

Sustainable beef certification: Exploring willingness to participate among Ontario beef producers

by

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A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Masters of Environmental Studies

in

Sustainability Management

Waterloo, Ontario, Canada, 2018

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT

Sustainable beef certification is an evolving initiative, currently in the planning stages, that seeks to provide consumers with a socially responsible, environmentally sound and economically viable beef product through certification of beef farm production that meet selected indicators. However, the degree to which the sustainable beef certification program will be adopted by producers is currently uncertain as little is known as to how beef producers view voluntary programs such as a sustainable beef certification. The purpose of this research is to understand what factors influence Ontario beef producers to participate in sustainable beef certification. Through utilizing diffusion of innovation theory as the foundation for this study, a number of variables related to farm characteristics, social norms, decision-making, and the characteristics of the certification program itself were identified and their significance related to willingness to adopt the sustainable beef certification program was evaluated. This research identified a number of variable that were found to significantly influence the willingness to adopt sustainable beef certification and makes recommendations related to program design that response to these findings and may help improve adoption rates of the beef certification program..

A paper and online survey was distributed to Ontario beef producers and 147 responses were gathered. Surveys were analyzed to identify relationships between characteristics of the decision-making unit, characteristics of the innovation and a willingness to certify. Prior conditions within the Ontario beef farming community were explored including social norms, previous practice and felt needs. Characteristics of the decision-making unit were investigated with results revealing that there was a significant relationship between age and education level and a willingness to certify with a future sustainable beef certification. Significant relationships with socio-demographic variables and various communication methods emerged with younger generation, and more educated farmers preferring online mediums for communication, providing valuable insights into how to target communication approaches for future programs. Various characteristics of the innovation were explored in regards to motivators and barriers to participation. Motivators such as product sold at a premium, access to markets, and product demand were motivators deemed significant. Barriers identified as significant

included time constraints, increased record keeping, changing consumer demands and operation size. Though the level of familiarity with the concept of sustainable certification was limited among respondents, when provided with a definition, 80% of respondents indicated a willingness to certify. Further to this, when asked how soon they would be willing to certify, 70% indicated that they would want to see how it works prior to certifying.

ACKNOWLEDGEMENTS

Special thanks go to my thesis advisor, Dr. Goretty Dias for her support and commitment to seeing this project through to fruition. Thank you to family and friends for their support throughout, and most importantly to the Ontario beef producers and the Beef Farmers of Ontario organization who made this research possible.

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1. INTRODUCTION

1.1 Emergence of a sustainable beef certification for Canadian Beef

A shift is evident in how industry is responding to societal and government concerns around environmental issues and natural resource management. Until recently the solution to addressing these concerns was the implementation of environmental laws and regulations (Borck & Coglianese, 2009). Today, industry is looking to move away from these rigid and costly regulations towards voluntary initiatives. Voluntary environmental programs (VEP) come in many sizes and forms with the single common thread being that they have no mandatory regulations (Borck & Coglianese, 2009; Meuwissen et al., 2003).

Certifications are one example of a VEP whereby they promote a market for products through establishing distinct standards for each product and developing a process for how these products get their certification (Borck & Coglianese, 2009). Certifications establish specific requirements for the production of a product and the certification is done during a verification process to determine compliance (Steering Committee of the State-of-Knowledge Assessment of Standards and Certification, 2012 (SCKASC, 2012)). It is believed that those who participate and become certified within a certification scheme should experience improved social wellbeing, improved livelihood and increased resilience and quality within their natural environment (SCKASC, 2012; Duchelle et al., 2014).

Proponents of certification feel that the process allows producers to obtain a financial incentive for improving their environmental, social and economic performance (Blackman & Rivera, 2011; SCKASC, 2012; Duchelle et al., 2014). However, various studies have investigated the producer level impacts of certification schemes with mixed results demonstrating that certification schemes can have benefits that are unequal along the supply chain (Blackman & Rivera, 2011; Duchelle et al., 2014; Bush et al., 2013; Mendez et al., 2010; Lyngbaek et al., 2001; Rickenbach and Overdevest, 2006; Hartsfield and Ostermeier, 2003; Humphries and Kainer, 2006; Auld et al., 2008). Understanding the performance of voluntary standards and certifications is becoming increasingly more

important as they become more prominent and prevalent within industry (Meuwissen et al., 2003).

The Canadian beef industry is renowned for providing safe and nutritious meat products to both domestic and international markets through many established certifications (Rajić et al., 2007). The current Environmental Farm Plan program is widely accepted among the farming community and promotes establishing goals and action plans for better environmental management on farm, through working through workbooks (Smithers and Furman, 2003). Voluntary certifications and programs such as the Verified Beef Production, Verified Beef Production +, and the Ontario Corn Fed Beef program look to differentiate beef products based on establishing standards that both the farmer and the consumer can be confident uphold desired environmental, quality and consistency attributes (Verified Beef Production, 2016; Ontario Corn Fed Beef, 2016). Though there can be considerable benefits for those who engage in the VBP program, adoption throughout Ontario has been low, with only 15% of producers engaging in the workshops and online modules, and less than 1% actually working through the entire verification process (Beef Farmers of Ontario, 2016). To expand on these programs and enhance the level of sustainability across the industry, the Canadian Roundtable for Sustainable Beef was established to implement a sustainable beef certification for beef farmers across Canada (Canadian Roundtable for Sustainable Beef, 2015). These farmers would be verified through the program and comply with established indicators to obtain product certification (Canadian Roundtable for Sustainable Beef, 2015). This type of certification is designed to bring the baseline environmental, social and economic elements of production up and be inclusive of farms of all sizes across the country.

Adoption of sustainable beef certification may be influenced by industry trends that identify a change in the way farming is taking place. More specifically in Ontario from 2006-2011, farm size grew by 4.7 percent (Statistics Canada, 2016), demonstrating that each Ontario farmer is now farming more acres than they had in the past. The cattle industry in Canada mirrors a similar story with the number of cattle on Canadian farms increasing slightly at 0.5% but the number of farms decreasing 1.4 percent from January 1, 2011 to January 1, 2012 and dropping 4.3 percent from January 1, 2010 to January 2012

(Statistics Canada, 2015b). These statistics indicate the importance of understanding how farm size affects tendency to support agri-environmental and conservation schemes. With the average farm size increasing across the country, it is important that future sustainability measures continue to entice the larger producer to participate.

More specifically, the academic literature fails to provide an understanding of the differences within the beef farming industry with regards to farm type. According to Statistics Canada there were 66,595 cow-calf operations, 10,865 backgrounding operations and 2,945 feeding operations in 2012 (Statistics Canada, 2015b). This demonstrates that across farm types there are clearly drastic differences in size and scale, specifically with cow-calf producers having much smaller herds than those with feeding operations (Statistics Canada, 2015b). Determining the influence that differences in the nature of the farm operation has on the likelihood of a farm adopting the sustainable beef certification scheme is an area in the academic literature where very little is known.

1.2 Research Problem

A driving force behind the implementation of certification schemes comes from industry and consumers pushing the beef industry to reach a defined performance level and to make this performance level known to stakeholders (Meuwissen et al., 2003; CRSB, 2015). The stakeholders for the sustainable beef certification include producers, consumers, government, NGO's, each making up a critical component of the Canadian Roundtable for Sustainable Beef (CRSB, 2015). The certification of beef, through the development of clear indicators, is geared at making a more sustainable product that will address many of the concerns consumers have with the environmental impact of beef, the quality of beef products, and the welfare of cattle more broadly.

However, a major problem with certifications is that they are a voluntary initiative and their impacts are only felt if adoption occurs (Meuwissen et al., 2003; SCKASC, 2012). There are many different voluntary programs and certifications available to beef farmers in Ontario and Canada more broadly. Not all of these initiatives have been successful in capturing the large-scale implementation that a sustainable certified beef initiative would look to achieve. Understanding what key motivators serve to encourage participation and

identifying the barriers that serve to hinder participation will be of critical importance to both the academic community as well the beef industry as it looks to develop a sustainable beef certification scheme. This study looks to become a launch point to learning more about the beef farming community and their appetite for a sustainable beef certification, specifically within Ontario.

1.3 Purpose and Objectives

The purpose of this research is to understand what factors influence Ontario beef producers to participate in upcoming voluntary programs to certify sustainable beef. The theoretical framework for understanding the factors and influences is the diffusion of innovation theory. Specifically, this study will focus on the first two stages of Rogers 5 stage model, Knowledge and Persuasion, along with the “Prior Conditions”. Through surveying the Ontario beef farming community, it is expected that there will be new insights with respect to the diffusion of innovation model related specifically to the Ontario beef farming community and their potential adoption of sustainable beef certification.

The thesis has five primary objectives:

1. Identify farmer characteristics (farm size, age, education, farm type) that are related with current participation in programs or motivations to participate in future programs.
2. Determine the prior conditions for participation in sustainable beef certification, specifically as they relate to productionist and environmental values.
3. To identify preferred modes for communicating new programs or certification schemes.
4. Determine barriers and motivations for participating in voluntary programs and certifications as they relate to characteristics of the innovation.
5. Identify the program attributes and target audience for a sustainable beef certification scheme.

1.4 Definition of key terms

Certification – The voluntary assessment and approval by an accredited party on an accredited standard (Meuwissen et al., 2003).

Sustainable Beef – Beef produced in an economically viable, environmentally sound and socially responsible way (CRSB, 2015).

Diffusion of Innovation – How, why and at what rate new ideas and technology travel through cultures (Rogers, 1995).

1.5 Thesis Structure

Chapter 2 provides an in-depth literature review on the diffusion of innovation as it applies to agricultural settings, as well as context on existing certifications and barriers to participation in voluntary programs. Chapter 3 presents the methodology, survey design and distribution, as well as the approach to data analysis. Results are presented in Chapter 4 using the framework for Rogers' diffusion of innovation theory. Chapter 5 addresses the findings and implications relative to the objectives of the research, and within the limitations, examines the contribution of this study. The final chapter summarizes the implications of this research and establishes future directions for research based on the findings identified in this thesis.

2. LITERATURE REVIEW

2.1 Outline

The following chapter will delve through the available academic literature in an effort to uncover what is known about the diffusion of an innovation, with focus on adoption of innovations launched at the farming community. Within this realm, emphasis will be on identifying the key characteristics of both the innovation and its adopter that will increase the likelihood of adoption. Further, literature on certification schemes will be examined to determine their prevalence and impact at the producer level. The goal of this literature review will be to identify the current level of knowledge surrounding this topic and to identify voids in the knowledge base that represent opportunity for contribution to the academic literature.

2.2 Theoretical concept: Diffusion of Innovation

Diffusion of innovation theory attempts to explain the conditions that may increase or decrease the likelihood of a new idea, product or practice being adopted by a group of individuals or a society (Rogers, 1995). Everett Rogers popularized the theory and argues that there are four main elements that influence the spread of a new idea, specifically the innovation itself, communication channels, time, and the social system (Rogers, 2003). Closer examination of diffusion of innovation theory reveals that when a new concept is introduced the individual utilizes communication tactics within the social system to decide if they will choose to adopt or reject the innovation (Rogers, 1995).

The process through which a decision to adopt an innovation begins illustrated in Figure 1, a five-stage decision-making model pioneered by Rogers (1995).

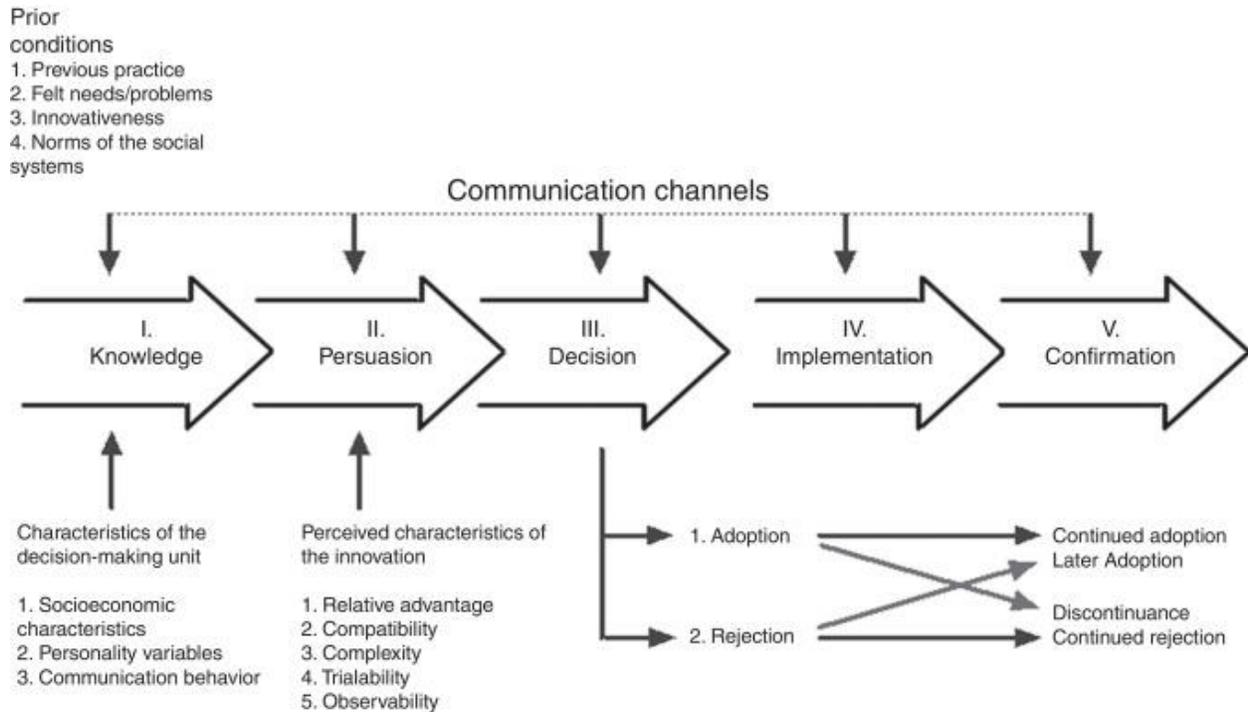


Figure 1 - Five-stage decision-making model as suggested by Rogers, taken from Sahin (2006)

Within Rogers (1995) model the first influence on the likelihood of adopting lies within the prior conditions. These conditions can be thought of as the norms or the practices that the social system is built upon (Rogers, 1995), such as the potential adopters level of experience engaging with programs and/or their level of progressiveness or desire to be innovative. With regards to the beef farming community the prior conditions may include, participation in voluntary programs related to the beef industry. Felt needs may include a lack of adequate market for their specialized product. The perceived level of innovativeness will be very specific to each individual producer and may be determined through a comparison with other programs available.

