ANALYSIS OF SOURCES OF MARKET INFORMATION FOR FARMERS IN SASKATCHEWAN

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ABSTRACT

With several sources of information available to farmers, it is not certain where Saskatchewan farmers looking for market information turn to for help in their businesses. Survey data from a sample of 577 crop farmers across the province are used to assess the usefulness of information sources to the farmers. The study uses a probit regression model to determine which of the various sources of market information Saskatchewan farmers use and the factors that influence these preferences. Results show that preferences are varied depending on characteristics of the operator and farm business. The majority of the farmers interviewed indicated their preferred market information source is another farmer who is in the same business. The next preferred source of market information is a telephone call or text message from trading partners. Social media is the least preferred source of market information among respondents. The level of education of farmers and whether or not they use the Internet to search for market information influence preferences for market information source usage. The sizes of operation, farmers' age, and whether they use more modern farm technology have no statistical significance on evaluation of usefulness.

Keywords: Market prospects, market information, probit regression, sources, information.

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CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction

Information can be considered as one of the crucial factors that determine the success of any agricultural business and it is the basis for the provision of agricultural extension services to farmers. Production agriculture involves a lot of risk and to be able to deal effectively with the risk inherent in agriculture, farmers have a need for accurate and relevant information in order to make sound production and marketing decisions. In particular, market information is important to farmers. Farmers need price information in order to time their sales to maximize their profit. As a result of the critical role that market information plays in the marketing of agricultural produce, its value has increased tremendously and has become a crucial factor to the financial success of farmers (Diekmann et al., 2009).

Luckily, farm operators (any person responsible for the management decisions made for an agricultural operation) have more choices than ever before to gather information from both public and private sector providers at the same time. These can be owners, tenants or hired managers of the agricultural operation, including those responsible for management decisions pertinent to particular aspects of the farm - planting, harvesting, raising animals, marketing and sales, and making capital purchases and other financial decisions (Statistics Canada, 2017a).

There is increased competition among information providers in the agricultural sector for the attention of farmers. Agribusiness marketers, for example, are able to use various methodologies to communicate product, service, as well as other types of information to farmers. One such methods used by these agricultural marketers is farm publications, for example, *The Western Producer*, *Small Farm Canada, The Ontario Farmer* and so on (Gloy et al., 2000).

Besides farm publications, farmers also receive information from other sources such as farmers education programs aired on radio, television shows, videos, from agricultural consultants, direct mail, government sources, universities, sales people and the internet (Gloy et al., 2000). Nowadays with the advancement in telecommunication technology, producers also receive direct market information from email newsletters and text messages on their mobile phones such as tweets and regular short message systems text, as well as through personal contact with other farmers. These different sources of market information present an

array of challenges and bring their own unique advantages and disadvantages. The ability of producers to sift through these varied sources for relevant information for their farm business is a difficult but important skill that producers have to deploy constantly if they are to remain competitive in the industry.

For a farmer to choose a particular source of information for his/her business, it is dependent upon factors such as the type of information the farmer receives from that source and the mechanism through which the information is received as well as the interest or capability of the farmer to understand the information being received from that source. For example, a farmer in his late fifties who is not abreast with modern information technology may find the use of the Internet for market information purposes tedious and may prefer using radio or television report or other traditional media sources to get his information. Radio and television are easy to use and do not require any effort on the part of the user, although information obtained through radio and television is short lived. For more detailed and longer lasting information, a farmer might prefer using print media or salespersons as a source. Salespeople are able to offer highly personalized and detailed information to producers depending on the circumstance in which the producer finds himself. The means through which market information get to farmers are highly varied and each source has its own advantages and disadvantages. The challenge for the farmer is to determine which of the sources provide the best communication platform.

Despite the numerous channels through which information can be conveyed, there is limited understanding of the extent to which the information needs of farmers are being met. The current study helps fill this gap by identifying the sources through which commercial farmers in Saskatchewan get their market information and to evaluate their perceptions of the usefulness of information received from these sources.

1.2 Background to the study

In an effort to help farmers get a one-stop-shop for the majority of their market information needs, the Food and Agriculture Organisation (FAO) and other stakeholders involved with the development of agricultural marketing have for some time now been calling on governments and non-governmental organisations in both developed and developing countries to help in the creation of market information services (MIS) to assist farmers in their businesses. Market information service, according to the FAO is a service usually provided by the public sector (Ministry of Agriculture or a dependent agency or institute), which includes

the collection of information on prices, and in some cases quantities supplied, of widely consumed agricultural products, from wholesale markets, rural assembly and retail markets, as appropriate, and dissemination of this information on a regular basis through various means (bulletin boards, radio or television bulletins, newspapers, etc.), to farmers, traders, government officials, policy-makers and others (Shepherd & Schalke, 1995).

Market information should be distinguished from marketing information, which is a wider concept encompassing details on prospective market channels, the type of payment systems that will be required, packaging of the products, quality identification or labeling, and a range of other information, including market information. Availability of improved market information services leads to efficiency in the marketing systems and price formation. With access to improved market information, it is believed that farmers would have reliable data to plan their production in response to the demand situation in the market, to take decisions as to which market they would like to participate in, as well as to help them negotiate better deals with other market participants. Nonetheless, fully functional market information service offices in most countries are either nonexistent, non-functional or the information coming out of these offices do not meet the needs of farmers in their decision-making. For example, the FAO conducted a survey of all member countries to determine the effectiveness of market information services. It turned out that while a large number of countries operate MIS, the vast majority of services cannot be considered to provide commercially useful information for farmers and traders (Shepherd, 1997). Although information is collected in many countries, they are neither up-to-date nor distributed to farmers in a way that would make the information useful to them in their businesses (Shepherd, 1997). The situation in Saskatchewan might have changed as for example, the government of Saskatchewan provides weekly update of prices on their website. It is uncertain though, whether the information provided is useful to the farmers and that they make use of such information being furnished or they look elsewhere for help.

One of the observations of Shepherd (1997) is that Indonesia has a vibrant MIS and that farmers used the price broadcasts every day primarily to check on prices obtainable at the local market prior to negotiating with their trading partners for their produce and to compare prices they received the previous day. Although the type of farming practised in Indonesia might be different from that of Saskatchewan in terms of scale and type of crops, the importance of a system that furnishes farmers with the kind of market information they need

cannot be overemphasized. It is necessary, therefore, to know the kind of information farmers in Saskatchewan require, and the sources they use to get that information.

Aker & Mbiti (2010) state that improved flow of market information has the potential to significantly improve access to markets and reduce, if not remove, impediments to market participation. If farmers have access to prompt and reliable market information, it can potentially improve their ability to negotiate better trade deals with their trading partners to get better prices for their production and significantly reduce their transaction costs in general, which will in turn improve returns on their investment. On the other hand, a lack of reliable market information may serve as a hindrance to farmers in terms of higher transaction costs. If farmers rely on inaccurate historical information that is not relevant to the current market situation to make decisions, they might not realize the full potential returns that they stand to gain from the sale of their crops.

In spite of the deficiencies in the provision of market information to farmers in most countries, information technology has evolved over the years in a way that has led to dramatic improvements in access to information. Farmers in the United States, for example, have quickly embraced the emerging information communication technologies over the past two decades and have better access to information now than ever before (Gloy et al., 2000). Farmers can source timely information through multiple channels at relatively lower cost through computers, mobile phones, and easy access to the Internet. Consequently, it is very easy to assume that farmers would turn to the use of the Internet for their market information needs due to easy accessibility and availability, especially in advanced countries. This might not always be the case. For example, farming activity in the Perth region is a very important one for Australia. In the 2009/2010 agricultural year, there were 1,511 agricultural firms cultivating roughly 487,000 hectares. The Australian Bureau of Statistics report that 33% of farmers in the Perth region get their market information from the Internet whereas 39.8% use the Internet to get their information across Western Australia. As high as 47.5% and 47.1% of the farmers receive their information from agricultural media and other farmers respectively (Kininmonth, 2011). Understanding where farmers get their market information is important to formulating any communication and marketing strategy and associated production planning.

1.3 Problem statement

Judging from the importance of market information to any business entity, agricultural producers, like managers of any other business need relevant, accurate, and timely information to plan and make decisions on production and marketing as well as for financial planning. Recent statistics from the 2016 Census of Agriculture indicate that there are about 45,350 farmers in Saskatchewan with total farms of 34,523 (Statistics Canada, 2017d). Farms with gross sales of more than $500,000 in Saskatchewan form about 18.1% of all farms. These farms produce roughly 82.4% of the total farm revenue of the province, according to the 2011 Farm Financial Survey (Statistics Canada, 2011). Since the top 18.1% of farms in the province generate much of the farm revenue, the decisions of these top farmers with regards to production and marketing have enormous output and financial impacts on the agricultural sector of the province's economy. Despite the huge economic impact that decisions of these top farmers or producers have on the economy of the province, it is uncertain where these farmers obtain their information for production and marketing purposes. If these farmers do not have the right data on which to base their decisions, the consequences of their decisions on the province could be profound. A review of the literature reveals that considerable work in this area has been done in other countries like India, Nigeria, and the United States (Fawole, 2008; Ford & Babb, 1989; Gloy et al., 2000; Mittal & Mehar, 2013). There has not been any such study in Canada. The closest study in Canada found in the literature examined information availability to help farmers in the prairies region to conserve soil and water in order to adapt to the environment (Tarnoczi & Berkes, 2010).

