISU Organic Agriculture Program, Iowa Organic Association, Practical Farmers of Iowa, ISU extension, MOSES, and USDA-SARE.
   - Which program or what kind of the program do you think it’s more helpful for you, and why?
   - Did you participate those programs before you start organic farming or after?
   - What do you think how those educational programs influence your decisions in organic farming?
   - Are you aware of any educational programs for potential organic farmers?

10. Is there a need for more education regarding organic farming practices and marketing?
    - What specific topics you want to get more information?
    - Can you give me an example of a good experience you had when you participate an educational program for organic farming?

11. What are your suggestions to improve educational programs for organic farming?
    - When you were beginning organic farmer, what kind of education service you wish you can have?
    - What format of education you think is more effective for organic farmers? Such as field day, one on one mentorship, workshop, and webinar.

12. Do you have any other comments/recommendations that you want me to know?
Demographic information and farm characteristics

1. Please choose your age category.
   - Under 35 years old
   - 36-45 years old
   - 45-55 years old
   - 55-65 years old
   - 66 years or older

2. What is your highest level of education?
   - Less than a high school degree
   - 2-year college degree
   - High school graduate/GED
   - 4-year college degree
   - Graduate degree

3. Which year did you start your organic grain operation? ___________________(year)

4. Which year did you get your organic certification? __________________(year)

5. What is the size of your farm operation in 2017?
   _______ (acres) organic corn and soybean
   _______ (acres) conventional corn and soybean
   _______ (acres) other organic crops ____________________________ (crop names)
   _______ (acres) other conventional ____________________________ (crop names)
   _______ (number) organic livestock ____________________________ (livestock names)
   _______ (number) conventional livestock ______________________ (livestock names)

6. What is the percentage of your farm land that is rented? __________________(percent)

7. How many people are working for your farm? _____________________________ (number)
   Of them, ________________ (number) family members
   _______________ (number) hired long-term farm workers
   _______________ (number) hired seasonal farm workers

8. ________________________(percent) my household income came from my farm.
APPENDIX D. FARMER SURVEY

Dear Iowa Organic Farmer,

Organic grains are an important part of the organic food sector, as organic dairy, livestock, and egg producers and organic food companies all rely on organic grains. The Organic Trade Association and other organic agriculture organizations have been calling for greater organic grain production. The USDA has also established programs to support organic research and education.

Responding to these calls, researchers at Iowa State University think it is important to increase understanding of why and how farmers adopt organic grain farming. Therefore, we are surveying Iowa organic grain farmers. Specifically, we are interested in knowing farmers’ 1) motivations to adopt organic grain farming; 2) challenges impeding organic grain farming; 3) strategies for adopting organic grain farming; 4) benefits associated with organic grain farming; and 5) needs for educational and technical assistance programs. The findings will help government agencies, land grant universities, and agricultural organizations to develop more effective programs to better serve organic farmers’ needs.

The questionnaire will take about 25 minutes to complete. The information you provide is strictly confidential and used only for statistical purposes in combination with 600 other organic farmers. Your participation is very important as high participation rates improve the reliability and validity of the results, but your participation is voluntary. There is no consequence if you do not respond. This survey is part of a graduate student’s dissertation research project in Sustainable Agriculture. We hope you can complete the survey and return it to us within the next 7 days using the enclosed business reply envelope. We enclosed a $2 bill as a token of our appreciation.

For questions about the survey or the project, please call or email the researcher Mr. Guang Han, (515) 598-6781, guanghan@iastate.edu or Dr. Nancy Grudens-Schuck, (515) 294-0894 ngs@iastate.edu. If you have questions about the rights of research subjects, please contact Iowa State University IRB Administrator, (515) 294-4566, IRB@iastate.edu.

Thank you for participating in the 2019 Iowa Organic Grain Farmer Survey!

Please send back in 7 days!

Guang Han, M.S.  
Graduate Research Assistant  
Sustainable Agriculture Program  
Dept.Agricultural Education and Studies  
Iowa State University

Nancy Grudens-Schuck, Ph.D.  
Associate Professor  
Sustainable Agriculture Program  
Dept.Agricultural Education and Studies  
Iowa State University
PART I: Motivating factors to adopt organic farming

1. We are interested in knowing about factors that motivated you to adopt organic farming. Please rate the level of agreement with the following statements. Please circle one number on each line.