With the prior conditions identified, the next stage in the decision-making process is knowledge. It is at this stage that the individual's characteristics become potential differentiating factors that might influence the potential to adopt (Rogers, 1995). These individual characteristics could include their age, sex, and socio-economic status. With regards to the beef farm operation, farmer characteristics are important, but as are farm

characteristics. These farm characteristics may include variables such as herd size, acreage, plans for future ownership, and farm type.

Following the knowledge stage is the persuasion stage, during which the focus shifts to the potential adopters perceptions about the characteristics of the innovation. These perceptions may include the complexity of the innovation and/or whether it may offer them a relative advantage if they choose to adopt. There are various perceived characteristics of the innovation that are important to consider within the persuasion stage. With regards to the beef industry, relative advantage may include receiving a premium or market access for a beef product. Compatibility may include the practicality of implementing the innovation on the farm operation. Complexity may include the ease with which the innovation can be adopted and utilized on the farm operation. Trialability and observability may include the ability to test out the innovation, or see it in action on another farm operation. Each of these characteristics of the innovation are important to evaluate to determine if an individual will be persuaded to adopt the innovation.

Based on individual knowledge and the perceptions the decision stage will follow. During the decision stage the individual chooses to either adopt or reject the innovation. If the innovation is adopted the implementation stage begins and innovation is put to use. At the implementation stage a specific behaviour change is required. The confirmation stage involves the individual contending with the changes that the innovation has brought on. The individual will either incorporate the innovation into their normal routine or will discontinue it (Rogers, 1995).

Through the examination of the theory of Diffusion of Innovation this section has identified key variables that the model suggests influences the decision to adopt specific innovations. Further, by applying this model to the context of beef production this section identifies key variables proposed to influence the specific decision beef producers will face regarding the adoption of sustainable beef certification. These context specific variables are further explored in Section 2.3.

2.2.1 Diffusion of Innovation and Agriculture

The diffusion of innovation theory has been utilized as a theoretical framework across many different disciplines over the last seven decades (Greenhalgh et al., 2004). A notable study from which the diffusion of innovation theory was first characterized was the Iowa Hybrid Seed Corn study. The innovation was the newly developed hybrid corn seed available to farmers in Iowa, a key corn producing state (Ryan and Gross, 1943). Hybrid seed promised increased yields of almost twenty percent, as well as other desirable plant qualities that served to better suit the corn producers in Iowa (Ryan and Gross, 1943). The study revealed that non-economic factors influenced corn producer's decision of whether or not to adopt the new technology (Ryan and Gross, 1943; Rogers, 2004). This work by Ryan and Gross, later popularized by Rogers, identified many factors that resulted in the eventual diffusion of an innovation. Early adopters of the new hybrid corn technology were characterized as larger sized farms, with higher income and more education, as well as farmers with more exposure to Des Moines- the largest city in Iowa. Additionally, the study revealed that at the heart of the diffusion process was the exchange of information about the innovation. As the farmers shared their personal experiences with the new corn technology, the innovation was given meaning and diffusion occurred (Ryan and Gross, 1943; Rogers, 2004).

There are various other examples of diffusion of innovation theory and its application to the agriculture industry (Atari et al. 2009; Smithers and Furman, 2003). Smithers and Furman (2003) utilized aspect of the diffusion on innovation model in their study on Ontario Environmental Farm Plan Participation. Specifically, they explored both characteristics of the farm and farm, along with prior conditions. Findings suggested that these prior conditions were previous participation in environmental programs translated into wide participation and sustained commitment in the Environmental Farm Plan program. Smithers and Furman (2003) also identified that wider participation was related to confidence in the program and a belief that it would respond to their needs. These results showcasing the importance of innovations fitting the prior conditions of the potential adopters as described in Rogers 5 (1995) stage model.

2.2.2 Diffusion of Innovation and Voluntary Programs

The diffusion of innovation theory can apply very well to program adoption as a form of innovation. There have been many studies that have looked at specific programs and their rate of adoption across multiple different target audiences using the principles outlined in the diffusion of innovation theory (Steckler et al., 1992; Rogers, 2002; Beets et al., 2008; Potvin, Haddad and Frohlich, 2001; Greenhalgh et al., 2004). Specifically, one study evaluated health promotion programs and their level of adoption to determine the significance of the prior conditions and knowledge to the level of adoption of health programs within school boards (Steckler et al., 1992). This study demonstrated that through using the diffusion of innovation theory it is possible to develop an understanding of specific characteristics of a target audience that will make them more or less likely to adopt a new program. For the purpose of evaluating beef farmers, it is expected that the use of the diffusion of innovation theory will apply in the same way as the Steckler et al. study (1992), to determine the characteristics of a beef producer that will make them most likely to engage in certification.

2.3 Factors Affecting Innovation Adoption

Through the application of Rogers (1995) decision-making model to the context of beef production (see Section 2.2) a number of key variable though to influence the decision to adopt sustainable beef certification were identified. These variables a variety of characteristics, both individual characteristics and characteristics of the innovation, that influence adoption of an innovation. These characteristics make up the Prior Conditions, Knowledge (characteristics of the decision-making unit), and Persuasion (characteristics of the innovation), three aspects of the decision-making process as described by Rogers (1995). The following sub-sections examine these variables in more detail and identify previous research that have examined their influence in agricultural settings.

2.3.1 Social Norms & Prior Conditions

As described by Rogers (1995), prior conditions include previous practice, felt needs/problems, innovativeness and norms of the social system. It is these conditions that

lead an individual to seek knowledge of an innovation and continue to move towards adoption. For the purposes of this study, these prior conditions are related to the current beef farming community in Ontario.

The motivation to adopt an environmentally positive behaviour is based on a farmer's own perception of how farming should be practiced and it is this perception that makes up their self-identity (Reimer et al., 2012; Hyland et al., 2016). A 2012 study by Reimer et al., identified that a farmer's beliefs are filtered through an individual value system whereby key motivations are either based primarily on productionist views or environmental responsibility. Those farmers who were motivated by environmental responsibility rather than production goals and mere profitability, were most likely to adopt farmer practices that served to better conserve the environment (Reimer et al., 2012). Research by Hyland et al. (2016) had similar findings, but also emphasized that acknowledging a farmer's self-identity coupled with awareness of environmental issues and their perceptions of the issues are critical to tailoring initiatives that will improve agriculture's environmental performance. Hyland et al. (2016) reiterated that it is more than just a self-identity that determines one's behaviour, but rather a combination of it and what can be characterized as prior conditions and knowledge. Further exploration into the influence of self-identity in isolation will help identify whether it is a primary influence on behaviour, or rather it, as well as prior conditions and knowledge.

2.3.2 Characteristics of Decision-Making unit

Studies have identified various relationships between the characteristics of the individual farmer and their likelihood of adopting pro environmental behaviour (e.g. Burton, 2014; Wilson and Hart, 2000; Lambert et al., 2007; Austen et al., 2002; Aidrian et al., 2005). These characteristics include, but are not limited to, the individual's **age** (Filson, 1993; Bager and Proost, 1997; Bonnieux et al., 1998; Ellis et al., 1999; Vanslebrouck et al., 2002; Mathijis, 2003; Brodt et al., 2006; Siebert et al., 2006; van Rensburg et al., 2009; Boon et al., 2010; Murphy et al., 2011), **gender** (Filson, 1996; Curtis and DeLacy, 1996; Boon et al., 2010), **education level** (Wilson and Hart, 2000; Mathijis, 2003; Smithers and Furman, 2003; Lambert et al., 2007; Barreiro-Hurle et al., 2010; Filson, 1993), and **farming experience** (Crabtree et al., 1998; Smithers and Furman, 2003; Lobley et al., 2004;

Defrancesco et al., 2008; Siebert et al., 2006, 2010; Jongeneel et al., 2008; Moon et al., 2012). These indicators can serve to provide an inclination how a particular subset of a group will react or behave with respect to likelihood to adopt specific innovations (Burton, 2013). These key characteristics are elaborated further as they pertain to the farming community and adoption of specific pro-environmental behaviours.

Age of farmer

The age of the farmer has been long thought to be a key indicator of willingness to participate in agricultural conservation programs within the farming community (Filson, 1993; Bager and Proost, 1997; Bonnieux et al., 1998; Ellis et al., 1999; Vanslebrouck et al., 2002; Mathijis, 2003; Brodt et al., 2006; Siebert et al., 2006; van Rensburg et al., 2009; Boon et al., 2010; Murphy et al., 2011). In studies of environmental attitudes of farmers in south western Ontario, it was concluded that the older the farmer, the lower the level of concern for protecting the environment (Filson, 1993; Bager and Proost, 1997). In contrast other studies suggest that younger farmers tend to be less willing to pursue pro environmental behaviour due to their interest in more intensive agricultural practices (Defrancesco et al., 2008; Barreiro-Hurle et al., 2010). Yet others have found no difference in the age of producers who participated in environmental programs and those who did not (Atari et al., 2009; Siebert et al., 2010).

A systematic review completed by Burton in 2014 evaluated why such conflicting results are found when using age as an identifier of willingness to participate in environmental programs. Burton offers 4 explanations for the inconsistency of age as an identifying characteristic. First, the age of the farmer impacts the social cohort to which they belong. A cohort can affect the attitudes and beliefs of the individual or patterns of behaviours (Settersten and Mayer, 1997). A well-known demonstration of the cohort effect was outlined by Wilson when describing the post world war two productionist era where farmers were ingrained with the ideas of intensification, expansion and investment in technology (Wilson, 2001).

The second explanation that Burton (2000) offers is based on the impact age can have on physical and mental efficacy. Barreiro-Hurle et al., (2010) argue that as farmers

age they look to 'slow down' and this presents them more time to investigate and understand support schemes. The third explanation Burton offers is based on the correlation between age and experience, whereby age can serve as an indicator for experience (Burton, 2014).

Finally, the age of the farmer can serve to indicate where the life-cycle of the farm family lies (Burton, 2014). In certain time periods in the life-cycle there may be more opportunity for restructuring. As a farmer retires, or a farm is taken over by a younger generation, horizons for environmental planning decisions may lengthen or shorten (Lambert et al., 2007). Such findings indicate that the influence of age is context-specific; therefore it is evident that further analysis is needed to develop a more specific understanding of its influence in other contexts, such as within the beef farming community in Ontario.

Previous experience

The level of experience of a farmer has long been associated with environmental behaviour. Specifically, farmers who have previous experience with agri-environmental schemes show an increased likelihood of engaging with these new schemes (Smithers and Furman, 2003; Burton, 2014; Crabtree et al., 1998; Loblely et al., 2004; Defrancesco et al., 2008; Siebert et al., 2006, 2010; Jongeneel et al., 2008; Moon et al., 2012). In an investigation of Nova Scotia farmers, Atari et al. (2009) found that increased levels of farm experience were found to correlate with increased levels of Environmental Farm Plan participation. A program that promotes environmental action through creating action plans (Smithers and Furman, 2003). However, others suggest that those who have experience with intensive agriculture are more likely to focus on production maximization and as a result may be disengaged from environmental behaviours (Burton, 2014; Raymond and Brown, 2011). As such, identifying the level of experience farmers have with environmental initiatives, as well as understanding the type of production and production goals, will be imperative to determine the influence of experience as an indicator.

Education and Training

Education and training have been recognized for their capacity to change attitudes and perceptions among groups and thus it has a role in promoting environmental behaviour (Burton, 2000; Lambert et al., 2007; Ma et al., 2012; Wilson and Hart, 2000; Mathijis, 2003; Smithers and Furman, 2003; Barreiro-Hurle et al., 2010; Filson, 1993). In Filsons' 1991 study he determined that a farmer's level of education was positively correlated with concern about protecting the environment. Smithers and Furman (2003) suggested that technical training, more specifically, was a characteristic that was positively associated with participation in the Environmental Farm Planning program. The notion that technical skills translate into increased awareness to environmental issues is thought to be due to familiarity with new technological innovations such as climate forecasts, computerized farm management and a willingness to understand complex farming systems (Burton, 2014).