To fill this information gap, data on the main sources of market information to farmers in Saskatchewan and their attitudes towards the different sources with regards to usefulness of the information obtained through these sources is used. The analysis proceeds under the assumption that with the introduction of the Internet and other modern means of information dissemination, farmers' reliance on traditional sources of information such as radio and television reports, newspapers, farm magazines, extension officers and field days have dwindled. Farmers presumably, now turn to more modern sources like the Internet, email newsletters, and text messages for most of their market information needs. The study uses primary data obtained from a sample of large-scale Saskatchewan farmers with sales revenue in excess of $500,000. A probit regression model is used to analyze the sources of information of these large-scale farmers and the usefulness of the information obtained from these sources.

Adereti et al. (2006) define information as data that have been processed into a meaningful and useful context and which is relayed to the recipient who uses it to make decisions. In the context of agriculture, information may consist of all published and unpublished data in all aspects of the industry. Reliable price information is very crucial for effective formulation and execution of pricing policy to aid farmers to improve their marketing outcomes. Reliability of information in this sense refers to the degree of accuracy of the information and the credibility of the source from which the information is gathered. The reliability of market information available to farmers enables them to not only make informed decisions about pricing, production, and storage, but also adopt effective and profitable marketing strategies. Accurate market information may assist farmers to plan their marketing strategies such as deciding what quantities to be produced in a crop season, how much to be sold at the prevailing price and how much to be kept until later to make the most out of the market. A lack of reliable market information, for example, may be recognized as one of the key factors restraining farmers from accessing market opportunities. In the absence of easy access to accurate, timely and reliable market information, farmers in total may either over-produce or under-produce what is required of the market. They may in some situations, hold on to their inventory for far too long and lose out on profitable market opportunities that may exist.

As outlined earlier, the top 18.1% farmers in terms of operation size produce roughly 82.4% of the market value of output in Saskatchewan (Statistics Canada, 2011) and they obviously have significant impact on the agricultural sector in the province. Yet, it is uncertain where these farmers get their market information for making production and marketing decisions. The question addressed in this study is where do farmers in Saskatchewan get their market information? The objective of this study is to investigate the sources of market information available to farmers in Saskatchewan and to assess the usefulness of these information sources. As part of the objectives of this research project, the adequacy of information obtained from the Market Prospects program of the University of Saskatchewan, aired on CTV as part of their *Farmgate* program is evaluated.

1.4 Objectives of the study

(i) Evaluate the effectiveness of the Market Prospects program in terms of approval and use by the target audience of Saskatchewan farmers. Effectiveness is measured in terms of the usefulness of the information obtained from the various sources to the needs of the farmers.

(ii) Determine the usefulness of market information sources for farmers in Saskatchewan.

1.5 Research question

Accurate and relevant information from a source that the user has reasonable confidence in is indispensable in the efficient management of a business. Given the substantial risks faced by farmers in terms of weather, diseases, available markets and prices, farmers in Saskatchewan depend on timely, accurate and relevant information in their business. However, with so many different sources of information available to farmers, it is unclear where Saskatchewan farmers obtain their information to make marketing and production decisions. The fundamental research question addressed through this study is: where do farmers in Saskatchewan, especially the large-sized ones, get their market information? Are the various sources available to the farmers able to meet their needs? Is the Market Prospect program on CTV *Farmgate* meeting the objectives for which it was instituted?

1.6 Justification of the study

Farmers' information needs have greatly increased in the last half century because of unstable markets, sophisticated production technologies, and increased need to have effective financial planning and control. Recent technological advancements in agricultural production have necessitated increased output with minimal resources and it is now imperative that farmers take steps to study the market in order to manage output and sales to maximize net returns. The ability to study the market and to make the most out of the market depends on accurate and timely market information available to the farmer. By knowing the most important sources of information to the farmer through studies of this nature would enable farmers to improve the returns that they get from their investments since they would get to know the current situation on the market and all things being equal, react appropriately. For example, a study conducted by Shepherd & Schalke (1995) in Indonesia found that farmers rely heavily on radio broadcast of prices to aid their negotiations with farm gate traders or

collectors in selling their produce. Farmers use the reported numbers as the basis for their initial pricing of their produce. The study also reports that a short time after the introduction of market information service, farmers who had knowledge of the reported prices obtained higher prices for their produce compared to those who did not. This presupposes that having timely and reliable information sources can greatly influence financial outcomes of farmers.

Similar to what pertains in Indonesia, the objective of farmers in Saskatchewan is to be able to maximize the returns on their investment. If the local or provincial governments are able to identify the source of information usually used by Saskatchewan farmers, not only will it go a long way to help in channelling relevant information to the farmers at a relatively lower cost to the government, but also help the farmers to make informed decisions on production and marketing, which in turn will impact the profitability of their operations.

Also, input suppliers would benefit from this research since insights gained would help input suppliers to be more efficient in their strategies to market their products and at the same time better meet the needs of farmers. For instance, a study, conducted by *AgriMarketing,* a magazine in the United States, notes that agricultural input suppliers spent as much as $147 million in print advertisement, $98 million on farm trade shows, $64 million on direct mail advertisement and $60 million on radio advertising (AgriMarketing Magazine, 1998). Knowing the main sources, from which farmers get their information, would make it cheaper for these suppliers to market their products because they would have limited media to target in terms of advertisement spending and still achieve the desired results they seek. Likewise, new information relating to farming can be passed on to farmers at minimal cost and likely have the desired impact.

Lastly, policy makers stand to benefit from a study of this nature by getting to know the information needs of farmers in order to come out with policies and programs aimed at meeting such needs, which in turn lessen transaction costs of farmers and improve profitability.

1.7 Organization of the study

Chapter one encompasses the description of the background to the study, the desired objectives of undertaking the research project, the research question to be answered, justification of the study as well as how the research report is organized. A review of the

relevant literature is presented in chapter two. The first section of the chapter presents an overview of agriculture in Saskatchewan, which focuses on the type of farming and the crops and livestock involved. The second section of the chapter is devoted to discussion of the Market Prospects program on CTV and the reviewed literature follows. The methodology used in collecting data, description of the source and type of data used as well as the econometric approach used in analyzing data follows in chapter three. Data analysis and discussion of the results obtained is presented in chapter four; while chapter five concludes with the summary, conclusions, and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Commercial farmers receive information from different sources including telephone contacts, farm magazines, newspapers, newsletters, consultants, and local dealers of agricultural inputs, manufacturers of agricultural inputs, radio, television, the Internet, market presentations at conferences, and many other sources for the purpose of making informed decisions about their farm business (Ford & Babb, 1989; Gloy et al., 2000; Mittal & Mehar, 2013). There have been studies discussing the various sources that farmers use when they are looking for information to help them make decisions on their farm (Batte et al., 1990; Ford & Babb, 1989; Gloy et al., 2000; Patrick & Ullerich, 1996). The purpose of this chapter is to highlight a few of such studies found in the literature. One of the sources from which Saskatchewan farmers gather information relevant to their farm businesses is Market Prospects, which is a segment within the Saskatchewan *Farmgate* program on CTV, aired prior to spring planting season. The first section of this chapter discusses overview of Saskatchewan agriculture and the Market Prospects program.

2.2 Overview of Saskatchewan agriculture

Agriculture contributes significantly to the Saskatchewan economy and makes up a significant portion of the total exports of the province. The sector contributes billions of dollars to the province's economy each year. For instance, in 2015 the gross farm receipts were $13.8 billion (Statistics Canada, 2017c). With a relatively small population and large farmlands, the province has the space for farming on a large scale. It has subsequently earned for itself the accolade the breadbasket of Canada, according to the 2016 Census of Agriculture (Statistics Canada, 2017). There are about 34,523 farms in the province, according to Statistics Canada, 2016 Census of Agriculture with grains, oilseeds, and cattle dominating the sector. The majority of the farms in the province remain family-owned and operated and are often handed down from generation to generation.

2.2.1 Crop production

In 2015, Saskatchewan produced 99% of Canada's chickpeas, 94% of lentils, 85% of durum, 84% of flaxseed, 74% of mustard, 56% of oats, and 51% of canola (Saskatchewan Ministry of Agriculture, 2017b). The province accounted for more than 40% of the total field crop acreage in Canada with a share of 36.7 million acres, more than Alberta and Manitoba combined (Statistics Canada, 2017). The two largest field crops produced in the province in

terms of area is canola and spring wheat (excluding durum). Saskatchewan joined confederation on September 1, 1905. The first census year in which the province was included in the survey was in 1911. There were 95,013 farms reported and 28.1 million acres of farmland. Wheat and oats for grain were the largest field crops accounting for 5.3 million acres and 2.3 million acres respectively. The province is still the largest producer of wheat and canola and the leading producer of field crops in Canada, representing 46.8% of national field crop area in 2016 (Statistics Canada, 2017b). Other field crops that are heavily produced in the province include oats, barley, pulse crops – lentils, chickpeas, beans, and peas; oilseed crops – canola, flaxseed, sunflower, and mustard. In fact Canada is the largest producer of canola globally, and in 2016 Saskatchewan accounted for 53.7% of Canadian canola area (Statistics Canada, 2017c). Horticulture which includes garden crops, and fruits are also popular in the province. In Saskatchewan, the main horticultural products are small fruits and vegetables including potatoes.

2.2.2 Animal husbandry

The livestock industry in Saskatchewan is a big one with farmers keeping different types of farm animals. The province has over six million hectares of pastureland and large quantities of high quality feed, making it an ideal place for livestock development (Saskatchewan Ministry of Agriculture, 2017b). In Saskatchewan, the main livestock industries include beef, pork, bison, sheep, and goats. Rearing of cattle is the most dominant activity in the livestock industry in the province. According to the 2016 Census of Agriculture, beef cattle production in Saskatchewan is only exceeded by Alberta in Canada. In recent times, deer, and wild boar has opened up a new food industry. Chicken and egg production, geese, ducks, and turkey production has also been part of the livestock industry.