<table>
<thead>
<tr>
<th>Motivating factors to adopt organic farming</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. To go back to the traditional way of farming before chemicals were widely used..................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. To address my concerns about biodiversity loss..........................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. To capture additional profit from organic price premium ........................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. To earn enough income to sustain my farm operation..................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e. To reduce dependence on Ag-input companies...............................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>f. To challenge myself........................................................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>g. To create a safer environment for my family ...............................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>h. To minimize my exposure to toxic chemical .................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>i. To improve soil health....................................................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>j. To improve water quality in my watershed ..................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>k. To address my concerns about public health associated with our agriculture and food system..................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>l. To meet consumer demand for healthy food................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>m. To address my concerns with environmental degradation..............................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>n. To honor my family’s tradition of conservation ..........................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>o. To honor my religious beliefs.......................................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>p. To farm in harmony with nature.....................................................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>q. My family supported me to adopt organic farming..........................................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>r. My pre-existing operation’s system fit well with organic grain operations...............................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>s. I had prior-experience or knowledge with organic farming.............................................................................</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Motivating factors to adopt organic farming

| t. I had farmland (such as CRP land or hay land) that could be quickly converted to organic production | 1 | 2 | 3 | 4 | 5 |
| u. I had the resources and opportunity to make changes on my family farm | 1 | 2 | 3 | 4 | 5 |

PART II: Prior conditions before organic farming

2. Specific problems encountered in conventional farming have been found to affect farmers’ decisions to adopt organic farming. Please rate the degree to which you perceived the following items to be a problem in the conventional farming systems. Please circle one number on each line.

<table>
<thead>
<tr>
<th>Prior problems with the conventional farming systems</th>
<th>Degree of the perceived problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
</tr>
<tr>
<td>a. Health problems such as cancer, Parkinson’s and more</td>
<td>1</td>
</tr>
<tr>
<td>b. Chemical application injuries</td>
<td>1</td>
</tr>
<tr>
<td>c. Soil erosion</td>
<td>1</td>
</tr>
<tr>
<td>d. Watershed pollution</td>
<td>1</td>
</tr>
<tr>
<td>e. Agri-business is biased toward larger farm operations</td>
<td>1</td>
</tr>
<tr>
<td>f. The profitability of conventional farming had become too low to sustain my family farm</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Farming goals are long-term attributes that a farm business seeks to accomplish. Farmers may have multiple farming goals. Think back before you converted to organic; to what extent were these items a priority? Please circle one number on each line.

<table>
<thead>
<tr>
<th>Long-term farming goals</th>
<th>No Priority</th>
<th>Low Priority</th>
<th>Medium Priority</th>
<th>High Priority</th>
<th>Essential Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Ensuring the land I farm is in a better shape for future generations</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. Improving soil health on my farm</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. Protecting watersheds where my farm is located</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. Maximizing production yields of my farm operation</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Long-term farming goals

| e. Maximizing profit for my farm operation | 032 | 1 | 2 | 3 | 4 | 5 |
| f. Staying in full-time farming | 033 | 1 | 2 | 3 | 4 | 5 |
| g. Improving my family's quality of life | 034 | 1 | 2 | 3 | 4 | 5 |
| h. Producing healthy food for consumers | 035 | 1 | 2 | 3 | 4 | 5 |
| i. Being a leader in the farming community | 036 | 1 | 2 | 3 | 4 | 5 |
| j. Sharing knowledge and experience with other farmers | 037 | 1 | 2 | 3 | 4 | 5 |
| k. Reducing dependence on Ag-input companies | 038 | 1 | 2 | 3 | 4 | 5 |
| l. Farming in harmony with nature | 039 | 1 | 2 | 3 | 4 | 5 |
| m. Increasing the amount of farmland I own | 040 | 1 | 2 | 3 | 4 | 5 |

PART III: Challenges of organic farming

4. Converting a conventional farm operation to an organic farm operation can be quite challenging. Please rate the extent to which following challenges impeded your adoption of organic grain farming. Please circle one number on each line.