Gender

There are few studies that investigate gender as an indicator for pro environmental behaviour (e.g. Curtis and DeLacy, 1996; Filson, 1996; Riley, 2009; Boon et al., 2010), but most studies suggest a relationship between gender and pro-environmental behaviour. Filson (1996) concluded that women in south western Ontario were more likely to demonstrate pro environmental behaviour than their male counterparts. Curtis and DeLacy (1996) also concluded that women were more likely to undertake conservation activities and participate in agri-environmental behaviour. Finally, Riley (2009) suggests that the increase in paperwork as part of farm management – particularly with agri-environmental schemes – has further diversified the role of women and increased their influence in farm decision-making in many instances. With an increasing role in farm decision-making and a demonstrated positive relationship between women and increased pro-environmental behaviour, it may be expected that there will be more farm operations engaging in environmental initiatives.

Farmer Attitudes

Those individuals who make up the farming community across the globe are a unique group that has historically been characterised for their deep awareness of the earth's natural cycles and recognized as good stewards of the land (Sullivan et al., 1996). With an income that is dependant on the long-term prosperity of their farmland, it is not surprising that farmers would have such concern for the environment. There is general consensus that farmer behaviour types cannot be categorized simply on the assumption of rational decisions based solely on profit-maximization (Vanclay, 2004; Pannell et al., 2006; Hyland et al., 2016). Farmers have consistently demonstrated that profits are not the only thing they consider when making decisions regarding their farm operation (Hyland et al., 2016; Vanclay and Lawrence, 1994; Lockie et al., 1995; Edwards-Jones, 2006). Therefore, participation by farmers in environmental initiatives is determined by more than just the economic benefits. It is this social norm that makes it imperative to understand what underpins a farmer's decision to participate in environmental initiatives when developing such programs and policies (Vanclay et al., 2006; Pannell et al., 2006; Hyland et al., 2016).

Communication

One final attribute that is mentioned consistently in the literature is the need for effective communication of voluntary programs aimed at farmers (Marett et al., 2000). For many producers they need more than just awareness; they also need perception of the nature of the program as well as lines of communication to obtain additional information (Atari et al., 2009; Marett et al., 2000). Atari et al. (2009) found that there was a substantial portion of Nova Scotia farmers that were not aware of the Environmental Farm Plan program concluding that informational campaigns should be re-evaluated. However, Smithers and Furman (2003) found that informational campaigns and communication failed to encourage participation due to an inability to emphasize program confidentiality, credibility and effectiveness.

Furthermore, research has identified the concept of "champions", individuals who participate in an innovation and share their experiences, as a key contributor to effective communication strategies aimed at encouraging the adoption of innovations (Greenhalgh

et al., 2004; Lee et al., 2011). It has been suggested that the adoption of an innovation by individuals is more likely if key individuals (champions) in their social networks support the innovation (Greenhalgh et al., 2004; Backer and Rogers, 1998; Markham, 1998; Meyer and Goes, 1988; Schon, 1963). More specifically, Lee et al. (2011), suggests that role models or 'champions', can have a considerable impact on adoption of certification schemes. Champions are often highly successful and respected members of a community and other members of the community often emulate their decisions. This influence stresses the importance of getting community champions on board as a way to facilitate the uptake of adoption throughout the entire community (Lee et al., 2011). Further to this, the limited direct literature on efficacy of current communication strategies geared to the beef farming community in Ontario; there is a need to investigate what preferences exist in terms of communication strategies.

2.3.3 Farm Characteristics

Farm Size

There is some general consensus as to what influence farm size has on the likelihood of adopting agri-environmental schemes. Filson (1996) found that larger farms in south western Ontario were less receptive to government interventions than their smaller counterparts, and it was this effort to avoid regulations that kept them involved in conservation practices (Filson, 1996). Smithers and Furman (2003) found similar results and concluded that larger scale farmers had a greater likelihood and ability to participate in conservation initiatives, likely due to increased capital giving them more flexibility to try new farming practices in advance of regulation. In Reimer and Prokopy's (2014) study on farmer participation in US farm bill conservation programs, they concluded that small farms are less likely to adopt intensive conservation practices due to lack of capital (Lambert et al., 2007; Olenick et al., 2005). Given the various reasons why farm size influences the likelihood of participating in agri-environmental schemes, it is important to understand this influence on beef producer's participation in a sustainable beef certification scheme.

Nature of Farm Operation

Many studies have focused their analysis on the farming community identifying the importance of attitudes, farm size, along with other individual demographic characteristics (e.g. Reimer et al., 2012; Hyland et al., 2016; Filson, 1996). However, there are not studies that seek to understand how such demographic attributes, attitudes, and norms, influence the likelihood of innovation adoption within the beef farming community in Canada, and Ontario more specifically. Further to the characteristics of the decision-making unit, the characteristics of the innovation have a role in understanding the likelihood of an innovation achieving widespread adoption.

2.3.4 Innovation Characteristics

From the innovation literature, Rogers identifies that there are 5 key characteristics of an innovation that influence their adoption by farmers. These include: Relative advantage, compatibility, complexity, trialability and observability (1995). Additionally, within the adoption literature, communication is emphasized as a key to the effective adoption of an innovation (Atari et al., 2009; Marett et al., 2000). Each of these key characteristics of an innovation will be explored in more detail below.

Relative Advantage

Relative advantage signifies the properties of the innovation that make it more advantageous than the current method of operation (Rogers, 1995; Dirksen, Ament and Go, 1996; Marshall, 1990, Meyer, Johnson and Ethington, 1997). These advantages are based on an individual's perception and as such they may not be advantageous for all. Potential advantages could include time-savings, economic advantages or social prestige (Denis et al., 2002; Fitzgerald et al., 2002; Grimshaw et al., 2005; Greenhalgh et al., 2004; Rogers, 1995). Rogers argues that of the five attributes of an innovation, relative advantage is the most reliable predictor of the rate of adoption (Greenhalgh et al., 2004; Rogers, 1995).

In regards to programs as an innovation, understanding the relative advantage they would offer a potential adopter is key to understanding the likelihood of adoption. Potential relative advantage that program or certification participation might offer could be

access to new markets, time-savings, and or economic benefit. Therefore, it is crucial to identify and understand the key motivators that are specific to a study target group to understand what aspects of a program might offer the adopter a relative advantage.

Other Characteristics of Innovations

Along with offering the farmer a relative advantage, according to Rogers, it is critical for an innovation to be compatible. Rogers suggests that an innovation that is compatible with the intended adopter's current ideas, beliefs, norms and values is more easily implemented (1995). Rogers' theory on the importance of the compatibility of an innovation was later supported by several studies (i.e. Aubert and Hamel, 2001; Denis et al., 2002; Ferlie et al., 2001, Foy et al., 2002, and Greenhalgh et al., 2004). Compatibility within the context of adoption of beef certification by producers in Ontario may include whether producers already participate in voluntary programs; therefore, the details of compatibility need to be further explored (Smithers and Furman, 2003).

Complexity is another one of the 5 critical attributes Rogers describes. He describes complexity as the level of ease or difficulty with which an individual can understand an innovation (Rogers, 1995). For the farming community, complex innovations are undesirable due to the length of time it takes to learn about them and try to implement them (Atari et al., 2009; Marsh 1998; Denis et al., 2002; Marshall, 1990; Meyer, Johnson and Ethington, 1997; Rogers 1995). Therefore it is likely that a certification scheme directed at the beef farming community in Canada must be simple, easily integrated and well - explained.

The ability to trial an innovation is also a key characteristic of a successful innovation (Rogers, 1995; Grilli and Lomas, 1994; Plsek, 2003; and Yetton, Sharma and Southon, 1999), and is critical to achieving their full commitment (Atari et al., 2009; Pannell, 1999). Facilitating a trial of an innovation is not an option that applies to every innovation, however, trials are an effective way to introduce a potential adopter to an innovation without requiring high levels of commitment.

Finally, observability is the last of the 5 key characteristics of a successful innovation (Rogers, 1995). Rogers (1995) notes that the easier it is for farmers to perceive

the results of an innovation the better the likelihood they will adopt it. Previous studies have examined observability as it relates to 'role models' or 'champions' who can demonstrate the application of the innovation and its perceived benefit to them (Atari et al., 2009; Denis et al., 2002; Grilli and Lomas, 1994; Øvretveit et al. 2002).

2.4 Existing Certifications: Food and Agriculture Industry

Within the food and agriculture sector there are a number of existing certifications each established to deal with industry specific concerns and designed to improve and standardize production. To gain additional understanding of the benefits and challenges of certifying at the producer level, three product certifications are broadly explored. Forests, coffee and aquaculture each encompass very different value chains, and thus the certification scheme and standards within are all very different. However, there are potential parallels across each that may reveal insights into addressing the limitations and challenges product certification can have for producers.

Outlined in Table 1 is a broad look at the available academic literature that seeks to assess the effectiveness of certification schemes and their influence, either positive or negative, on the producer. These studies reflect only a focus on certification schemes and their impacts at the producer level, not how they influenced impacts, either positive or negative further along the value chain. Several themes emerge from the studies (Table 1). First, all studies feature both positive and negative aspects of the schemes. For example, in the study by Humphries and Kainer (2006), there was evidence of economic benefit but this benefit was predominantly seen among large producers and not among small producers. Another major theme that is evident is that there is an economic burden associated with participation in various food and agriculture certification schemes (Hartsfield and Ostermeier, 2003; Rickenbach and Overdevest, 2006; Lyngbaek et al., 2001; Bush et al., 2013). These associated costs are primarily why Auld et al. (2008) suggest that for small operations the fixed costs to participate in certification schemes are higher and thus discourage participation.

Finally, there are common benefits and disadvantages across all three industry groups. There is always some level of financial benefit for the producer (Humphries and

Kainer, 2006; Mendez et al., 2010; Philips et al., 2003), but there is also criticism of the limitedness of this economic benefit across all three industry groups (Hartsfield and Ostermeier, 2003; Kilian et al., 2004; Bush et al., 2013). The disadvantages are more focused on social and environmental outcomes. This final theme suggests that certification schemes more generally are limited in their ability to bring consistent benefits to the producers (Mendez et al., 2010; Creamer, Blatner & Butler, 2012; SCKASC, 2012).

Given the mixed effectiveness of certification schemes evident in Table 1, it is necessary to further investigate certification more broadly to better understand its potential to affect change for producers. Meuwissen et al. (2003) synthesized a set of costs and benefits of certification for producers. The associated costs were based primarily around the implementation and maintenance of the audit process. Benefits of certifications for producers included: reduced transaction costs, enhanced access to insurance, and effectuated due diligences (Meuwissen et al., 2003). Meuwissen et al., (2003) also stated that potential, but more case dependant benefits, include positive effect on trade, enhanced license to produce and price premiums. The costs of a certification scheme are likely to be nonlinear as there is potential for a comparative disadvantage for small and medium sized enterprises (Meuwissen et al., 2003; Unnevehr and Jensen, 1999; Taylor, 2001; Auld et al., 2008; SCKASC, 2012; Mendez et al., 2010; Creamer, Blatner & Butler, 2012). Inequality has been noted between those along a single products value chain in terms of who benefits from certification, with producers being noted as the group often reaping the least reward (SCKASC, 2012; Mendez et al., 2010; Creamer, Blatner & Butler, 2012). Though many studies have discussed criticisms towards certification schemes and their impacts on producers, certifications are still viewed as a mechanism capable of increasing baseline level production standards within an industry (Medlock, 2007; SCKASC, 2012).

Table 1 - Information derived from an article written by Blackman & Rivera (2011) and supported by other academic literature.

Economic Sector	Academic Source	Benefits for Producers	Disadvantages for Producers	Supporting Academic Literature
Forestry Products	Hartsfield and Ostermeier, 2003		No economic benefit or expansion of market access Significant costs for certifying	Cubbage et al., 2003; Markopoulos, 2003; McDaniel, 2003; Quevedo, 2006
	Humphries and Kainer, 2006	Varying economic benefit – predominantly for larger producers	High fixed costs for small operations	Auld et al., 2008
	Overdevest and Rickenbach, 2006	Can build human capital and positive reputation	No economic benefit or expansion of market access	Cubbage et al., 2003; Markopoulos, 2003; McDaniel, 2003; Quevedo, 2007
Coffee	Kilian et al., 2004	Increased farm level prices	No correlation between certification and social, environmental or economic benefit	Bacon, 2005; Philpott et al., 2007; Bacon et al., 2008; Jaffee, 2008; Martinez-Torres, 2008; Valkila, 2009
	Mendez et al., 2010	Some levels of improved income Diversified income sources	Variable profit margins Requires continuous improvement to quality and productivity	Raynolds et al., 2007; Duchelle et al., 2006; Bolwig et al., 2009
	Schau et al., 2009		Provides no benefit to education level or health	
	Lyngbaek et al., 2001	Minimal social and economic benefit	Net costs to producers	Fort and Ruben, 2008; Saenz Segura & Zuniga-Arias, 2008
Fish Products	Chaffee et al., 2003	Financial benefits for producers	No evidence of ecological benefit	Ward, 2008
	Bush et al., 2013		High costs, time consuming, restricted access, and language barriers Inflexible, divisive, and restrictive	

2.5 Barriers to Participation in Certifications

There is limited academic literature available to date that investigates beef farmer participation in certification programs and the barriers that exist hindering participation. However, one study suggests that simply the nature of farming systems represent a barrier to adoption in conservation farming practices as participation often involves an interlocked set of changes rather than a single change in management practice (Smithers & Furman, 2003). Reflecting on the sustainability certifications for forestry, coffee and aquaculture, common barriers include restrictions to small-scale producers who cannot make necessary changes to their production practices due to economies of scale. Barriers from cost, lack of time and lack of access were also reiterated from investigation into other food and agriculture certification schemes (Bush et al., 2013; Mendez et al., 2010; Lyngbaek et al., 2001; Rickenbach and Overdeest, 2006; Hartsfield and Ostermeier, 2003; Humphries and Kainer, 2006; Auld et al., 2008). Through the completion of this study it is hoped that a better understanding of the specific barriers can be identified as they relate to beef producers in Ontario and their participation in certifications.