According to the Saskatchewan Ministry of Agriculture, the value of agriculture and food exports in 2016 amounted to about $14.4 billion (Saskatchewan Ministry of Agriculture, 2017). Table 2.1 depicts the total number of agricultural operations by the type of operation in the province. Considering the contribution of agriculture to the province's economy, it is necessary that the needs of the farmers with regards to information be provided.

Table 2.1 Total number of agricultural operations by operation type for Saskatchewan

Operation type	Number of operations (thousands)
Oilseed and grain	21,505
Beef	7,167
Other crop	3,428
Other animal	1,642
Sheep and goat	159
Greenhouse and nursery	159
Dairy	120
Vegetable and melon	115
Poultry and egg	101
Fruit and tree nut	90
Hog and pig	37

Source: CANSIM table 004-0200

2.3 Background of Market Prospects

The Market Prospects program is an initiative of the Department of Agriculture and Resource Economics of the University of Saskatchewan. The stated aim of the program is to disseminate high quality and timely market and related information, analysis and education to farmers in Saskatchewan using mass media. Originally transmitted via satellite television, a partnership with CTV Saskatchewan's weekly farm program, *Farmgate*, with its large viewing audience, has been the principal mode of transmitting the Market Prospects series to its primary target audience of Saskatchewan farmers for many years. In recent years, the posting of interviews on an Internet website (*marketprospects.usask.ca*) and on YouTube has expanded the potential audience both within the province and globally. In addition to television and Internet dissemination, the Market Prospects project has also used public seminars and other electronic media such as DVDs to reach its intended audience.

Apart from the primary audience of Saskatchewan farmers, the information shared on Market Prospects is available to the entire prairie agricultural industry and to the general public. Past evaluation of the quality and effectiveness of the Market Prospects program and analysis of the profile of its primary farmer audience has been informal, based on the number of viewers for CTV's *Farmgate* program during the periods when Market Prospects is aired (http://en.numeris.ca/media-and-events/tv-weekly-top-30); the number of people who visit the Internet site and watch the YouTube postings; interaction with farmers, other agricultural professionals, and the general public at trade shows and conferences; as well as funding

support from a broad range of agricultural organizations, particularly from producer groups in recent years.

After almost two decades of hosting the *Farmgate* program and for that matter the Market Prospects segment, Bob Simpson has retired. With his exit, the Market Prospects on CTV has also come to an end. Nevertheless, it is important to find out from the farmers if the program has provided them with information that they needed in their businesses as originally intended.

2.4 Review of relevant literature

According to Jones (1990), before the Internet came into being the majority of agricultural information available to farmers in the United States at the local or state level was found largely in the colleges and universities. These sources of information were in response to the specific agricultural conditions of the immediate environment of these colleges and universities. The colleges and universities conducted applied research to aid in the development of the agricultural sector in their catchment areas. Jones (1990), states that the seventy-two land-grant universities and colleges in the United States, further fifty-three state universities and twenty-four system administrative offices together characterized the bulk of research information and other resources for agricultural development. These institutions had units that provided extension services through bulletins, reports, journals, conference proceedings and other publications. These publications served as the main sources of information to the local farmers as well as other farmers who may be interested across the country. At the national level, much of the sources of information to farmers could be obtained from the government through national research organizations and other institutions involved in agricultural research. Now, although these institutions continue to provide information to farmers, much of such information is housed on the Internet. For example, publications by the United States Department of Agriculture (USDA) and the Economic Research Service provide vast amounts of agricultural information to farmers and other interested parties through the Internet.

In general, discussions about farmer attitudes towards specific sources of information have been varied in the literature with different authors having different conclusions. For example, Ortmann et al. (1993) observed that information from the agricultural salesperson do not have any significant influence on farmers decisions on production. But Ford & Babb (1989) and Schnitkey et al. (1992) had earlier on found these salespeople to be important

information sources for production decisions. Ford & Babb (1989) also found that farm magazines are popular information sources for farmers, but added that large commercial farmers prefer personal, service-oriented information relative to written information. The conclusion by Ford & Babb (1989) stands in opposition to the study by Schnitkey et al. (1992) who found Ohio commercial producers to prefer written information.

There have also been a number of inconsistencies in the literature with regards to the factors that influence farmers' attitude toward specific information sources. Gloy et al. (2000) surveyed 1,742 farmers to know their opinion on the usefulness of information received from different sources and to identify factors that underline differences in their opinions on these sources. They found that farmers' age and education do not have a statistically significant influence on farmers' attitude towards information sources and that each information source has its own target audience, although other previous studies found statistical significance (Ford & Babb, 1989; Schnitkey et al., 1992). However, the conclusion of Gloy et al. (2000) is consistent with earlier studies by (Foltz et al., 1996; Ortmann et al., 1993; Pompelli et al., 1997). Farm size was also found to be a factor influencing attitudes of farmers towards information source and the use of those sources in studies by (Foltz et al., 1996; Ford & Babb, 1989; Ortmann et al., 1993; Schnitkey et al., 1992).

Gloy et al. (2000) observed that each information source has different appeal to different farmers and that each source has benefits to some producers. They found a positive relationship between perceived usefulness of a source and the number of crops produced by the farm. For instance, farms that produce multiple crops at the same time are more likely to view a variety of sources positively than farms that produce fewer crops. Internet use was also observed to have a positive relationship with perceived usefulness. Gloy et al. (2000) found that use of the Internet increases the probability that a farmer would view online source of information as useful. The authors also observed that crop/livestock specific publications and general farm magazines were the preferred sources by the majority of the farmers studied with direct mail having a narrower appeal to farmers. In another development, crop farmers were found to favor most sources than their counterparts in livestock farming. Factors like farm size, education, and age were found to have very little influence on perceived usefulness of an information source. However, if farmers were utilizing precision farming, they were more likely to evaluate the local dealer and manufacturer salespeople as useful sources of market information. The authors conclude that factors that influence information source preferences

are specific to the type of farming in which farmers are engaged and it is important to search for factors that might influence preferences (Gloy et al., 2000).

Zanello & Srinivasan (2014) explored how different sources of information and communication technologies affect the flow of market information to farm producers in a developing country context, with a focus on the role of mobile phones and radio. They used a data set that include information on the quantity and quality of price information for individual transactions made by farm producers and regressed the quantity and quality of information on the sources of information accessed and the technology used in accessing the information. The authors report that different source of information and the use of mobile phones and radio has had an impact on the quantity and quality of market information available to producers. They assert that the use of mobile phones and radio together increase the quantity and quality of price information to farmers by 30%. They define the quantity of price information as the number of prices from different markets that the seller had obtained at the time of the sale. The quality or reliability of price information is an ex-post indicator of whether the price realised in the transaction was greater or less that the expected price before the sale. The source of information is considered reliable if the realized price matched the expected and unreliable otherwise.

Zanello & Srinivasan (2014) found information flow from neighbors to increase the quantity of price information obtained, but this information was unreliable. They found evidence that farmers have stronger belief in extension agents than any other source of information. The authors conclude that although radio and mobile phones have greater impact on the quantity of market information obtained, the source of the information is more valued than how the information is transmitted, in terms of the quality and reliability. They also found that radio and mobile phones are particularly useful in increasing the quantity and quality of market information available to farm producers. And that radio and mobile phones provide them with a broader knowledge of current market developments for their production. The authors recommend that there are more gains to be received by integrating information technologies in the training of extension officers to provide farmers with more prompt and updated market information, which will have a positive impact on their welfare.

Mittal & Mehar (2013) used a survey to study 1,200 farmers in the Indo-Gangetic Plains of India to identify the information that they need and the network they build to manage risk in production and marketing of maize, wheat, and rice. They also sought to

analyze the factors that influence the choice of information source by farming households. They also analyzed the extent and potential benefit to farmers of mobile phone use to access agricultural information and their perception towards increased use of mobile phones to manage production and marketing risks. Respondents were asked to express an opinion on accessibility, relevance, reliability, and frequency of use and timeliness of information sources they use in their operations.

The authors grouped the 17 sources that they found farmers were using to access information into four categories (1) face-to-face interaction, (2) other farmers, (3) traditional media, and (4) modern information and communication technology (ICT). A multivariate probit model was used to determine the relationship between socioeconomic background and farmers' preference of an information source. Their model suggested that large farm size; better education and large number of crops grown are associated with increased likelihood of a farmer accessing information from more modern source of information. More than 90% of the respondents interviewed said other farmers in their own village or villages around them were the most reliable and accessible source of information.

They also found that although farmers had access to multiple sources of information, they were unable to state emphatically that one particular source was more useful or timely than another. They conclude that evaluation of usefulness of information sources are varied, especially with regards to ICT sources and that although mobile phones, as an information source, play a vital role in bridging the information gap, they cannot replace or substitute the pivotal role that face-to-face interactions play in delivering reliable and timely information to farmers in the region.

Besides the sources mentioned above, farmers also get information from friends and colleagues who are in the same business and can share market and other information among them. This was the conclusion reached by Conley & Udry (2010) in a study of new fertilizer technology adoption behavior of farmers in Ghana. They observed that technology adoption in social circles was stronger among farmers with similar features such as farm size, age, education level and crops cultivated compared to farmers with dissimilar characteristics. Conley & Udry (2010) emphasized the impact of information received from a neighbor or other farmers. Unlike Ghana where communal living is embedded in the culture, the Saskatchewan society is more individualistic so what works in Ghana might not necessarily

work in Canada. Nonetheless, it will be important to investigate the effect that other farmers have on the information choices of farmers.