<table>
<thead>
<tr>
<th>Challenges of organic farming</th>
<th>Level of challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>Minor</td>
</tr>
<tr>
<td>a. Lack of local organic marketing infrastructure (e.g., elevators)</td>
<td>041</td>
</tr>
<tr>
<td>b. Lack of organic corn and soybeans market</td>
<td>042</td>
</tr>
<tr>
<td>c. Lack of organic hay market</td>
<td>043</td>
</tr>
<tr>
<td>d. Lack of organic small grain market</td>
<td>044</td>
</tr>
<tr>
<td>e. Lack of transitional grain market</td>
<td>045</td>
</tr>
<tr>
<td>f. Weed control</td>
<td>046</td>
</tr>
<tr>
<td>g. Insect control</td>
<td>047</td>
</tr>
<tr>
<td>h. Plant disease control</td>
<td>048</td>
</tr>
<tr>
<td>i. Cover crop management</td>
<td>049</td>
</tr>
<tr>
<td>j. Soil fertility</td>
<td>050</td>
</tr>
</tbody>
</table>
### Challenges of organic farming

<table>
<thead>
<tr>
<th>Challenges of organic farming</th>
<th>Level of challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>k. Finding the necessary machinery for organic farming</td>
<td>Not at all Minor Some what Moderate Serious</td>
</tr>
<tr>
<td>l. Lack of skills to setup/operate machinery</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>m. Finding organic inputs</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>n. Complexities of certification process</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>o. Complexities of governmental programs</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>p. Crop insurance policies are not favorable to organic farming</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>q. High financial risk in the transitional period</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>r. Getting loans for organic farming enterprise</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>s. Finding enough labor</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>t. Organic farming is highly sensitive to the weather</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>u. Negative attitude against organic farming from other farmers</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>v. Feelings of isolation in the local rural community</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>w. Difficult to integrate no-till operation into organic farming</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>x. Difficult to farm organically on hilly ground</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>y. Insufficient educational programs for organic farming</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>z. Local extension agents lack expertise in organic farming</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>aa. Unstable land leasing agreement for organic operation</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>bb. Lack of owned land that I control</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
PART IV: Strategies

5. In the process of adopting organic farming, multiple strategies can be employed by farmers. If you employed the following strategies, please check the box and rate the importance by circling one number on each line.

<table>
<thead>
<tr>
<th>Strategies for overcoming barriers and challenges of organic farming</th>
<th>Taken on my farm</th>
<th>Level of importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Start organic operation from a small scale</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Start organic farming on CRP or hay land</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Strategically adjust crop rotations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Conduct on-farm experiments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Purchase older equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Share equipment with other farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Use of cover crops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Implement organic no-till system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Apply purchased organic fertilizer or manure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Rent land from family members for stable leasing terms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Acquire marketing information from other organic farmers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Acquire marketing information at organic conferences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Use organic market reports as marketing reference (e.g., USDA Organic Bi-weekly Report, Organic and Non-GMO Report)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Collaborate with other organic farmers to leverage marketing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>o. Forward contract organic grains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p. Sell organic grains following market trends without a forward contract</td>
<td></td>
<td></td>
</tr>
<tr>
<td>q. Sell transitional organic grains as non-GMO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategies for overcoming barriers and challenges of organic farming</td>
<td>Taken on my farm</td>
<td>Level of importance</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>-----------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>r. Sell organic grains directly to organic livestock producers</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>s. Sell organic rotation crops through organic networks (e.g., Organic Broadcaster, IOA/PFI mail list)</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>t. Hire a professional marketing company</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>u. Enroll in government programs for financial assistance (e.g., EQIP, CSP, CRP, etc.)</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>v. Enroll in organic certification cost share program</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>w. Apply for an organic research or education grant from organizations (e.g., USDA-SARE, PFI, etc.)</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>x. Ask other organic farmers about organic farming techniques</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>y. Ask older conventional farmers who have prior experience with non-chemical farming about farming techniques</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>z. Establish a mentor-mentee relationship with another experienced organic farmer</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>aa. Take an organic agriculture course offered at a university</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>bb. Contact professors at land grant universities for information related to organic farming</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>cc. Attend field days offered by organizations (e.g., PFI, Iowa Organic Association, MOSES, OCIA, etc.)</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>dd. Attend organic conferences (MOSES, Iowa Organic Association, Iowa Organic Conference, etc.)</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
<tr>
<td>ee. Research organic farming techniques on the internet</td>
<td></td>
<td>Not at all Slightly Some what Fairly Very</td>
</tr>
</tbody>
</table>
Strategies for overcoming barriers and challenges of organic farming

ff. Read farm magazines specialized in organic/sustainable agriculture (e.g., Acres USA, New Farm, etc.) .......................................................... 100

 gg. Read electronic newsletters of organic farming (i.e. MOSES Organic Broadcaster, PFI/IOA newsletters, etc.) ................................................ 101

 hh. Read general farm magazines for all types of farmers (e.g., Successful Farming, Progressive Farmer, etc.) .......................................................... 102

PART V: Benefits

6. There are many potential benefits related to organic farming. We are interested in knowing what specific benefits you have experienced from your organic grain farming operation. Please indicate the extent to which you experienced the following potential benefits. Please circle one number on each line.