2.6 Summary

Through examining in depth diffusion of innovation theory, it is evident that there are many are many stages along the decision-making process that require investigation in order to predict the likelihood a population will chose to adopt an innovation. The prior conditions within a population are a key area to understand. Within the farming community the literature tells us that there are many existing social norms that can be identified and serve to predict the likelihood of an individual supporting environmental initiatives. In many instances the farming community has demonstrated a willingness to engage in environmental conservation programs as well as certification schemes (Meuwissen et al., 2003; Smithers and Furman, 2003; Burton, 2014; Crabtree et al., 1998; Lobley et al., 2004; Defrancesco et al., 2008; Siebert et al., 2006, 2010; Jongeneel et al., 2008; Moon et al., 2012). Reimer et al., (2012) identified a key set of indicators that can help to categorize farmers within two main categories based on their social norms and can help to predict their likelihood of support an environmental initiative. With no literature

focusing on these social norms within the beef farming community it will be imperative for this study to narrow in on how beef producers characterize their self-identity and their motivations to support a voluntary sustainability measure.

There are many factors that can have influence in the adoption of an innovation, specifically an innovation geared towards the farming community. Not only are the characteristics of the innovation itself important to consider, but the characteristics of the farmer, as well as the farm, influence the likelihood of an agri-environmental or conservation scheme being adopted by a farmer (Rogers, 1995; Lambert et al., 2007; Bohnet et al., 2011). Understanding the influences and key characteristics that exist within the population of beef farmers in Canada, will provide new insights to the existing academic literature that seeks to understand farmer behaviour, as well as fill gaps that currently exist specific to understanding beef farmers and differences across the various types of beef farms and farmers.

Further, the diffusion of innovation theory requires the specific knowledge and perceptions among a population towards an innovation to be identified. Many studies have focussed on identifying the characteristics of a specific population that are significant determinants of their participation in a certification scheme. The existing academic literature lacks evidence of these characteristics among the beef farming community, both globally and locally here in Canada. Filling this void will allow for this study to attempt to group producers and determine what motivates specific groups of producers. Understanding the differences in characteristics, level of knowledge and perceptions among beef producers in Ontario will represent a novel findings that will allow for application to the diffusion of innovation framework useful for identifying the likelihood of wide spread adoption of future programs and certifications.

More specific to this study, gaps exist in terms of an understanding of what offers beef producers a relative advantage on their operation. From Rogers' diffusion of innovation theory it is clear that an innovation must offer an individual a relative advantage for them to choose to adopt (1995). In terms of a beef certification, the literature offers no insight as to what key motivators drive producers to change their production practices. By the same token, the barriers that are hindering beef farmers from

participation in voluntary programs and certifications have yet to be identified. Through surveying the beef farming community it will allow for comparison to what is known about the farming community more generally to determine any similarities or differences among a prominent subset of the group. Filling this void will offer valuable insight to the agriculture industry and the academic community as it will allow for voluntary programs and certifications to be assembled in a way that meets the needs of the producers offering them a relative advantage and encouraging them to adopt.

3. METHODOLOGY

3.1 Survey Design

The purpose of this study is understand the factors that serve to motivate or hinder participation in voluntary programs and, specifically, gauges the willingness to participate among Ontario beef producers with a sustainable beef certification. As there was limited data available on the behaviour of Ontario beef producers, the collection of primary data was required. Due to the vast nature of Ontario, and the wide spread distribution of farms across the province it was decided that a survey-based approach was the most appropriate method of collecting data for this study. A survey was deemed to be minimally intrusive and allowed for confidentiality to be maintained, important considerations with the confidential nature of many of the survey questions.

The research methodology consisted of a quantitative descriptive approach whereby the goal was to describe the current status of a phenomenon or set of phenomena in order to gain a better understanding of the topic (Burns and Grove, 2009). Deductive reasoning worked to move from the broad diffusion of innovation theory towards a more specific understanding of beef farmers in Ontario and how their knowledge and perceptions influence their decision to adopt a certification program (Creswell, 2013 p. 59).

The specific method utilized to address the objectives of this study was an online and paper survey. The survey design was derived from Mercker and Hodges 2007 study on forest certification (2007). The full survey can be found in Appendix C. The survey consisted of 23 questions and 94 response variables. Dillman survey design elements were integrated where possible (Dillman, 2000). For the most part, questions were closed-ended in nature, with options for respondents to provide additional feedback or responses other than those provided. Stakeholders from the organization, Beef Farmers of Ontario were consulted and provided input on developing an initial draft of the survey. Consideration was given towards the clarity of questions, appropriate terminology, and the length of time of survey completion.

3.2 Survey Administration

The paper survey was distributed at the Beef Farmers of Ontario Annual General Meeting in March of 2017, where 227 Ontario beef producers received a copy of the survey in their attendance package along with return postage to return, via mail, the completed survey. The online survey was identical to the paper survey. It was created and shared using SurveyMonkey and was promoted through the Beef Farmers of Ontario (2017) social media and online communications. The survey link was provided in the BFO weekly Bulletin for three consecutive weeks beginning in February of 2017. The Bulletin is sent via email to roughly 6000 individuals. Additionally, the online survey link was shared through the Beef Farmers of Ontario twitter page where it was visible to 6278 followers. Each survey was accompanied with an information letter that explained the goal of the study as well as assured the producers of the confidential nature of the study and the standards that will be maintained to ensure the confidentiality of their responses. Additionally, a feedback letter was provided thanking respondents for their participation and outlined when the results would be available for them to consider. An effort was made to distribute the survey during a period of time where the work demands on the beef producers would be lower. The collection of data occurred for two months from February 2017 to April 2017.

3.3 Sample Frame

A goal of this study was to get a survey in front of as many Ontario beef producers as possible, however there were logistical and budgetary constraints that served to limit the capacity of this study to reach all producers. As such, convenience sampling was utilized. Convenience sampling is a sampling method that obtains data from population members who are conveniently available to participate in the study (Emerson, 2015). Distributing the paper survey at the BFO AGM took advantage of a convenient sample of Ontario beef producers. Additionally, the online survey, though it was shared using a variety of online mediums, only captured a convenient sample of the total Ontario beef producer population. The selection of convenience sampling within this study did introduce bias within this study, which is assessed in the discussion chapter of this thesis.

3.4 Study Area and Study Scope

Geographically, the boundaries placed on this study consisted of the province of Ontario. A map of the province outlining the various regional municipalities, counties and districts can be seen in figure 2. Beef operations in Ontario are dispersed throughout the entire province with the majority of operations located in western Ontario (Statistics Canada, 2017). The scope of this study focused on beef farm operators. A beef farm operator is a person who is responsible for the day-to-day management decisions made on a farm or agricultural operation. For census purposes up to three farm operators could be reported per farm (Statistics Canada, 2016). According to the 2011 census of agriculture there are 9520 beef farm operators in Ontario (Statistics Canada, 2016).

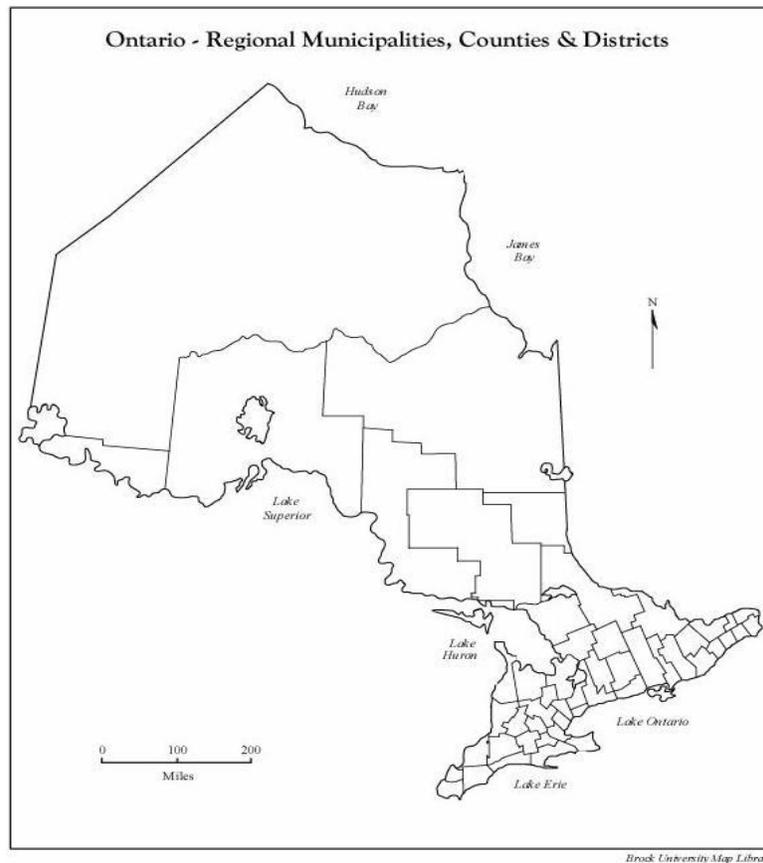


Figure 2 - Survey sample area: Province of Ontario

3.5 Data Analysis

The analysis of the survey data utilized two approaches. Data analysis was done using SPSS (Statistical Package for the Social Sciences). The first method of analysis was descriptive where by discrete data were collected and presented through frequency tables and graphs. Data means, medians, variances and interquartile ranges were then calculated where appropriate. The interquartile range is a measure of variability and is calculated by dividing the data set into quartiles. This measure of variability is more robust against outliers and non-normal data. Through the initial descriptive analysis it was possible to then check the validity of the data set against other data sets available for Ontario beef producers. Through this initial analysis it was possible to identify the representativeness of the sample.

Table 2 - Survey variables

Diffusion of Innovation Stage	Variable
Characteristics of the Decision-making Unit	Willingness to certify
	Location
	Gender
	Experience
	Length of future employment
	Education
	Age
	Level of Employment
	Farm Type
	Farm Size
Prior Conditions	Reasons for beef farming
	Environmental attitude
	Current program participation
	Importance of staying up to date
	Preferred communication methods
Characteristics of the Innovation	Timeframe to participation
	Motivators to participate

	Barriers
	Significance of barriers

The second analytical approach utilized in this study involved searching for any statistically significant relationships in the factors hypothesized as influential in willingness to certify as well as motivators and barriers for sustainable beef certification. Table 2 summarizes all the relationships that were tested and further subdivides each analysis into the stages along the diffusion of innovation model with which it fits. For data that was nominal, Chi-squared tests were utilized. Chi-squared tests allow for comparison of dependent and independent variables through the use of cross tabulation (Furman, 1997). Visual analysis of the contingency tables allowed for the direction of the relationship to be determined (Furman, 1997; McCullagh, 1974). Spearman’s correlation was utilized when data were ordinal. Prior to testing for Spearman’s R, a test for monotonic relationships was completed using a scatter plot. Results were reported as statistically significant when $P \leq .05$.

3.6 Prior Conditions

As a starting point, the prior conditions among the Ontario beef farming community were explored. As outlined by Rogers (1995), understanding the societal norms and values is critical to understanding the likelihood of adoption within a society or group. The literature outlined that the farming community can be categorized into two distinct subsets based on their value set, specifically, a value set motivated either by productionist or environmental values (Reimer et al., 2012). Based on Rogers stated importance of prior conditions and the distinct value sets identified by Reimer et al. (2012). The first hypothesis is:

- Null hypothesis 1: There is no relationship between the identified value set and willingness to participate in a sustainable beef certification.

To explore hypothesis 1 a Chi-squared test was completed to identify any potential relationships between willingness to certify and each of the two specific value sets as described by Reimer et al (2012).

Additionally, previous practice such as participation in other voluntary programs may serve to shape the views of the farmer and help create knowledge of sustainable beef certification or other certification schemes. The literature suggests there is a relationship between participation in previous voluntary programs whereby it increases the likelihood of participating in future voluntary programs (Greenhalgh et al., 2004). Therefore the second hypothesis is:

- Null hypothesis 2: There is no relationship between current and/or previous participation in voluntary programs and willingness to participate in a sustainable beef certification.

To explore hypothesis 2 a chi-squared test was completed to test for relationship between the dependant variable and previous participation, the independent variable.

3.7 Characteristics of Decision-making Unit

Further to the prior conditions, this study sought to identify the individual characteristics with influence on the dependant variable, willingness to certify. The exploration into these characteristics aligns with the knowledge phase of Roger's diffusion of innovation model (1995). The literature review detailed the influences of many farm and farmer characteristics on likelihood of adoption. A series of hypothesis were assembled to determine if the data on Ontario beef farmers would align with the current academic knowledge base on farmers and diffusion of innovation. Based on a wide selection of literature the following hypotheses were formulated.