Ford & Babb (1989) analyzed sources of information used to make farming decisions. They used data from 2,537 large farmers from Indiana, Iowa, Illinois, and Georgia. Their study examined the relationship between sources of information, farm, and farmer characteristics. Their study showed that other farmers and farm magazines were the most consulted sources; and that the county extension agent was rarely consulted. They found that when it comes to marketing of grains, the preferred source of information differ in each region. Illinois farmers favored commercial newsletters; Iowa farmers preferred using cooperatives; Indiana farmers favoured private firms, while Georgia farmers use mostly commodity brokers as their source of information for grain marketing. They also found that farm size have a positive relationship with the usefulness of market information gathered through personal contacts because salespersons can provide unique information relevant to the large farm operators and therefore are more useful to these operators than general information to all farmers. The implication of Ford & Babb (1989) is that farmers' preferences for information sources are not homogeneous and that they do differ depending on the type of crop or the location of the farmers.

Opara (2008) used responses from a sample of 1,386 farmers in Imo state of Nigeria to answer two questions (1) what are the sources of agricultural information available to farmers in Imo State? (2) What are the preferred sources for agricultural information provision? He used a stratified proportionate sampling technique on 34 farm blocks and 63 farm cells within the Agricultural Development Program zones of the state and used descriptive statistics to analyze the data. He found that many of the farmers, (88%) received agricultural information through extension agents. Radio and television were less popular although many of the respondents acknowledged having specialized radio sets from which agricultural information is disseminated to them.

Idachaba (1980) as cited in Fawole (2008), stressed the importance of dissemination of information in easily understood forms by farmers to have a positive impact on pineapple production in Nigeria. According to Fawole (2008), an increase in pineapple output is associated with the channel or the form through which farmers received their information. If the information received is in a form that is easily understood by farmers, production increases and vice versa. Ucheagwu (1985) also conducted an adoption of new farming

technology study and found out that if the information of such a technology is in a form that is understandable and accessible to the farmers, adoption is easy compared with if there is no available information on the new farm technology. The aim of the study was to determine the factors that influence producers' preferences for alternative sources of precision farming information.

Fawole (2008) has noted, Information transmission to pineapple farmers in the remote areas is an important part of the call for adoption of innovations and agricultural development. The usefulness of sources and frequency of agricultural information availability then become of vitally important, if any meaningful development is to be achieved. Information sources may also have related linkages to the utilization of information essential in packaging and adapting information for local applicability (Fawole, 2008). He finds that farmers main source of information are radio, television and other colleague farmers and less use of newspapers as a source of farm information. The study concludes that four demographic characteristics namely age, gender, marital status and educational attainment influence pineapple farmers' sources and use of information and that while gender is significantly related to agricultural information usage, education and farming experience are associated with pineapple farmer's interaction with extension agents. The study further states that as farmers' education level improves, they are more likely to source and use information. This conclusion stops short of the preferences that are expressed by the farmers through frequency of usage.

Asogwa et al. (2012) used primary data collected from 150 soybean farmers in the Benue State of Nigeria to examined agricultural marketing information usage among soybean farmers. They found that the most important sources of agricultural marketing information are mainly through other soybean farmers, family members, neighbors, and farmer's co-operative organization and extension agents. They also found that other soybean producers, family, neighbors, farmer co-operative society, and extension agents were evaluated as highly useful sources of information to the farmers. These same factors together with off-farm employment significantly influence the probability of producers evaluating their agricultural marketing information as adequate. Asogwa et al. (2012), advocate that extension agents be moved to where farmers are residing to ease accessibility and to adopt other methods of information dissemination being used to convey information to farmers in a way that farmers would easily understand the message and the marketing information being communicated to them.

Agricultural technology has evolved over the years in a way that has led to dramatic improvements in productivity. Developments in agriculture, for example, precision agriculture, farm management software, and affordable sensors all within reach of even the smallest farmer today has impacted farm productivity and profitability as did irrigation systems, tractors and other mechanical innovations in the 19th and 20th centuries. In this age of information explosion due to the advent of computers, mobile phones and the Internet, farmers can source timely information through multiple channels. The various channels through which farmers can source information have been put under four main categories (Mittal & Mehar, 2013). These categories are personal, traditional media, modern ICT, and other farmers. It is very easy to assume that farmers would turn to the use of internet for their information needs due to easy accessibility and availability, especially in the advanced countries. This might not always be the case. For example, farming activity in the Perth region of Australia is a very important one for the country. In the 2009/2010 agricultural years, there were 1,511 agricultural firms cultivating roughly 487,000 hectares. Per a release by the Australian Bureau of Statistics, 33% of farmers in the Perth region alone get their information from the Internet, 39.8% of farmers use it to get their information across Western Australia. As high as 47.5% and 47.1% of the farmers source their information from agricultural media and other farmers respectively (Kininmonth, 2011). Understanding where farmers get their information is important to formulating any communication strategy and associated plan.

An improved flow of market information has the potential to significantly improve access to markets and reduce, if not remove, impediments to market participation because of lack of well-developed and functioning transportation infrastructure (Aker & Mbiti, 2010). If farmers have access to prompt and reliable market information, it can potentially improve their ability to negotiate better trade deals with their trading partners to get better prices for their products and significantly reduce their transaction costs in general, which will help in improving returns on their investment. On the other hand, the lack of reliable market information may serve as a hindrance to farmers in terms of high transaction costs. If a farmer relies on inaccurate historical information that is not relevant to the current market situation to take decisions, he might not realize the full potential returns that he stands to gain from the sale of his or her products.

Patrick & Ullerich, (1996) explored whether large-scale farm operators, professional farm managers, and agricultural bankers hold similar views when it comes to sources of information. They investigated the importance of different sources of information for production, marketing and financial decisions. The three groups were asked to rate the sources of information on a five-point Likert type scale of 1 for low and 5 for high. All three groups rated more sources of information above 3 for production decisions compared to marketing decisions. Again, all three groups of respondents rated nine or more sources above the mid-point for production decision-making, but none of them rated more than three sources above the mid-point for financial decision-making. The large farm operators, farm managers, and bankers indicated that internal sources of information are more valuable to them than external for decision-making. These internal sources include employees for farm operators, tenants for farm managers and borrowers for agricultural bankers. The large-scale farmers did not regard other colleague farmers as a valuable source of information contrary to the other groups and earlier studies, for example (Batte et al., 1990; Ford & Babb, 1989). These studies found technical consultants to be an important source of information to farmers rather than their colleague farmers. Some of the sources of information considered following the work of Rogers (1961) were interpersonal communication channels such as tax preparers, salesmen, marketing consultants, attorneys, specialized farm magazines and general information sources such as agricultural farm magazines, radio reports, television reports, and extension agents and so on. The general conclusion drawn by Patrick & Ullerich (1996) is that geographic and firm specific information sources are more important in production and financial decisions while market reporting services together with firm level records are paramount in marketing decision making (Patrick & Ullerich, 1996).

In summary, previous literature underscored the crucial role that information plays in the production and marketing of agricultural products. It appears that the sources of agricultural information available to farmers are many and varied. Depending on the location whether developing or developed countries, the type and number of crops that farmers produce, and the circumstances unique to farmers, different sources of information are preferred and used. In the context of Saskatchewan farmers, it is unknown which of the sources are used or preferred and whether or not the characteristics found to be important in influencing farmers' preferences still hold true. It is important, therefore, to investigate these sources to ascertain the true preferences of Saskatchewan farmers

CHAPTER 3: DATA COLLECTION AND ANALYTICAL METHODS USED

3.1 Introduction

In this chapter the theoretical framework within which the research is undertaken as well as the sources of data and data collection method used in undertaking the empirical study is discussed. Next the variables used in the final model and their expected relationships as well as other variables of interest are also defined and described in detail. The econometric methodology employed in analyzing the data as well as the expected relationships of the variables are discussed.

3.2 Theoretical framework

The theory of consumer behaviour explains consumption patterns of consumers of a product or service using the concept of utility. Utility is the satisfaction the consumer gains from using a product or service. Utility maximization models are based on the assumptions of rational consumers making the most value out of their limited resources. Consumers have a budget constraint because their individual resources are limited in supply. They also are assumed to have clear preferences in the consumption of goods or services. Thus, they are aware of the utility they derive from each incremental unit of the good or service, and that every product or service has a price tag. The rule of utility maximization is that consumers allocate resources such that the marginal utility per dollar spent on one good or service is the same as the marginal utility per dollar of another good or service. So long as the marginal utility per dollar of one good or service exceeds that of another, the consumer will derive more satisfaction from the good or service whose marginal utility per dollar is high and will consume more of that commodity or service.

Farmers' utilization of information from different sources is akin to the consumption of any regular good or service. Farmers commit resources (energy, time, money, equipment), which are in limited supply and as such serves as a constraint in seeking information. Fortunately, these information sources provide satisfaction or utility to the famers if the source in question provides useful information needed to run their farms. The source of information that provides the most satisfactory information relative to the amount of resources expended on it, are used most often by farmers to make decisions. Data from a cross-section of Saskatchewan farmers is used to determine their information source preferences and to determine the factors that influence their preferences.

3.3 Sampling and data collection methodology

Information used in undertaking this research was obtained through a survey. Two types of surveys were conducted – (a) one-on-one telephone interview of farmers and (b) an Internet survey. Telephone calls were made to randomly selected farmers from proprietary farmers database (Insightrix Research Inc. database) to answer questions about their farm operations and other farmer demographic characteristics (see Appendix E). Due to logistical and financial constraints, it was decided that majority of the respondents should come from the Internet survey since it was relatively cheaper and can be conducted in a short period of time. While not randomly chosen, the telephone interview may respondents have been found to match population parameters (age, education, farm gross sales).