Potential benefits of organic farming

<table>
<thead>
<tr>
<th>Level of benefits</th>
<th>Not at all</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Improve my farm’s profitability                     103</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Achieve my farm’s long-term viability                104</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Improve soil health                                   105</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Improve biodiversity                                  106</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Bring more beauty to my farm                          107</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Enjoyment from social interaction with other organic farmers 108</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. More quality time with family                         109</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Being recognized as a good farmer by other farmers    110</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Being appreciated by consumers/ general public...    111</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Enjoyment of daily field operation                    112</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Validation of my environmental/ land stewardship values 113</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Potential benefits of organic farming

<table>
<thead>
<tr>
<th>Level of benefits</th>
<th>Not at all</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validation of my values about healthier food production</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation of my religious beliefs</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation of my other ideological beliefs and values</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create a healthier environment for my family</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PART VI: Need for educational and technical assistance programs

7. We would like to know what educational and technical assistance programs are needed by organic grain operations. Please rate the extent to which you feel the need for programs that address the following topics. Please circle one number on each line.

<table>
<thead>
<tr>
<th>Need for programs</th>
<th>Not Needed</th>
<th>Slightly Needed</th>
<th>Somewhat Needed</th>
<th>Moderately Needed</th>
<th>Strongly Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>More agronomic research on organic farming</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More economic (market) research on organic farming</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More on-farm research projects related to organic farming</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More organic agriculture courses offered by universities</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educate younger people about organic agriculture</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educate conventional farmers about organic agriculture</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning farmers' programs focused on organic transition</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More winter educational programs for organic farming</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local yield data for organic grains</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local organic farmers networks</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic farming manuals</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
8. We are interested in knowing the effectiveness of different forms of educational programs for organic farming. Please rate the effectiveness of the following program delivery formats. Please circle one number each line.

<table>
<thead>
<tr>
<th>Program delivery formats</th>
<th>Ineffective</th>
<th>Slightly effective</th>
<th>Moderately effective</th>
<th>Effective</th>
<th>Highly effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Field days or pasture walks</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. One-on-one mentors</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. YouTube (or other) online videos</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. Webinars (“farminars”)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e. Farmer-to-farmer workshops</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>f. Workshops by professors, extension or consultants</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
16. How many acres do you farm in each of the following categories in 2019? ........................................

- Corn _______ organic acres; _______ transitional acres; _______ conventional acres
- Soybeans _______ organic acres; _______ transitional acres; _______ conventional acres
- Small grains _______ organic acres; _______ transitional acres; _______ conventional acres
- Hay _______ organic acres; _______ transitional acres; _______ conventional acres

17. In 2019, do you have livestock operation? □ Yes □ No .................................................................

If you chose “Yes”, are your livestock organically operated? .................................................................

□ Yes, all my livestock are organic □ Yes, some of my livestock are organic □ No, all my livestock are conventional

18. What percentage of the operated farmland do you own in 2019? ___________% ................................

19. What percentage of the operated farmland are highly erodible in 2019? ______________________________

If you have highly erodible land, what type(s) of operation do you have on this land in 2019? ........

□ Organic no-till □ Conventional no-till
□ Organic (with tillage) □ Conventional (with tillage) □ CRP or fallow

20. Which category best represents your estimated gross farm sales for 2019? Please circle one number. .......................................................... .......................................................... .......................................................... ..........................................................

- None .................................................. 1 $150,000 to $249,999 .............. 6
- Less than $2,500 .................. 2 $250,000 to $349,999 .............. 7
- $2,500 to $9,999 .............. 3 $350,000 to $499,999 .............. 8
- $10,000 to $49,999 .............. 4 $500,000 to $999,999 .............. 9
- $50,000 to $149,999 ............ 5 $1,000,000 or more .............. 10

21. Comments or suggestions for us to know? ..........................................................................................................

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

____________________________________________________________________________________________

Thank you for your help!