- Null hypothesis 3: There is no relationship between willingness to certify and age
- Null hypothesis 4: There is no relationship between education levels and willingness to certify

To explore hypothesis 3 and 4 a series of Chi-square tests were completed. Specifically, the Chi-squared tests sought to identify any relationships between willingness to certify, the dependant variable and a selection of independent variables describing individual characteristics.

To begin to understand the knowledge transfer that is required to take place whereby an Ontario farmer connects with sustainable beef certification as a concept, it is imperative to understand the most impactful communication strategies. In addition, to increase the relevance of this study to policy makers and sustainable beef certification administrators, communication methods were explored to assess their perceived usefulness in connecting Ontario beef producers with necessary information to engage with a new pro-environmental program. Based on various studies exploring communication within the farming community hypothesis 5 was formulated.

- Null hypothesis 5: There is no relationship between communication methods and socio-demographic variables

Spearman's R sought to identify any relationships between a selection of independent variables and the various communication methods which were evaluated based on perceived usefulness by each respondent.

3.8 Characteristics of the Innovation

Finally, exploratory research seeks to identify program attributes and the ideal target audience for a sustainable beef certification. Through exploratory research, key motivators and barriers are investigated to identify key characteristics of the innovation and their relationships with relative advantage, compatibility and complexity. Median and interquartile ranges are used to rank motivators and barriers to identify the significance of each.

4. RESULTS AND DISCUSSION

First, the overall survey responses and sample characteristics are reported, followed by a description of the results based on the diffusion of innovation framework. Note that when respondents chose to answer “Other”, they did not elaborate their response further, and so no further information is described in this study. Table 3 outlines all the variables tested and the parent theme with which it fits, in regards to the diffusion of innovation framework for innovation adoption. Further to this, Table AP 8 outlines all tested variables with demonstrated statistically significant relationships.

4.1 Survey response and sample

There were 147 surveys completed for both paper and online surveys. Out of a total of 227 paper surveys that were distributed, there were 49 useable paper surveys returned, yielding a response rate of 22%. The paper survey was supplemented with 98 responses from the online survey over the two-month period it was made accessible. There is a possibility that some individuals who received a paper copy of the survey may have chosen to complete it online and these instances are not captured in the response rate of 22%.

There are 9520 Ontario beef farm operators, therefore based on the sample size of 147, the confidence level for the results is 95% with an 8% margin of error. The implications for this study based on a small sample size resulted in some categories (Operation type; Age) being small and as such the results may not be representative. Nevertheless, the response rate is only slightly lower than other Canadian studies geared at the farming community, which had response rates of ~30% (Furman, 1997; Atari et al., 2009).

There were 36 different counties represented by respondents. Most of the respondents were from Huron (36) and Bruce (21) counties, followed by Grey (10), Lambton (9). The cluster of responses align with the distribution of cattle within Ontario as 68% of the current head of beef cows, heifers, steers and calves currently located within southern and western Ontario where Huron, Bruce, Grey and Lambton counties are located (Statistics Canada, 2016). The full list of the geographic location of respondents can be

found in Appendix A. Though the sample size was small, there was representation by at least one survey respondent in 36 of 49 counties within Ontario.

Table 3 - Themes based on Rogers' diffusion of innovation model that may serve to influence willingness to certify

Parent Themes and Sub Themes	Definitions
Prior Conditions	Prior experiences, attitudes and perceptions that can shape an individuals knowledge about sustainable beef certification and their likelihood of adopting it
<i>Norms of the social system</i>	The current perceptions, practices and behaviours of the current Ontario beef farming community.
<i>Previous Practice</i>	Any prior experiences that may shape knowledge of sustainable beef certification
Characteristics of the adopter	Any characteristic of the decision-making unit, the potential adopter, that will shape their knowledge and or attitudes of the sustainable beef certification
<i>Socio-demographics variables</i>	Characteristics of the Ontario beef community specific to each individual farmer
<i>Communication preferences</i>	Descriptors of the individuals communication preferences
Characteristics of the Innovation	Characteristics of the sustainable beef certification perceived by Ontario beef farmers that many persuade them to adopt it
<i>Relative Advantage</i>	The perception that sustainable beef certification will offer advantages over alternatives
<i>Compatibility</i>	The perception that sustainable beef certification will align with existing values and practices within the Ontario beef farming community
<i>Complexity</i>	The perception that sustainable beef certification is difficult to implement or understand

* Definitions and table format derived from Rogers (1995) and Fernandez et al., 2016.

4.2 Prior Conditions

4.2.1 Previous Practice, Innovativeness of Proposed Program and Willingness to Certify

A large percentage (61%, n=90) of respondents were involved in the Environmental Farm Plan program (EFP). The full list of programs and their participation rates is

presented in Table 4. The Environmental Farm Plan program offered cost share support to farmers willing to work through the program and identify areas of environmental weakness and strength on their farm (Ontario Ministry of Agriculture, Food and Rural Affairs, 2016; Smithers and Furman, 2003). Cost-share initiatives have been utilized in other voluntary programs and certification schemes to drive participation, specifically within forestry certification schemes (Crow and Danks, 2010; Mercker and Hodges, 2007). Thus the high level of participation in the EFP program is likely due to this, as well as a desire for Ontario farmers to protect the integrity of the operations (Smithers and Furman, 2003). Overall respondent’s participation in the Environmental Farm Plan program was higher than participation rates presented in within other studies suggesting there was bias within the sample with those who participated being more involved and willing to engage with voluntary programs (Smithers and Furman, 2003; Atari et al., 2009).

There were no significant relationships identified between involvement in current programs and a willingness to certify with a future sustainable beef certification. This study failed to reject the null for hypothesis 2. Hypothesis 2 stated that there would be a relationship between previous participation in voluntary programs and a willingness to participate in future programs. The fact that no statistically significant relationship existed between involvement in current voluntary programs and willingness to certify did not align with the literature which suggested that those who currently engage in programs are more likely to get involved in a new program or certification (Greenhalgh et al., 2004). However, it does suggest that sustainable beef certification, as described to respondents, is not the innovation that will meet the current perceived needs of the beef producer.

Table 4 - Participation in current voluntary programs and certifications

Voluntary Program	Frequency
Environmental Farm Plan	90
None	45
Branded Beef Programs	27
VBP/VBP+	25
Other	6

*Note respondents were able to select multiple programs if applicable

4.2.2 Norms of Social system

Table 5 shows selected reasons for owning/operating a beef operation with medians and interquartile ranges reported. The highest median score at 5, was having land not suitable for cropping. This was followed by financially-related reasons of income/employment, enjoying livestock, providing family with beef and being part of heritage. Of the 8 reasons for operating a beef farm, none were significantly related to a beef farmer's willingness to certify their operation.

Table 5 - Reasons for operating a beef farm

Reason for operating	Median	Interquartile Range
Have land not suitable for cropping	5	1
Enjoy livestock	4	1
As part of my family heritage	4	1
Provide family with beef	4	2
Provide income/employment	4	2
To pass on to my children	3	1
Long-term investment	3	1

4.2.3 Environmental Values and Willingness to Certify

An objective of this study was to examine if environmental values had a relationship with a respondents willingness to certify their beef operation through a sustainable beef certification. The literature suggested that the motivation to adopt a pro environmental behaviour is based a farmer's self-identity (Reimer et al., 2012; Hyland et al., 2016). It is also suggested that this self-identity is based primarily on either productionist or environmental views (Reimer et al., 2012; Hyland et al., 2016). A large portion (54% n=79) of respondents, if given enough information, had an inherent motivation to protect their land regardless of economic considerations. Another 39% (n=57) of respondents indicated that they must be provided with sufficient incentive to adopt environmental conservation practices on their farm. The remaining 7% indicated other, but did not elaborate on their

responses. Nevertheless, there were no statistically significant relationships found between environmental values and other variables (e.g. age, gender).

Statistical tests were completed to analyze whether there was a relationship between these identified values and a willingness to certify. The findings were largely inconclusive and failed to support hypothesis 1, thus we cannot reject the null as the data failed to establish a statistically significant relationship between the two value statements provided and a willingness to certify. This finding was not expected as previous studies suggest there is a relationship between environmental attitudes and participation in pro environmental behaviour (Reimer et al. 2012; Hyland et al. 2016). Therefore the lack of a relationship in this study needs to be studied further, as this may be a result of insufficient variables that would serve as proxies for productionist and environmental views.

4.3 Characteristics of Decision-Makers and Relationship with Willingness to Certify

According to the diffusion of innovation framework, the characteristics of the decision-making unit are made up of socio-demographic variables, personality variables and communication behaviour.

4.3.1 Socio-demographics and Willingness to Certify

Out of the 147 respondents, 78% were male, 21% were female, and 1% preferred not to identify their gender. Males are slightly more represented in this study compared to the national average of 73% as reported by Statistics Canada for farm operators for all farm operators, not specific to beef farming (2011), which may be due to the small sample size or this may reflect a real difference in gender ratios specific to beef farmers. Figure 3 shows that 54% of respondents (80) were 50 years or older, which is similar to the current average age of farmers within Ontario, 54.5 years in 2011, as determined through the agricultural census of Canada (Statistics Canada, 2011). A majority of respondents (62%, n=91) indicated that they have at least a college or university level education, which is higher than the national level of 52% (Statistics Canada, 2011).

Those who were younger were more likely than older respondents to be willing to certify their beef operation ($\chi^2 = 11.057, P < .05$), which supports hypothesis 3; there will

be a relationship between willingness to certify and age. Additionally, there was a relationship between increased education and an increased willingness to certify ($\chi^2 = 16.881, P < .05$), which supports hypothesis 4; that there will be a relationship between education levels and willingness to certify. However, there were no significant relationships identified between gender, location, level of employment, farm type, herd size, acreage, or length of ownership, and a willingness to certify which was not expected as previous studies suggest these factors all relate to participation in pro environmental behaviour (Filson, 1993; Boon et al., 2010; Smithers and Furman, 2003; Defrancesco et al., 2008).

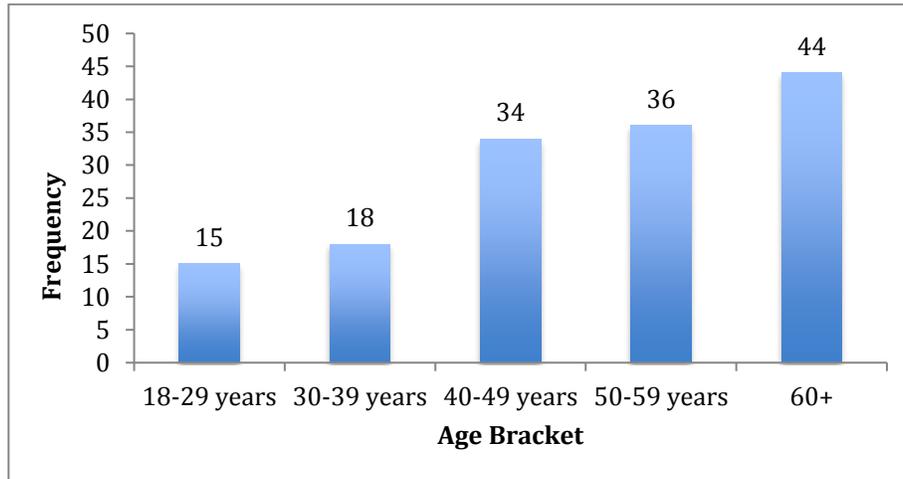


Figure 3 - Frequency of respondents within each age bracket

4.3.2 Farm type and size

The most common farm type was cow-calf operations (49%), with other farm types representing between 9% and 16% of the operations. The data breakdown including measures of central tendency can be found in table 6. In contrast, the median herd size was lowest for cow-calf producers, followed by cow-calf to finish, background, custom feeder, and feedlots (Table 6). The overall median herd size for all respondents was 195 head, which is much higher than the average of 66 reported for Ontario in the agricultural census (Beef Farmers of Ontario, 2017), and this may be due to the small study sample, which may not be representative of beef operations in Ontario. The median total acreage for

respondents (n=147) was 200 acres, with a median of 150 acres utilized to produce feed for livestock. There was no statistically significant relationship identified between farm type of size and a willingness to certify.

Table 6 - Percent ownership and median herd size based on farm type. Percentage may not add up to 100 due to rounding

Operation Type	% Respondents	N	Median herd size	Interquartile Range
Cow-Calf	49	72	35	30
Background	16	23	135	160
Feedlot	14	20	400	532
Cow-Calf to Finish	13	19	48	35
Custom Feeder	9	13	170	200

4.3.3 Level of Employment and Ownership

For 45% of respondents, their beef operation is their primary employment. Another 45% of respondents identified their farm operation as part-time employment with only 11% identifying their beef operation as a hobby operation. This is consistent with Statistics Canada (2010) data showing that 48% of Ontario farm operators work at an off-farm job or business in addition to operating their farm business.

Furthermore, increased herd size for cow-calf, background and custom feeding producers was related to increased level of employment (Spearman $R = .576$, $P < .001$; Spearman $R = .385$, $P < .05$; Spearman $R = .700$, $P < .01$, respectively). This is to be expected because as herd size increases, the workload and level of commitment increases; however, there was no significant relationship between herd size and an increased level of employment for feedlots and cow-calf to finish operations (Spearman $R = .365$, $P > .05$; Spearman $R = .301$, $P > .05$, respectively), which is an unexpected finding and cannot be explained by the data obtained in this study.