A structured interview schedule based on the objectives of the study was used to collect data from the sampled farmers. Pretesting of the questionnaires was done using selected students from the University of Saskatchewan who are children of farm operators or are engaged in farm operations themselves and are part of the management. Key consideration during the development of the questionnaires was respondents' involvement in the day-to-day management and decision-making on the farm business. If a respondent indicated that he or she was not involved in management decisions, responses from such a respondent was not included in the analysis.

The University of Saskatchewan contracted Insightrix Research Incorporated, a private marketing research company, to administer the survey for the study. Insightrix did implement the sampling procedures and actual questionnaire administration. Data collection took place between Thursday February 16th 2017 and Sunday March 12th, 2017. In total, 600 completed survey responses were obtained consisting of 513 online via a unique link emailed to respondents and 87 by telephone via Insightrix call centre in Saskatoon. While the majority of responses were collected online, telephone data collection was implemented in order to target larger farms. The number of cultivated acres and gross sales from last year's production were used to set qualification for inclusion in the random sampling of farmers with an emphasis toward larger farms. If a respondent was randomly chosen to be included in the telephone interview and the farmer indicated his or her cultivated acres were below 3,520 acres, that farmer was not included in the telephone interview sample.

In order to ensure representativeness of Saskatchewan farms, western Canadian farmer list was utilized, which includes a random representative cross-section of farms in the province. In total, Insightrix farmer list includes 12,525 farmers in Saskatchewan and covers a representative distribution of farm sizes as well as a mix of farm types. A total of 600 respondents were interviewed, but the analysis is based on 577 due to missing observations.

3.4 Data analysis

The analysis begins with descriptive statistics such as frequency tables, bar graphs and pie charts, contingency tables and other measures of central tendency to summarize the data to identify the distribution and patterns of the variables involved. Following the descriptive statistics, a probit regression is used to analyze the usefulness of market information provided to farmers through the various sources such as e-mail newsletters, television discussion programs (e.g. Market Prospects), radio talk shows, marketing information websites and the other sources of market information. A probit model is a type of regression where the outcome variable is binary (success or failure) denoted by zeros and ones; for instance, whether a farmer applied fertilizer on his farm or not. The basic underlining purpose of the probit regression model is to estimate the probability that an observation with certain features will fall into the success category. It is mostly used when the categories of the outcome variable are ordered or binary. The coefficients of the model are usually estimated by maximum likelihood employing the probit link function.

In this study, a set of independent variables are used to predict the probability of an individual farmer evaluating a particular source as either useful or not useful given the characteristics of that farmer, such as age, his or her level of education, farm size and whether the farmer uses farm technology in his or her operations or uses the Internet to search for market information. A more elaborate justification of the method is presented under econometric model.

3.5 Variable specification and expected relationship

The age of respondent (*age*) is measured in years at the time of the survey. The age of respondents ranges from 19 to 91 years with a mean age of 53 years. A decision maker's need for information is impacted by age. According to a study by Schnitkey et al. (1992) and Mittal & Mehar (2013), age is related with experience and that as a farmer gains more experience his demand for information from outside sources should be less. However, Gloy et al. (2000) observed that age is generally unimportant in explaining information preferences.

In the current study, six of the information sources in this study (crop specific publication, direct mail/email newsletter, general farm publications, radio, television, marketing information websites) can be characterized as media sources and four as personal sources (extension officers, telephone call/text, social media, other farmers). Schnitkey et al. (1992) states that acquiring information from the media sources requires some form of individual investment in information retrieval and interpretation of such information on the part of the farmer. As farmers get older, they may find such investment of time and energy in information retrieval and interpretation undesirable relative to younger farmers. Consequently, it is expected that age would have an inverse relationship with information received from media sources, following the experience argument. On the other hand, Kool et al. (1997) found that input suppliers were more likely to have established relationships with older farmers and that if farmers value information received through these relationships, then it is more likely that age should have a direct relationship with usefulness of information received from personal sources.

The level of education attained by the respondent *(educ)* is a categorical variable with four levels. The category of those who have had either no school or other type of education is the reference category. Those with high school education, university education, and those with graduate school education are the other categories. The reason for the inclusion of education as a determinant of the usefulness of information source is that higher levels of education is expected to have a positive relationship with usefulness of information received from all sources. As people attain higher levels of education, their ability to process complex information or to seek information from varied sources also increase. As such, higher levels of education should impact evaluation of farmers about the usefulness of information received from different sources positively. Farmers who have had higher education are more likely to view modern sources of information as useful compared to farmers with little or no formal education.

The gross sales revenue from farm business in the previous year including program payments (*grossales)* is a categorical variable with four levels. However, the first two levels are combined in the final model for parsimony. The reference category is those farmers with less than $0.75 million (the first two categories). The other categories are farmers with last year's gross sales of $0.75 million up to $1 million, and those with more than $1 million. Gross sales from previous year are used as a proxy for farm size.

The focus of this study is to get an idea of how the size of operations influence where the operator looks for market information. As such, we model the probability of a farmer evaluating a particular source of market information as useful given that he or she is a manager of a large farm. Large-size farmers in this study are farmers who earn more than $500,000 in gross sales from the previous year. Farm size is expected to have a positive relationship with usefulness of information from both media and personal sources. Ford and Babb (1989) found a positive relationship between farm size and usefulness of information received from personal sources. One of the reasons why farm size is expected to have a positive relationship with usefulness of information from personal sources is in regard to salespeople. Salespeople tend to provide customized or operation-specific information, which is seen by farmers as more valuable to them and their operations than non-specific information. Moreover, sales people are more likely to call on operators of large-sized farms than on small-sized farms for economic reasons and as they are seen as providing more valuable information to farmers, it is expected that farmers will more likely view information provided through personal sources useful.

The variable (*drone_use)* is a proxy for whether the farmer is highly innovative and uses modern farm technology such as precision agriculture and drones for monitoring. The use of modern technology should also impact information preferences of farmers. Modern technologies such as precision farming are more complex than the use of other simple and straightforward technologies that has been used in the past. Farmers are more likely to seek help about implementation of such technologies. As such it is expected that the use of precision farming technologies will be positively related to the usefulness of information received from personal sources as opposed to general sources. Implementers of such modern technologies are more likely to seek information from manufacturer technical specialist and salespersons as well as local dealer sales and technical people. Some media sources such as farm magazines also carry valuable technical information, therefore it is expected that there will be a positive relationship between the use of precision farming technologies and the usefulness of information from both personal and traditional sources. Forty-six respondents indicated that they use drones in their operations during the survey.

The last independent variable, (*internet_use*), is also dummy variable coded as 1 if the respondent uses the Internet to look for market information and 0 otherwise. The use of the Internet is also expected to influence farmers' evaluation of the usefulness of information. If

a farmer uses the Internet it is more likely that he or she uses it to collect product and market information (Gloy et al., 2000). Therefore, the use of the Internet is expected to increase the probability that farmers receive useful information from all sources. On the other hand, Internet users might consider information from the Internet as a substitute for information received from media sources. In that regard, Internet use is expected to have a negative relationship with information obtained from media sources. However, it is difficult to substitute Internet information for information received from personal sources. In actuality, the Internet is used to communicate with suppliers and other farmers. Thus, it is expected that Internet use would have a positive relationship with the usefulness of information received from personal sources.

3.6 The econometric model

Empirical studies in economics sometimes encounter situations in which the economic variable being analyzed has a discrete choice among a set of alternatives, in which case the optimum cannot be estimated with regular calculus methods. This is in contrast with situations where the outcome variable is continuous and calculus methods can be used to estimate the optimum by first order conditions. Thus, instead of estimating 'how much' in the case of a continuous response variable, we identify 'which one' when it comes to discrete response variables.

There are two kinds of qualitative response models. The first is when the choice to be made is between two alternatives and the second is when the alternatives or categories are more than two. If the choice to be made is between two alternatives of the response, a binary choice model is identified. This model endeavors to describe, explain, and predict choices between two discrete alternatives, such as whether a cancer patient received chemotherapy treatment or not. When the alternatives are more than two, a multilevel or multinomial choice model is appropriate such as models that are used to predict the type of transportation system an individual will choose to go on vacation (road, rail, air, water).

The discrete choice models are further categorized into two groups. Ones that are meant to deal with ordered responses, for example, people's opinion on some legislation can be strongly opposed, opposed, neutral, support and strongly support; and ones that are meant to deal with unordered responses, such as students choice as to which program of study to belong, for example, Arts, Business, Sciences and so on. In situations where the dependent

variable has only two categories, logit/probit regression models can be used to empirically ascertain the likelihood of a choice being made or belonging to a particular category.

A probit regression model is employed in this analysis because the dependent variable has two categories (Amemiya, 1985; Greene, 1997, 2012; Johnston, 1997; Verbeke et al., 2000). The objective is to model whether a source of information provides information that is useful to farmers. The evaluation of the usefulness of sources of information and the attributes of the farmers are statistically related. The probability that a farmer evaluates a source of information as useful or not are estimated as well as how farmers' choices change based on changes in the demographics. The next section summarizes the general aspects of the model to ease understanding of the coefficients that is estimated.