A majority (59%, n=86) of respondents intend to own/operate their beef operation for more than 15 more years as displayed in figure 4, and those that were younger

intended to operate their farms for longer (Spearman $R = -.574$, $P < .001$). Therefore this suggests that not only do a significant portion of beef owners/operators have a long-term outlook of their future in the beef industry, but that young farmers, who are starting out, plan on remaining active in the beef industry over the long-term.

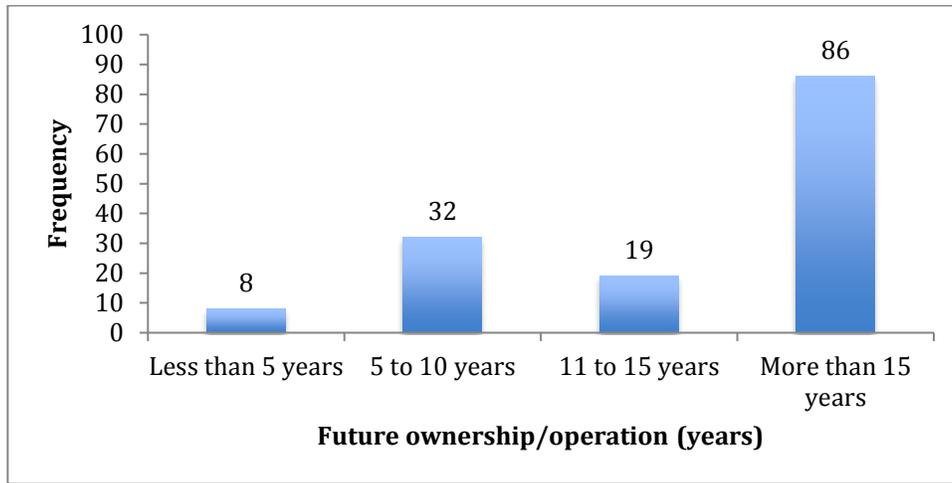


Figure 4 - Respondents anticipated length of future ownership/operation of their beef farm

4.3.4 Importance of Staying Up to Date

Most of the respondents generally thought it was “*Very*” to “*Extremely*” important ($N=61$ and 44 , respectively) to stay up to date with new programs and practices (Median = 4 , Interquartile range = 2). Additionally, those respondents with a higher education level were more likely to stay up to date with programs and certifications (Spearman $R = .220$, $P < .01$). Furthermore, those who intend to operate their farm for longer placed an increased importance on staying up to date with new farming programs and practices (Spearman $R = .172$, $P < .05$). The results of this study suggest that education level may play a role in influencing more than just concern for the environment, but also desire to stay up to date with new programs and practices related to beef farming. Furthermore, those who have a more long-term outlook on their farm operation are more likely to consider learning about new programs. Burton (2014) explored the lifecycle of a family farm and suggests that a longer horizon for environmental planning might encourage increased participation.

4.3.5 Knowledge of program

When respondents were asked to rate their familiarity with the concept of sustainable beef certification, 41% of respondents rated their level of familiarity with sustainable beef certification as “Somewhat *Familiar*” (Median = 3, Interquartile range = 2), with 25% and 5% rating themselves as “*Familiar*” or “*Very Familiar*”. Even though respondents had low familiarity with sustainable beef certification, when sustainable beef certification was defined for them, 80% of respondents reported they would be willing to certify. When asked how soon they would be willing to certify, 70% of those willing to certify (85 respondents) said they would want to see how it works first, with only 18% being willing to certify as soon as the program was available and 12% only willing to certify if they had to. Due to the nature of the question asked there is a possibility that respondents may have felt pressured to provide an answer that was socially acceptable (Marquis et al., 1986).

Additionally, those with higher education levels were more familiar with Sustainable Beef Certification (Spearman $R = .249$, $P < .01$). The results suggest that a more educated farm operator is engaging with the current communication methods being employed to share information about the future sustainable beef certification scheme. Achieving higher education levels has the ability to encourage and promote participation in pro environmental behaviour (Burton, 2000; Lambert et al., 2007; Ma et al., 2012; Wilson and Hart, 2000; Mathijis, 2003; Smithers and Furman, 2003; Barreiro-Hurle et al., 2010; Filson, 1993).

Cow calf producers with increased herd sizes were more familiar with sustainable beef certification (Spearman $R = .309$, $P < .01$), but no significant relationships were established with other operation types or herd sizes. This relationship suggests that the larger the operation the more in tune they may be with emerging programs and certifications. Other studies suggest that larger operations have more capacity and capital allowing them greater flexibility to engage in voluntary programs (Filson, 1996; Smithers and Furman, 2003; Reimer and Prokopy, 2014; Lambert et al., 2007; Olenick et al., 2005).

4.3.6 Communication preferences among Ontario Beef Producers

A variety of communication methods are utilized to share important information throughout the beef farming community. These communication methods and their ranked preferences are displayed in Table 7. Respondents were asked to rank their preference through outlining the usefulness of each method in their perspective. The median and interquartile ranges are reported. In person meetings, television programs and online workshops had the highest median scores all at 4.

Those respondents who were more familiar with sustainable beef certification preferred: Online workshops, websites, conferences and in person meetings respectively (Spearman $R = .450$, $P < .001$; Spearman $R = .240$, $P < .01$; Spearman $R = .246$, $P < .01$; and Spearman $R = .203$, $P < .05$). These results suggest that currently online communication strategies, as well as conference-like environments, such as the Beef Farmers of Ontario Annual General Meeting, are effective communication methods for sharing information regarding sustainable beef certification.

Respondent age and education levels had a statistically significant relationship with preferred select communication methods supporting hypothesis 5 which stated that there would be a relationship between communication methods and socio demographic characteristics. Younger producers preferred to learn through the use of websites (Spearman $R = -.200$, $P < .05$). More educated operators were more likely than less educated producers to prefer learning about new programs and certifications through websites, conferences and online workshops respectively (Spearman $R = .235$, $P < .01$; Spearman $R = .230$, $P < .01$; Spearman $R = .192$, $P < .05$). The increased preference towards technologically based education methods in both younger respondents as well as more educated respondents has been argued within the literature to be due to increased exposure to technology and online forms of communication (Prokopy et al., 2008). Therefore we can reject the null hypothesis 5 as statistically significant relationships can be identified between communication preferences and various socio-demographic variables. There were no statistically significant relationships between farm type or size and communication preference.

Table 7 - Communication methods and their level of usefulness for respondents

Communication Methods	Median	Interquartile Range
Online workshops	4	1
Television programs	4	1
In person meetings	4	1
Beef farm field days	3	1
Conversations with other farmers	3	1
Newsletters, magazines or newspapers	3	2
Websites	3	2
Pamphlets	2	1
Conferences	2	1
Other	5	0.5

5 point scale: 1 = Not Useful; 5 = Very Useful

4.4 Characteristics of Innovation: Motivators and Barriers

4.4.1 Motivators for Certifying with a Sustainable beef certification

There are many different motivating factors that may serve to encourage Ontario beef farmers to participate in a sustainable beef certification. Participants were provided with 17 potential motivators as well as an option to provide other motivators with each outlined in Table 8. Various motivators were noted as *'Important'*. Specifically, product sold at a premium, product demand and access to different markets were among those motivators regarded as *'Important'*. The results of this study, coupled with the literature on existing certification schemes, stress that economic benefit is a very important motivator for producers to consider certifying their farm products (Mendez et al., 2010; Creamer, Blatner & Butler, 2012; SCKASC, 2012).

Table 8 - Motivators and their importance to respondents

Motivators	Median	Interquartile Range
Technical assistance	4	0.8
Product sold at a premium	4	1
Product demand	4	1
Access to different markets	4	1
Improved efficiency in farm input use	4	1
Minimizing barriers to marketing beef	4	1
Skills and techniques for better environmental management	4	1.3
Improved yield	4	2
Preparation for future legislation	4	2
Access to credit	4	2
Give an overall advantage over competition	3.5	1
Higher quality product	3	1
Skills and training	3	1
Minimizing risk	3	1
Access to grants/financial assistance	3	1
Promoting the integrity of my farming activities	3	1
Diversified income sources	3	2
Other	5	2

5 point scale: 1 = Not Important; 5 = Very Important

The next step of this analysis involved understanding which, if any, individual characteristics shared significant relationships with the various motivators to participate in future programs. Understanding what motivates a specific subset of a population is vital as it allows for programs to be constructed specifically to emphasize these motivators and thus increase the likelihood that individuals would participate (Biedenweg et al., 2014).

Skills and techniques for better environmental management was a motivator that demonstrated significant relationships with increased level of employment on a beef operation as well as decreased age of the farm operator. The relationship between young farmers and a desire to learn and advance skills has been explored in the literature. Trede and Whitaker (2000) focused their study on beginning farmers in Iowa and identified a desire for skills advancement opportunities within young producers. The results from this study are similar to those of Trede and Whitaker, but go further to suggest that in addition to young producers, those producers whose beef operation represents more of an employment commitment are also more likely motivated by opportunities for skills and technique advancement opportunities.

Additionally, those who had increased levels of employment related to their beef operation were motivated by technical assistance and increased product quality. The literature fails to explain the role that level of employment associated with a beef operation has in the various motivators to participate in a pro environmental behaviour. Understanding how employment might influence motivators to participate is important as 48% of Ontario farm operators had off-farm employment in 2010 (Statistics Canada, 2016). With nearly half of farm operators finding employment in addition to their beef operation, it is imperative that the motivations for this subset of the beef farming population be understood. As such, future studies should look to examine more specifically the influence of level of employment, specifically within this beef industry.

Furthermore, younger respondents were more likely to be motivated to certify when offered opportunities to advance skills and techniques for better environmental management (Spearman $R = -.176$, $P < .05$). Those who had increased beef farming employment levels were motivated by technical assistance (Spearman $R = .222$, $P < .01$), skills and techniques for better environmental management (Spearman $R = .207$, $P < .05$) and increased product quality (Spearman $R = .182$, $P < .05$). There were no other significant relationships identified between socio-demographic variables and motivators to pursue sustainable beef certification.

4.4.2 Barriers hindering Program Participation

A large percentage (76%) of respondents indicated that they felt there were barriers that would limit their participation in voluntary programs or certifications related to farming or beef production. The full list of barriers and their ranked significance is provided in Table 9. From Table 9 we can see that time constraints, increased record keeping, knowledge of programs, changing consumer demands, and operation size all had the highest median score of 4, regarded as ‘*Significant*’. For those who were willing to consider certifying their operation, operational size and operation type were cited as significant barriers ($\chi^2 = 10.267, P < .05$; $\chi^2 = 9.604, P < .05$). Operation size has been examined in-depth to understand its influence on participation in pro environmental behaviour. As operation size increases it is argued that capital and flexibility increase making an operation better equipped to participate in conservation practices (Smithers and Furman, 2003). There were no other significant relationships between any other variables and a willingness to certify, including reasons for operating a beef farm (intrinsic or extrinsic values), or motivators.

Table 9 - Barriers and their significance for respondents

Barriers	Media n	Interquartile Range
Time constraints	4	1
Increased record keeping requirements	4	1
Changing consumer demands	4	1
Operation size	4	1
Knowledge of programs	4	2
Awareness of program availability	3	1.5
Access to program support	3	1
Costs to operation	3	1
Operation type	3	1
Concerns around confidentiality	3	2
Other	4	2

5 point scale: 1 = Not Significant; 5 = Very Significant

5. APPLICATION AND CONTRIBUTIONS OF RESEARCH

5.1 Socio-demographics characteristics: Participation in programs and communication preferences

Many studies have explored the influence of age, level of experience, education, gender, and attitudes as they related to adoption of pro environmental behaviour (Burton, 2014; Wilson and Hart, 2000; Lambert et al., 2007; Austen et al., 2002; Aidrian et al., 2005). In regards to the characteristics of the decision-making unit and their role in the first phase of adoption (ie. knowledge) this study found that there was a statistically significant relationship between younger age/higher education level and willingness to certify, supporting the findings of other researchers who found a similar relationship related to increased participation in pro-environmental behaviour (e.g. (Filson, 1993; Bager and Proost, 1997; Bonnieux et al., 1998; Ellis et al., 1999; Vanslebrouck et al., 2002; Mathijis, 2003; Brodt et al., 2006; Siebert et al., 2006; van Rensburg et al., 2009; Boon et al., 2010; Murphy et al., 2011; Burton, 2000; Lambert et al., 2007; Ma et al., 2012; Wilson and Hart, 2000; Mathijis, 2003; Smithers and Furman, 2003; Barreiro-Hurle et al., 2010). Within the knowledge phase, age and education are thought to be differentiating factors that influence the potential to adopt an innovation (Rogers, 1995). Thus, age and education level could be key indicators for the adoption of an innovation such as a new certification. This finding being of value industry organizations looking to implement a program such as sustainable beef certification as it suggests a target group for preliminary program dissemination.