3.7 Conceptual framework of the probit model

We have a binary dependent variable Y which takes values 1 if an event happens and 0 if it does not happen and we also have a vector of independent variables X which are assumed to influence the dependent variable Y. Specifically, the information sources have been recoded to have two outcomes, either the sources provide useful information or they do not, which is denoted as 1s and 0s. Mathematically, the probit model is stated as follows:

$$P(Y = 1 \mid X) = \Phi(X^T\beta), \quad (1)$$

Where P denotes probability, and Φ is the cumulative distribution function (CDF) of the standard normal distribution. The parameters β are typically estimated by maximum likelihood.

It is possible to state the probit model in terms of a latent variable where we suppose there exists an auxiliary random variable

$$Y^* = X^T\beta + \varepsilon, \quad (2)$$

In this case ε is assumed normally distributed with mean zero and constant variance.

Y^* = a continuous real-valued index variable for observation *i* that is unobservable, or latent.

$x_i^T = (1\ X_{i1}\ X_{i2}\ \ldots X_{ik})$, a 1×K row vector of regressor values for observation i.

$\beta = (\beta_0\ \beta_1\ \beta_2\ \ldots\ \beta_k)^T$, a K×1 column vector of regression coefficients.

$x_i^T\beta$ = a 1×1 scalar called the index function for observation *i*.

Then the observable outcomes of the binary choice problem is represented by a binary indicator variable Y_i that is related to the unobserved dependent variable Y* as follows:

$Y_i = 1$ if $Y_i^* > 0$ and $Y_i = 0$ if $Y_i^* \leq 0$ and the conventional binary dependent variable model would be specified as:

$$Y_i^* = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots + \beta_k X_{ik} + u_i , \quad (3)$$

where u is an independently and identically normally distributed random error term for observation *i*.

3.8 Model estimation

3.8.1 Maximum likelihood estimation

Suppose that a dataset contains *n* independent statistical units then their joint log-likelihood function is:

$$\ln L(\beta, y) = \sum_{i=1}^{n} \left[y_i . \ln \Phi(x_i^T \beta) + (1 - y_i) \ln \Phi(-x_i^T \beta) \right] \quad (4)$$

To estimate a probit model, we maximize the log likelihood function. The estimator $\hat{\beta}$, which maximizes this function, will be consistent, asymptotically normal and efficient provided that E [XX'] exists and is not singular. It can be shown that this log-likelihood function is globally concave in β, and therefore standard numerical algorithms for optimization will converge rapidly to the unique maximum. In order to get the score function, which is the gradient of the above function, we take the derivative of the log-likelihood function above.

$$S(\beta) = \nabla_\beta \ln L(\beta, y) = \frac{\partial \ln L(\beta, y)}{\partial(\beta)} \quad (5)$$

$$=\sum_{i=1}^{n}\left[y_i \frac{\varphi(x_i^T\beta)}{\Phi(x_i^T\beta)} x_i + (1-y_i)\frac{\varphi(-x_i^T\beta)}{\Phi(-x_i^T\beta)} \right] \tag{6}$$

$$=\sum_{i=1}^{n}\phi\left(x_i^T\beta\right)\left[\frac{y_i}{\Phi(x_i^T\beta)} - \frac{(1-y_i)}{\Phi(-x_i^T\beta)} \right] x_i \tag{7}$$

Noting that $\frac{d}{dx}\varphi(x) = -x\varphi(x)$, we differentiate the score function again with respect to the β to obtain

$$\begin{aligned}\nabla_\beta^2 \ln L\left(\beta, y\right) = &-\sum_{i=1}^{n}\left(x_i^T\beta\right)\phi\left(x_i^T\beta\right)\left[\frac{y_i}{\Phi(x_i^T\beta)} - \frac{(1-y_i)}{\Phi(-x_i^T\beta)} \right] x_i x_i^T \\ &- \sum_{i=1}^{n}\phi\left(x_i^T\beta\right)\left[\frac{y_i\phi\left(x_i^T\beta\right)}{\Phi(x_i^T\beta)^2} + \frac{(1-y_i)\phi\left(-x_i^T\beta\right)}{\Phi(-x_i^T\beta)^2} \right] x_i x_i^T\end{aligned} \tag{8}$$

Using the fact that $E(y_i) = \phi\left(x_i^T\beta\right)$, the information matrix is therefore:

$$I(\beta) = \sum_{i=1}^{m} \frac{\phi\left(x_i^T\beta\right)^2}{\Phi(x_i^T\beta)^2\Phi(-x_i^T\beta)^2} x_i x_i^T \tag{9}$$

Given the score function and the information matrix, we can then estimate the probit model via Fishers scoring method. Here the R statistical software version 3.3.2 is used to estimate the parameters.

3.8.2 Marginal probability effects

After estimating the probit coefficients we need to compute the marginal effects. The marginal probability effects are the partial effects of each explanatory variable on the probability that the observed dependent variable $Y_i = 1$ given that the other explanatory variables are held constant at their means in the model. In probit models $\Pr(Y=1) = \Phi(x^T\beta)$ is the standard normal cumulative density function evaluated at $x^T\beta$. The marginal effects are found by taking partial derivative of the log-likelihood function with respect to each of the explanatory variables in the model. For a more detail mathematical computation of marginal

effects, the reader is referred to (Greene, 1997, 2012; Wooldridge, 2009). Here the R statistical package version 3.3.2 is used to estimate the marginal probability effects.
For the current study, the functional form that the classical binary dependent variable model takes is specified as follow:

$$y_i = b_0 + b_1 age + \sum_{i=2}^{5} b_i educ_i + \sum_{i=6}^{7} b_i \text{int}ernet\_use_i + \sum_{i=8}^{9} b_i drone\_use_i + \sum_{i=10}^{12} b_i grossales_i. \quad (10)$$

3.9 Summary

This chapter has looked at the theoretical framework of utility of information, sampling, and data collection methods used as well as analysis procedures that is employed. A brief description of variables and their expected relationships has also been discussed. A brief background concerning the kind of data and the econometric model that is employed in the next chapter has been given as well as the conceptual framework of the probit model. The estimation procedure concludes the chapter.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

Different tools were used to analyze the data at hand. Chapter four presents the results and discussion of the results. The first section of the chapter is devoted to the statistical description and summary of demographic variables included in the econometric model and other variables of interest. Variables covered in the first section include the age of respondents, gender, educational attainment, farm size in acreage, farm ownership, the number of years farmers have engaged in the business, gross sales from previous year's operations, and whether or not they use the Internet to look for market information. A summary of farmers' evaluation of the Market Prospects program as well as test of independence among farm size, educational attainment and information sources are also presented in the first section. The second section discusses the econometric analysis of the data.

4.2 Descriptive statistics of relevant variables

4.2.1 Farmer/operator age

One of the things to find out is the average age of Saskatchewan farmers. It turns out that the average age of respondents interviewed is 53 years with a standard deviation of 14. This compares with the provincial average of 54.2 years in 2011 and 55 years in 2016 (Statistics Canada, 2017c). The figures suggest aging farm operator population in the province. The youngest respondent is aged 19 years with the oldest 91 years for a range of 72 years.

4.2.2 Gender

As the farming industry has been perceived as male dominated, it was interesting to find out if the situation is different with the current data. Respondents were asked in the survey to indicate their gender. Figure 4.1 shows the distribution of gender in the sample. It became apparent that males still dominate the industry. The majority of the respondents interviewed were males (77%) compared to females (23%).

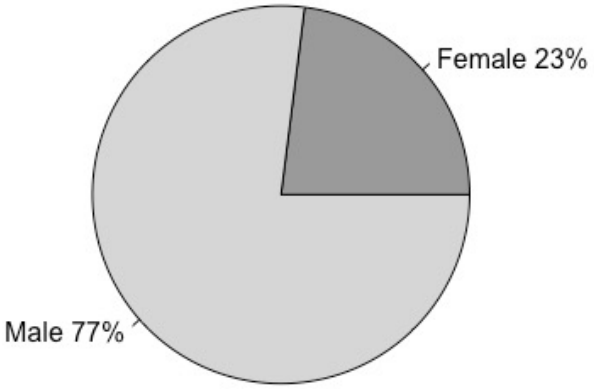


Figure 4.1. Gender distribution of respondents; (n = 577)

4.2.3 Educational attainment

There have been studies that have linked agricultural productivity, efficiency and the likelihood of using more information sources to higher levels of education (Jamison & Moock, 1984; Pudasaini, 1983). As part of the survey questionnaire administered, respondents were asked to indicate the level of education that they have attained. Figure 4.2 shows the distribution of farmers based on educational attainment.

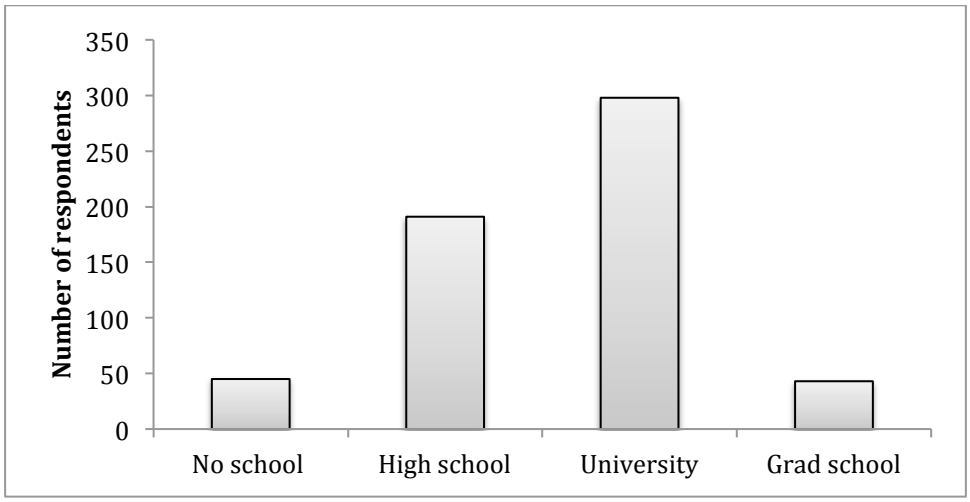


Figure 4.2. Distribution of respondents' educational attainment; (n = 577)

As can be seen from Figure 4.2, more than half of the sample (51.6%) has at least a college education, and 7.4% attended graduate school. Put together, about 59% of respondents (341 people) have received at least a university education. Only 7.9% have no formal education or have not attended school at all. High school graduates form 33.1% of the

sample. The statistics above are suggestive of a farm population that is well educated. However, the reader is cautioned about the reliability of these statistics as the observed results might be due to sampling bias. According to the 2011 Census of Agriculture total farm operators with no university degree stood at 44,415 whereas total farm operators with university degree was 4,890. Thus farms with operators who have university degree formed 9.92% of the total farm operators (CANSIM table 004-0104).