The most preferred method of communication as described by respondents of this study was in person meetings, with conversations with other farmers being regarded as '*Useful*'. These results served to further support the use of 'champions' to share information about new beef farming programs and practices (Lee et al., 2011). These 'champions' could showcase certification in action and serve as a contact for other producers who are interested, but want to see how the process works. In this study, 70% of respondents identified they wanted to see how it works first. In order to achieve wide spread adoption of a sustainable beef certification it is vital that the 70% of producers who look to see a positive experience from another producer, are able to look to a champion

who can showcase their experiences. The literature suggests that many programs fail to appropriately communicate with farmers and as such participation rates are reduced (Atari et al., 2009; Smithers and Furman, 2003). Thus, understanding the importance of producer-to-producer interaction as it relates to voluntary programs is critical in establishing a program that will attract high levels of participation.

Furthermore, there was a statistically significant relationship showing that younger beef producers prefer to learn through the use of websites. Additionally, there was a statistically significant relationship between those respondents who were more educated and a preference of learning through websites, conferences and online workshops. This reflects societal changes, the continually increasing role of the internet, changing technology and the adoption of technology for communication; as younger more educated farmers are increasingly comfortable with technology and receiving information through online forums.

5.2 Motivators, Barriers and Value sets

The results of this study suggest that time constraints are a key barrier, and may be incompatible with further participation in programs that require additional time commitments. This is a consistent barrier within other food and agriculture industries looking to implement certifications (Bush et al., 2013; Mendez et al., 2010; Lyngbaek et al., 2001; Rickenbach and Overdeest, 2006; Hartsfield and Ostermeier, 2003; Humphries and Kainer, 2006; Auld et al., 2008). Additionally, the anticipation of additional record keeping requirements represents a significant barrier for Ontario beef producers. The existing Environmental Farm Plan program encouraged producers to work through workbooks and set goals to improve their farm operations environmental performance (Smithers and Furman, 2003; Atari et al., 2009). It requires record keeping and the submission of paperwork. With producers identifying additional record keeping as a barrier it would suggest that any future programs look to limit the burden of record keeping and perhaps align required records with existing programs, such as the EFP, to avoid duplication.

The results of this study suggest that some form of financial assistance is important for Ontario beef producers to encourage them to get involved in new programs. This is a

common finding, and financial and economic considerations as well as program support are regarded as motivators to participate in other voluntary programs and certification schemes (Atari et al., 2009; Smithers and Furman, 2003). The notably high participation in the Environmental Farm Plan program can in part be credited to the targeted financial assistance that has offered to participants in the past. Upon completion of the farm plan, incentives were offered such as refunds on cattle handling equipment. Though these incentives have changed, the current environmental farm plan gives producers access to funds to help finance farm operation improvement projects (Atari et al., 2009). The results of this study suggest that in order to encourage participation financial incentive may be required.

5.3 Characteristics of the Innovation

5.3.1 Relative Advantage: Sustainable beef certification

Referring back to Rogers' theory of diffusion of innovation we note that relative advantage is key component of an innovation that achieves widespread adoption (Rogers, 1995). This relative advantage signifies the characteristics of the innovation that make it more advantageous than the current method of operation (Rogers, 1995; Dirksen, Ament and Go, 1996; Marshall, 1990, Meyer, Johnson and Ethington, 1997). The results of this study suggest that for Ontario beef producer's, product premium, product demand and access to different markets are all characteristics of a potential new program that would offer them a relative advantage (Table 8). This finding is supported within the agricultural program literature as economic considerations as well as program support are regarded as motivators to participate in other voluntary programs and certification schemes (Atari et al., 2009; Smithers and Furman, 2003). As the sustainable beef certification is assembled, as well as other programs geared to the Ontario beef farming community, it is critical that factors such as pricing premiums and access to markets be considered to ensure that participation offers a relative advantage to participants, thus driving adoption.

5.3.2 Compatibility: Sustainable beef certification

In addition to relative advantage, an innovation must be compatible with potential adopters. Compatibility refers to whether the innovation will fit within the potential adopters current ideas, beliefs, norms and values (Rogers, 1995; Aubert and Hamel, 2001; Denis et al., 2002; Ferlie et al., 2001, Foy et al., 2002, and Greenhalgh et al., 2004). In terms of the characteristics of a sustainable beef certification that make it compatible with Ontario beef producers, the results of this study suggest that operation size is a significant barrier that would serve to make sustainable beef certification less compatible with Ontario beef producers (Table 9). This finding is supported by the literature which suggests that operation size does have influence in adoption of pro environmental programs with larger operations having more flexibility to participate due to increased capital (Smithers and Furman, 2003; Lambert et al., 2007; Olenick et al., 2005). Characteristics of a sustainable beef certification that would make it more compatible with Ontario beef producers could include, improved operational yield, assistance and financing, as these were all motivators that were deemed '*important*' to respondents.

5.3.3 Complexity: Sustainable beef certification

Along with relative advantage and compatibility, complexity is another critical attribute of an innovation as described by Rogers (1995). For those in the farming community, academic literature has demonstrated that complex innovations are undesirable due to the amount of time it takes to learn and implement them (Atari et al., 2009; Marsh 1998; Denis et al., 2002; Marshall, 1990; Meyer, Johnson and Ethington, 1997; Rogers 1995). The results of this study suggest that increased record keeping and changing consumer demands represent potential complexities that may serve to deter individuals from participating in a sustainable beef certification. Potentially alleviating complexities could be achieved through coupling record keeping requirements with requirements from existing voluntary programs. Among respondents who identified that they currently participate in a voluntary program the most widely cited program participated in was the Environmental Farm Plan (90 respondents), followed by Branded Beef Programs (27 respondents) (Table 4).

5.4 Sustainable beef certification: Program attributes and Target Audience

In order to establish new programs that will encourage adoption among beef producers it is vital to understand key motivators and barriers that serve to either encourage or discourage participation. This study showed that premiums for a certified product are key to drive producer participation similar to other studies. Economic benefit was deemed important to producers in studies examining forestry, coffee and fish certification schemes (Humphries and Kainer, 2006; Mendez, et al., 2010; Philips et al., 2003).

Time is a very important barrier to understand in terms of its relation to the farming community. Many farming activities are very time sensitive, often leaving little available time to pursue additional activities without requiring additional labour. Bush et al., emphasized the barrier that time can be for producers looking to implement a certification scheme (2013). For many producers, they do not have the time to devote to necessary processes such as application, audit and maintenance of additional programs for their operation. As such it is important for new programs to be simple to implement so as to reduce the amount of time it takes to learn and implement them therefore reducing time constraints as a barrier to participation (Atari et al., 2009; Marsh 1998; Denis et al., 2002; Marshall, 1990; Meyer, Johnson and Ethington, 1997; Rogers 1995). Much alike the barrier of time, 'Increased record keeping' was identified as a barrier with a median of 4. The literature has briefly examined record keeping as a potential burden for farms, both in regards to its time requirements and concerns around confidentiality (Atari et al., 2009). Decreasing the burden of record keeping could be done through coupling record requirements with existing programs to prevent overlap.

Findings from this study suggest that a future sustainable beef certification should target the young, and educated, up and coming generation of beef farmers in Ontario. This subset of Ontario beef producers demonstrated an increased willingness to certify their operation. They intend to own/operate their beef operations for longer, and this long-term outlook on their beef operation was positively related to an increased likelihood of staying up to date with new beef farming programs and practices. To motivate this younger group of farmers to certify, a sustainable beef certification scheme should offer opportunities to advance skills and techniques for environmental management, a key motivator for this

subset of the population. Additionally, communication should focus on online mediums such as websites, online workshops or social media. Technology is going to continue to play an evolving role in the beef industry and a new certification should focus on communicating through the target audiences preferred communication channels.

Certainly, the goal when implementing a new certification scheme is not to be exclusionary of any subset of a population. To target the remaining group of Ontario beef producers a certification scheme should focus on establishing 'champions' to showcase how the certification would work on an operation. These individuals can start a conversation amongst farmers, a communication method deemed to have some level of usefulness among all producers. Additionally, a future certification scheme should focus on limiting the time commitment and record keeping requirements as these represent the most impactful barriers among all producers. Finally, offering a premium for a certified product would serve as a key motivator to encourage producers to participate.

5.5 Limitations

The convenience sampling used in this study may result in sample bias, defined as a sample that is collected in such a way that some individuals within the target population are less likely to be included than other individuals also within the population (Fowler, 2013 pg 10). A portion of survey responses came from those who attended the Annual General Meeting of the Beef Farmers of Ontario. Those that prefer conferences may represent a subset of the beef farming population that is more interested in advancement and innovation than the average Ontario beef farmer. More specifically, the results related previous program participation among respondents is slightly higher than participation rates reported in other studies. This suggests that the sample may have been biased resulting in those who participated being a subset of the population that is more likely to engage in programs than the average across the entire population. Future studies should look to implement a randomized sampling approach to eliminate the risk of sample bias within their study. Nevertheless, this sample bias should not affect the interpretation of the results as but may have served to exclude a portion of the beef farming community in Ontario that is less apt to become involved in a certification. The results of this study are

still valid as the sample size was adequate for generalizability, and a representative sample was achieved.

5.6 Scholarly Contribution

The exploratory study has made a significant empirical contribution as it is the first to comprehensively outline the motivators and barriers for participating in voluntary programs, and willingness to certify for sustainable beef amongst Ontario beef producers. As a result the findings of this study serve to contribute to a better understanding of the beef industry in Ontario and to a better understanding of how pro environmental certification schemes are likely to be received amongst the beef industry here in Ontario.

5.6.1 Theoretical Contribution

Diffusion of innovation theory provides a framework with which a researcher can begin to understand the conditions that may increase or decrease the likelihood of a new product or idea being adopted by a group of individuals (Rogers, 1995). This study sought to apply the diffusion of innovation framework to better understand the specific characteristics of the Ontario beef farming community and their ability to predict the likelihood of adoption of a sustainable beef certification. Through a comprehensive investigation into the literature on diffusion of innovation theory, with specific focus on studies investigating the agriculture industry it became possible to outline a selection of characteristics and attitudes that aligned with the first three stages of Rogers five-stage model. Through surveying the Ontario beef farming community and collecting data on a selection of variables tested within the current academic literature it became possible to test a selection of hypothesis. These hypotheses were tested to understand the influence of specific characteristics and attitudes on the likelihood of adoption of sustainable beef certification. The results of this study served to support age and education levels as characteristics with which a statistical relationship exists between willingness to adopt a sustainable beef certification. These results align with current academic literature and further serve as support for diffusion of innovation as a theory with applications in the agriculture industry.

5.6.2 Applied Contribution

The research makes several practical contributions to the Ontario beef industry as well as to agricultural program development. Specifically, the findings of this study are of value to organizations looking to implement a sustainable beef certification to be made available to Ontario beef farm operators. The results of this study identify subsets of the population that may be beneficial to target. Additionally, this study identified specific communication methods that resonate with these subsets and allow for a more targeted approach to program dissemination that could be geared to target subsets of the Ontario beef operation population.

More broadly, the results of this study suggest that Ontario beef producers would be willing to engage with a sustainable beef certification. This is important for organizations looking to implement such a certification as it suggests that beef producers in Ontario are ready to take on such an initiative.

6. CONCLUSIONS

The results of this study reinforced existing academic understanding of the effectiveness of the environmental farm plan program in attracting livestock producers to participate. However, there was no significant relationship identified between previous participation in voluntary programs and willingness to participate in a sustainable beef certification. This finding suggesting that the respondents could not clearly identify characteristics of the innovation that could satisfy a felt need or that the sustainable beef certification scheme as presented was not innovative enough, as it seemed to fit with their previous practices and existing social norms. The literature suggests that an individual's value set can serve as an influential characteristic in their likelihood of being involved with pro-environmental behaviour. Though the results of this study failed to identify any relationship between productionist and environmental value sets and a willingness to participate in a sustainable beef certification, more research should be done to further develop an understanding of these value sets to establish a more comprehensive data collection tool

A broad range of socio-demographic variables were collected through the use of a survey and tested against a selection of dependant variables to test for relationships. Two variables emerged with significant relationships with willingness to participate in a sustainable beef certification. Those who were younger were more willing to participate as well as those with higher levels of education. The results of this study, with regards to increased herd size having no statistically significant relationship with increased willingness to participate in sustainable beef certification, are not supported by the current academic literature. Due to the small nature of this study, it is possible that large operations, that the literature suggests would be more inclined to participate, were not surveyed, as there were only three operations that identified as having over 1000 head of cattle. A more comprehensive study should look to capture a larger sample size to better capture the industry picture and allow for more comprehensive statistical analysis.

Respondent's communication preferences were assessed to test relationships between communication preferences and socio-demographic variables as well as to provide some tangible benefit for local associations who look to target widely accepted communication preferences. Those who are younger and more educated prefer to utilize

online mediums for learning about new farming programs and practices. Among all respondents, in person meetings were deemed very useful

Through exploring the significance of various motivators and barriers, the characteristics of sustainable beef certification were identified that would provide respondents with relative advantage, would increase compatibility and would decrease complexity. Economic benefit and market stability were deemed significant motivators that if part of a sustainable beef certification would motivate them to participate. Addressing concerns of operation size as a barrier would serve to make sustainable beef certification more compatible with Ontario beef producers. Finally, decreasing record keeping requirements through coupling with existing programs would decrease complexity for Ontario beef producers.

This study, though descriptive, was largely exploratory in nature and as such further research to identify the nature of the relationships identified as significant would be beneficial. Further to this, the small sample size of this study limited examination of some variables such as location. Future research, with an increased sample size may allow for investigation of more variables deemed influential within the literature. Follow up research upon implementation of a sustainable beef certification would allow for evaluation of those who adopt and those who would not. Additionally, a national survey to evaluate beef farmers across Canada would give a more holistic perspective of the beef industry, as it is undoubtedly interconnected across the provinces. It is likely that a more comprehensive investigation would yield a more thorough understanding of prior conditions as they relate to the Ontario beef farming community.

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Appendix A - Additional Tables

Table AP 1 – Education level of respondents

Education	Percent of operators	n
Elementary School	4	6
High School	34	50
College/University	56	83
University Post-grad	5	7
Other	1	1

Table AP 2 – Gender distribution of respondents

Gender	n	Percent
Male	115	78
Female	31	21
No Response	1	1
TOTAL	147	

Table AP 3 – Level of employment of respondents

Level of Employment	Percent	n
Hobby	11	16
Part-time	45	65
Primary	45	65
TOTAL		146

Table AP 4 – Current length of ownership of respondents

Length of ownership/operation	n
0 to 5 years	14
6 to 10 years	15
11 to 20 years	36
21 to 30 years	34
31 to 40 years	26
40 or more years	22
Total	147

Table AP 5 – Expected length of future ownership

How much longer do you intend to own/operate a beef farm?	n	Percent
Less than 5 years	8	6
5 to 10 years	32	22
11 to 15 years	19	13
More than 15 years	86	59
Total	145	

Table AP 6 – Distribution of respondents based on farm type

Operation Type	n	%
Cow-Calf	72	49
Background	23	15.6
Feedlot	20	13.6
Cow-Calf to Finish	19	12.9
Custom Feeder	13	8.8

Table AP 7. Geographical location of respondents within Ontario

County	Count (n)	County	Count (n)
Algoma	3	Ottawa-Carlton	1
Brant	1	Oxford	3
Bruce	21	Perth	7
Cochrane	2	Peterborough	2
Dufferin	3	Prescott	1
Dundas	1	Prince Edward	1
Grey	10	Rainy River	2
Haldimand	3	Renfrew	2
Hamilton	1	Simcoe	1
Hastings	3	Stormont	1
Huron	36	Greater Sudbury	1
Kawartha Lakes	2	Timiskaming	1
Lambton	9	Thunder Bay	1
Leeds	3	Waterloo	3
Lennox & Addington	2	Wellington	7
Manitoulin	3	Wentworth	1
Niagara	2	York	1
Norfolk	1	Not Indicated	2
Northumberland	2	TOTAL	147

Table AP 8. Statistically Significant Relationships from Dataset

Test	Independent Variable	Dependant Variable	Relationship	Value
Spearman's R	Herd Size	Level of Employment	Increased Cow-Calf herd size was related to increased level of employment	Spearman R = .576, P < .001
			Increased Background herd size was related to increased level of employment	Spearman R = .385, P < .05
			Increased Custom Feeder herd size was related to increased level of employment	Spearman R = .700, P < .01
	Age	Future length of ownership	Decreased age was related to intention to own farm for longer	Spearman R = -.574, P < .001
	Education	Staying up to date with programs and practices	Increased education was related to increased importance of staying up to date with programs and practices	Spearman R = .220, P < .01
	Future length of ownership	Staying up to date with programs and practices	Intention to operate a farm for longer was related to increased importance of staying up to date with programs and practices	Spearman R = .172, P < .05
	Education	Familiarity with sustainable beef certification	Increased education levels were related to increased familiarity with sustainable beef certification	Spearman R = .249, P < .01
	Herd Size	Familiarity with sustainable beef certification	Increased herd size among Cow-Calf producers was related to increased familiarity with sustainable beef certification	Spearman R = .309, P < .01
	Communication methods	Familiarity with sustainable beef certification	Preference towards online workshops was related with increased familiarity with sustainable beef certification	Spearman R = .450, P < .001

Spearman's R			Preference towards websites was related with increased familiarity with sustainable beef certification	Spearman R = .240, P < .01
			Preference towards conferences was related with increased familiarity with sustainable beef certification	Spearman R = .246, P < .01
			Preference towards in person meetings was related with increased familiarity with sustainable beef certification	Spearman R = .203, P < .05
	Age	Communication preferences	Decreased age was related to preference in learning through websites	Spearman R = -.200, P < .05
	Education	Communication preferences	Increased education levels were related to preference in learning through websites	Spearman R = .235, P < .01
			Increased education levels were related to preferences in learning through conferences	Spearman R = .230, P < .01
			Increased education levels were related to preferences in learning through online workshops	Spearman R = .192, P < .05
	Age	Motivators to participate	Decreased age of participants was related to increased motivation related to advancing skills	Spearman R = -.176, P < .05
			Increased farming employment of participants was related to increased motivation related to receiving technical assistance	Spearman R = .222, P < .01
			Increased farming employment of participants was related to increased motivation related to advancing skills and techniques	Spearman R = .207, P < .05
			Increased farming employment of participants	Spearman R = .182,

Chi-Square			was related to increased motivation related increased product quality	P < .05
	Barriers	Willingness to Certify	Those who felt operation size was a significant barrier were more willing to certify	$\chi^2 = 10.267, P < .05$
			Those who felt operation type was a significant barrier were more willing to certify	$\chi^2 = 9.604, P < .05$
	Age	Willingness to Certify	Those with decreased age were more likely to be willing to certify	$\chi^2 = 11.057, P < .05$
Education	Willingness to Certify	Those with increased education levels were more likely to be willing to certify	$\chi^2 = 16.881, P < .05$	

Appendix B - Copy of Survey

You are invited to participate in a research study conducted by **Jodie Eadie**. This study is being completed as part of a Master of Environmental Studies thesis requirement and is seeking to assess what are the drivers and barriers for sustainable beef certification amongst Ontario Beef Farmers. It hopes uncover the needs and priorities of Ontario beef producers to allow for voluntary programs and certifications to be created in a way that best suits the producer. The deadline for completing the survey is **March 3, 2017**.

For each question please put an 'X' in the box or fill in your answers where appropriate. All of your responses will remain strictly confidential and will not be associated with your name. The survey is expected to take **15 minutes**, at any time you may choose to not complete a question by leaving it blank. At the end of the survey you may choose to enter your name in a draw for **one of ten \$10 Tim Hortons gift cards**.

Before beginning the survey, please make sure you have read the information letter included with the survey. By indicating your consent below and mailing the survey back to the researchers, you are implying your consent to participate. By providing consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

1. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study (please return your survey in the envelope provided)

I agree to participate I do not wish to participate

2. Are you currently an owner/operator of a beef farm in Ontario that is over the age of 18?

Yes

No (If not, there is no need to continue with the survey but please return the survey in the envelope provided. Thank you for your time).

3. What county is your primary beef operation located within? _____.

4. What is your gender? _____.

5. What type of beef operation do you run (Please select one answer you feel best characterizes your operation)

Cow-calf Background Feedlot Cow Calf to Finish Custom Feeder

6. What is the average size of your herd?

Cow-Calf	Background	Feedlot	Cow-Calf to Finish	Custom Feeder

7. How many acres do you operate on average each year? _____.

8. Out of these total acres how many on average are used to produce feed for your beef operation each year _____.

9. How would you describe your farm in terms of personal level of employment? (Please select one answer)

Hobby Part-time employment Primary employment

10. What age group do you belong to?

18-29 years 30-39 years 40-49 years 50-59 years 60+ years

11. How long have you owned/operated a beef farm?

- 0 to 5 years 6 – 10 years 11 – 20 years 21 – 30 years
31 – 40 years 40 or more years
-

12. How many more years do you intend to own/operate a beef farm?

- Less than 5 years 5 – 10 years 11 – 15 years More than 15 years
-

13. What is the highest level of education you have completed? (Please check only one)

- Elementary school High school Completed college/university

University post graduate degree (masters or doctorate)

Other (specify) _____.

14. What statement do you feel best describes your individual motivations when deciding to adopt environmental conservation practices on your beef farm?

- I must be provided with sufficient incentive to adopt environmental conservation practices on my farm

Or

- When given adequate information about an environmental issue I have an inherent motivation to protect my land regardless of economic considerations.

If you feel that neither statement captures your individual motivations please specify in a brief statement what you feel drives your management decisions on your farm _____.

15. People operate farms for many different reasons. Please indicate how important each of the following reasons for operating your own beef farm is to you when you think about your operation.

Reasons for ownership	Not Important	Of Little Importance	Somewhat Important	Important	Very Important
To pass on to my children or heirs	<input type="checkbox"/>				
Long-term Investment	<input type="checkbox"/>				
Provide family with beef	<input type="checkbox"/>				
Providing income/employment	<input type="checkbox"/>				
Have land that is not suitable for cropping	<input type="checkbox"/>				
As part of my family heritage	<input type="checkbox"/>				
Enjoy livestock	<input type="checkbox"/>				
Other (specify) _____:	<input type="checkbox"/>				

16. How important is it for you to stay up to date with new beef farming practices and programs?

Not Important	Of Little Importance	Somewhat Important	Important	Very Important
<input type="checkbox"/>				

Why or why not? _____.

17. When it comes to learning about new programs and certifications your farm could participate in, which forms of communication do you find to be the most effective?

	Not useful	Somewhat useful	Useful	Very useful	Extremely useful
Pamphlets	<input type="checkbox"/>				
Newsletters, magazines or newspapers	<input type="checkbox"/>				
Websites	<input type="checkbox"/>				
Online workshops	<input type="checkbox"/>				
Beef farm field days	<input type="checkbox"/>				
Conferences	<input type="checkbox"/>				
Television Programs	<input type="checkbox"/>				
In person meetings	<input type="checkbox"/>				
Conversation with other farmers	<input type="checkbox"/>				
Other (specify) _____.	<input type="checkbox"/>				

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18. Are you actively involved in any voluntary programs associated with farming or beef production more specifically? (Check all that apply)

Verified beef production/ VBP+

Branded beef programs (Ontario Corn Fed Beef, Certified Red Angus)

Environmental farm plan None

Others (Specify) _____.

19. Do you feel there are any barriers that may limit your participation in voluntary programs/certifications in the beef industry?

Yes

No (skip to question 21)

20. If yes - How significant are these potential barriers in keeping you from participating in programs/certifications?

	Not Significant	Somewhat Significant	Significant	Very Significant	Extremely Significant
Costs to Operation	<input type="checkbox"/>				
Time Constraints	<input type="checkbox"/>				
Increased record keeping requirements	<input type="checkbox"/>				
Operation Size	<input type="checkbox"/>				
Operation Type	<input type="checkbox"/>				
Access to Program Support	<input type="checkbox"/>				
Awareness of Program Availability	<input type="checkbox"/>				

Knowledge of Programs	<input type="checkbox"/>				
Changing consumer demands	<input type="checkbox"/>				
Concerns around confidentiality	<input type="checkbox"/>				
Other (specify) _____.	<input type="checkbox"/>				

21. How familiar are you with the idea/concept of sustainable beef certification? (Please select one answer)

Not at all familiar	A little familiar	Somewhat familiar	Familiar	Very familiar
<input type="checkbox"/>				

Please read the following definition of sustainable beef certification and answer the final question

Certified Sustainable Beef are beef products produced in an economically viable way, are environmentally sound and socially responsible. Certification is a voluntary process that can require a third-party audit or oversight.

22. What would a certification need to offer you to motivate you to certify your beef operation under a sustainable beef certification?

	Not Important	Of little importance	Somewhat Important	Important	Very Important
Product sold at premium	<input type="checkbox"/>				
Product Demand	<input type="checkbox"/>				
Access to different markets	<input type="checkbox"/>				
Skills and Training	<input type="checkbox"/>				
Diversified Income Sources	<input type="checkbox"/>				
Improved Yield	<input type="checkbox"/>				
Improved efficiency in	<input type="checkbox"/>				

farm input use					
Preparation for future legislation	<input type="checkbox"/>				
Higher quality product	<input type="checkbox"/>				
Technical Assistance	<input type="checkbox"/>				
Access to grants/financial assistance	<input type="checkbox"/>				
Access to Credit	<input type="checkbox"/>				
Skills and techniques for better environmental management	<input type="checkbox"/>				
Minimizing barriers to marketing beef	<input type="checkbox"/>				
Promoting the integrity of my farming activities	<input type="checkbox"/>				
Give me an overall advantage over competitors	<input type="checkbox"/>				
Minimizing farm risk	<input type="checkbox"/>				
Other (specify) _____.	<input type="checkbox"/>				

23. Would you ever consider certifying your beef operation under a sustainable beef certification?

Yes No (If no skip to question 25)

24. At what point in the future would you be willing to participate?

- As soon as it's available
- I want to see how it works first
- Only if I have to

25. If you wish to have your name entered in a draw for **one of ten \$10 Tim Hortons gift cards** please indicate that below and include your information for Question 27

Yes I would No I would not

26. If you would like a copy of the study results upon completion of the study please indicate that here and include your information for Question 27

Yes I would like a copy

No I would not like a copy

27. If you answered that you would like your name in the draw or you would like a copy of the study results please include your contact information below.

Note – We will keep your contact information confidential and it will be stored separately from the survey results to ensure that there is no directly identifying information associated with your responses.

Name	
Address	
Email	
Phone Number	

Thank you again for your time