4.2.4 Farm ownership

Most of the farms in the sample are either family owned corporations (42.5%) or sole proprietorships (40.67%). Family owned corporations are farm businesses in which two or more family members are involved in the day-to-day administration and family members maintain majority of control or ownership. Less than 1% of the respondents operate large corporate farms with outside investors and 16% operate partnerships. Figure 4.3 depicts the distribution of farm ownership of respondents.

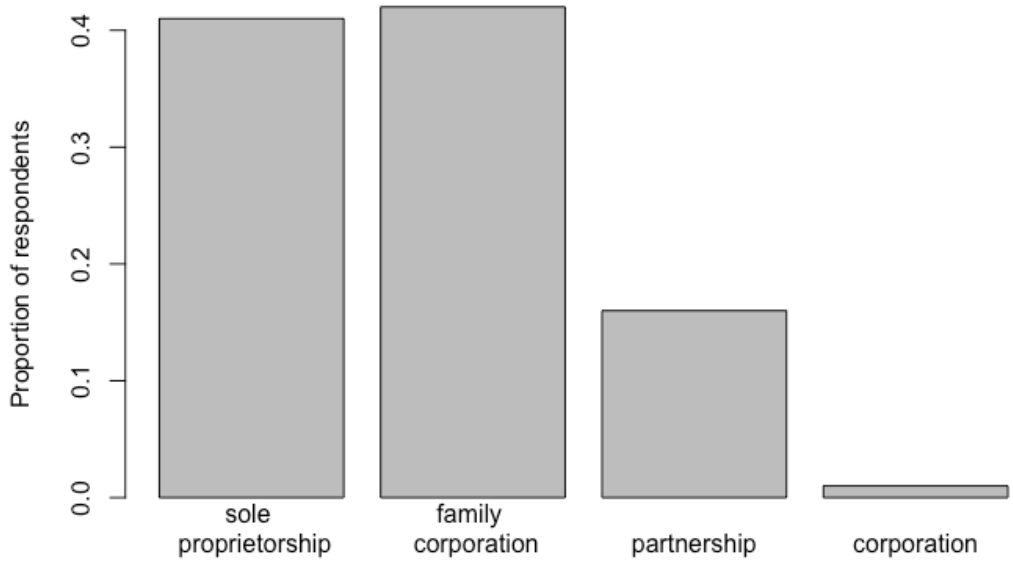


Figure 4.3. Distribution of farm ownership of respondents; (n = 577)

4.2.5 Gross sales for the previous year

Respondents were asked to indicate their gross sales receipt from previous year from their farm business. Figure 4.4 shows the distribution of gross sales receipts in the sample.

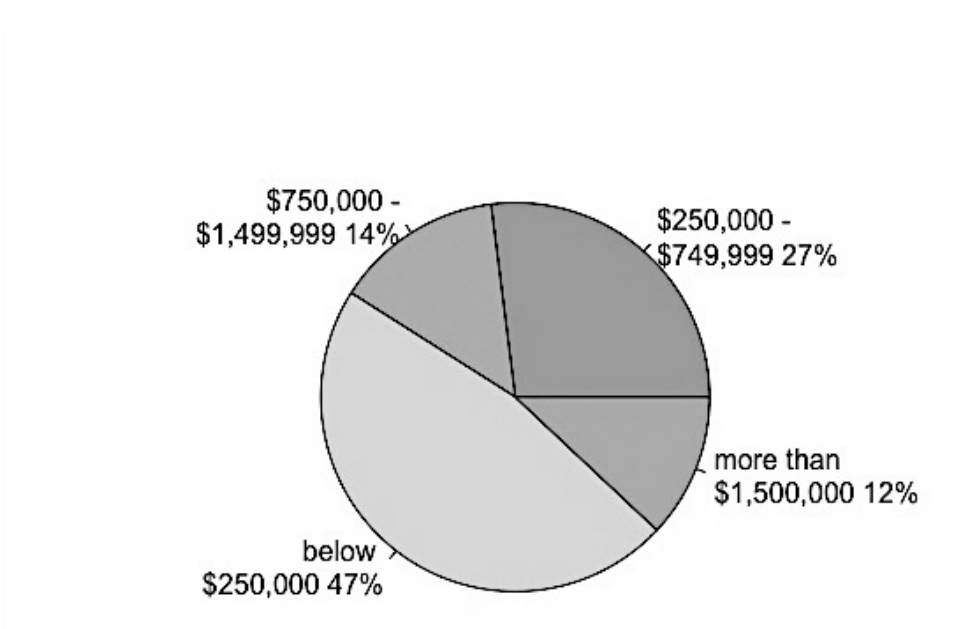


Figure 4.4. Distribution of farmer's gross sales from last year; (n = 577)

It is seen from Figure 4.4 that almost half of the respondents (47%) received less than $250,000 in gross sales from the previous year, 27% received between $250,000 and $750,000, 14% received between $750,000 and $1,500,000, while 12% received more than $1,500,000. The average gross farm receipt in the sample was determined to be $500,624. Farm cash receipt measures the cash paid to farmers for the sale of their agricultural products and from direct program payments to producers. Current numbers from the Statistics Canada are unavailable, but the 2014 average Saskatchewan farm family gross revenue stood at $363,668 (Statistics Canada, 2016).

4.2.6 Farm experience

Number of years in farm business varies in the sample. Those with less than 10 years of farm experience are in the minority (14%) whereas those with more than 40 years form the majority (29%). Sixteen percent of respondents have between 11 and 20 years of experience, 15% have between 21 and 30 years, and 26% have between 31 and 40 years. More than half (55%) of the operators sampled have more than 30 years of experience on the farm. The average farm experience is 29 years. Figure 4.5 shows the distribution of farm experience.

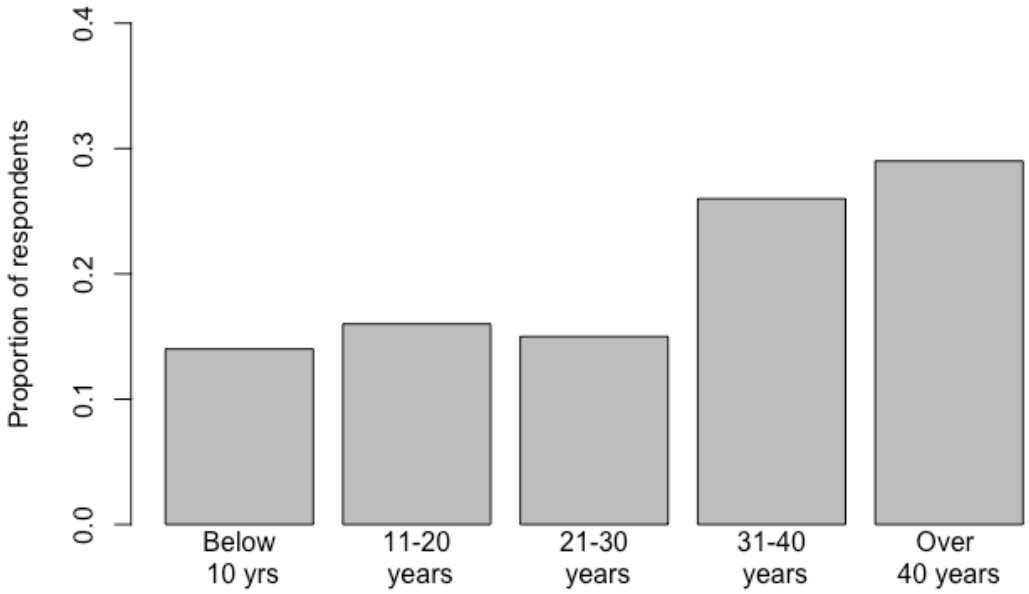


Figure 4.5. Number years respondents have been in farm business; (n = 577)

4.3 Analysis of Market Prospects

4.3.1 Number and frequency of view

To achieve the second objective of developing a profile of people who watch the Market Prospects program on CTV's *Farmgate*, respondents were asked to indicate whether they watch the program at all, and if they watched it, through which medium did they watch the program? Figures 4.6 and 4.7 below show the distribution of respondents' answers to the two questions.

Forty-seven per cent of the respondents (269) said they watch the program while 53% (308) said they do not. Further inquiries were made to determine the medium through which they watch the program. Of the 47% who watched, 88% do that on television while 17% watch on the Internet (either via YouTube channel or the program's website). This suggests that about 5% of those who watch the program use both mediums interchangeably.

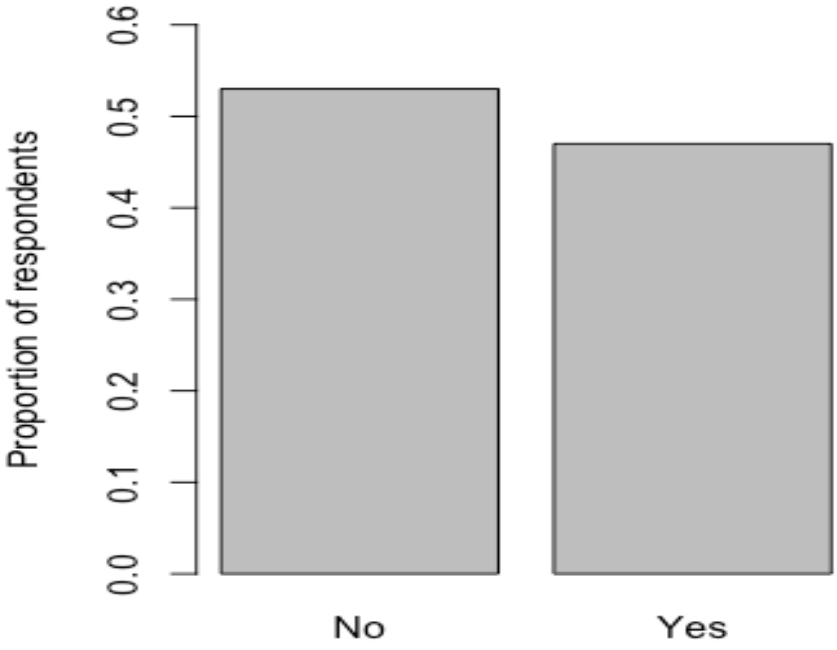
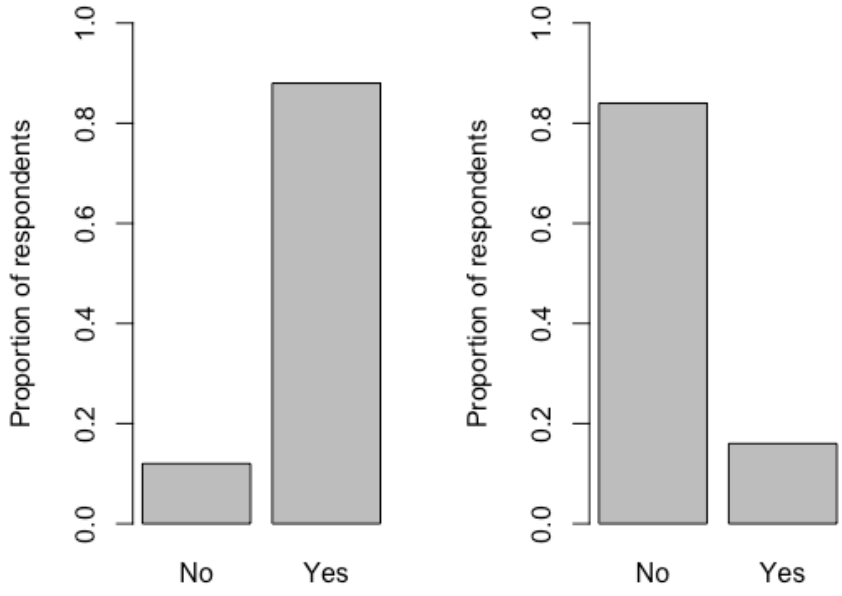


Figure 4.6. Proportion of respondents who watch Market Prospects; (n = 269)



Panel A Television Panel B Internet

Figure 4.7. Viewers of Market Prospects on television and on the Internet; (n = 269)

Panel A of Figure 4.7 shows that 88% of those who watch the program do so on television. Only 12% watch it using other channels such as YouTube or podcast on the website of the program. Respondents were asked to indicate how often they watch the Market Prospects program, either on television, YouTube or listen to podcast on the program's website. Of the respondents who indicated they watch the program (269), 7% said they watch it almost always, 56% said they sometimes watch the program and 32% indicated they watch it very often. However, 5% said they rarely watch the program. Figure 4.8 is a visual representation of the responses obtained.

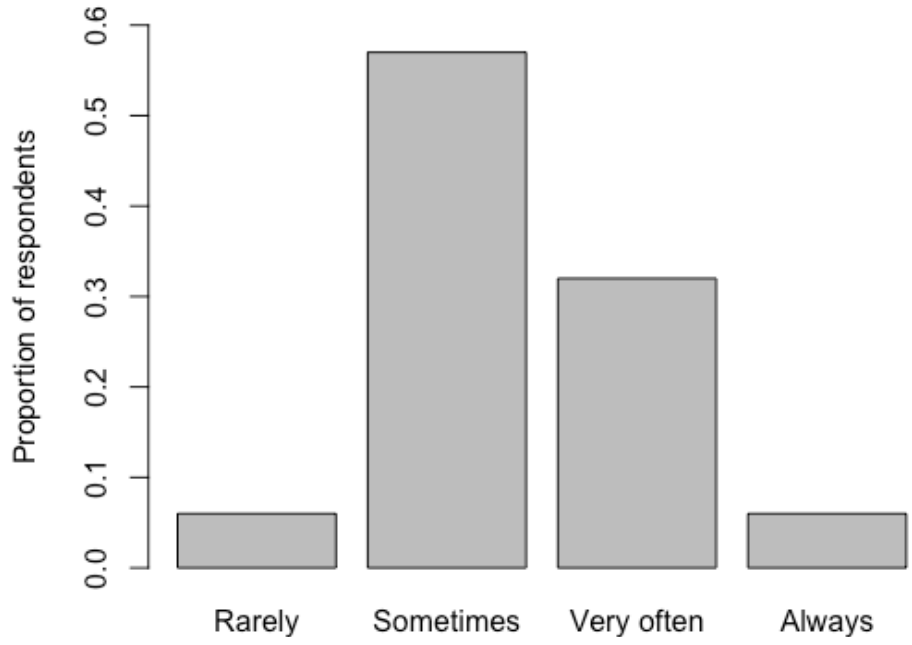


Figure 4.8. How often respondents watch the Market Prospects; (n = 269)

A host of different topics are discussed on Market Prospects program ranging from the weather situation for a particular cropping season, farmland values, output prices, research and development and so on. Table 4.1 shows proportion of respondents who evaluated the usefulness of these topics discussed. It is observed that a greater proportion of respondents have positive views of the various topics that are discussed on the program. For instance, 7% of respondents view output prices discussions on the program as either never useful or seldom useful. Similar observation can be made with regards to research and development

discussions. On all the topics presented in the survey, at least 80% of respondents who watched the program indicated that they are useful to their operations on the farm. On the other hand, if those who said the program sometimes gives them useful information are considered as a negative evaluation, then only 40% derive value from the program. Plots of respondents' evaluation of the various topics discussed on the program are presented in Appendix A.

4.3.2 Evaluation of Market Prospects

Table 4.1. Respondent's evaluation of topics discussed on Market Prospects

	Never Useful	Seldom Useful	Sometimes Useful	Often Useful	Always Useful
Output prices	1.06	5.99	49.30	34.15	9.50
Weather	3.17	10.92	39.78	32.75	13.38
Farmland values	3.17	7.37	50.03	28.87	10.56
Input prices	2.82	8.45	39.79	35.56	13.38
Research & Development	1.76	5.28	40.85	38.73	13.38
Market transparency	2.82	10.92	48.93	26.06	11.27
Rental rates	8.10	18.66	42.61	20.77	9.86

* Numbers represent the percent of the sample that evaluated each of the topics; n = 269

Farmers receive information about marketing their products from a variety of sources. Respondents were asked to evaluate the sources of information according to how often they get useful information from each. The evaluation was done on a five-point Likert scale from 1 to 5 with 1 representing never useful and 5 representing always useful. Points 2, 3, and 4 represented seldom useful, sometimes useful, and often useful, respectively. Table 4.2 summarizes the responses given by the farmers. The numbers represent the proportion of the sample that evaluated each of the sources and how frequently they get useful information from them. From the table it can be seen that crop-specific publication, direct mail or email newsletter, extension agents, general farm publication, radio broadcast, television broadcast, and marketing information websites sometimes provide useful information to farmers. The majority of respondents regard information coming from other farmers as often useful in their

business. The same is true for telephone call or text messages from business partners. Information from social media and sources other than what has been stated were interestingly evaluated as never providing valuable information for decision-making. This might be due to majority of the farmers being older and not using social media.

Table 4.2. Evaluation of the usefulness of information sources

	Never Useful (1)	Seldom Useful (2)	Sometimes Useful (3)	Often Useful (4)	Always Useful (5)
Crop-specific Publication	10.33	13.33	43.83	24.33	8.17
Direct mail/email newsletter	13.83	17.00	36.33	25.83	7.00
Extension agent	18.83	22.83	34.50	17.83	6.00
General farm publication	5.33	13.33	45.50	29.67	6.17
Other farmers	3.83	9.17	33.00	38.17	15.83
Radio broadcast	9.33	22.50	40.83	21.50	5.83
Television broadcast	12.33	24.50	37.67	21.17	4.33
Telephone call/text	8.67	14.00	30.66	33.50	13.17
Marketing info Websites	10.17	14.33	33.67	32.33	9.50
Social Media	31.00	24.50	28.67	12.66	3.17

Figures indicate percentage of respondents who rated the sources; n=577

Table 4.3 gives details of the other sources where farmers receive market information in the sample. These sources were not expressly stated as options to be selected in the questionnaire, but respondents were asked to specify where else they receive market information apart from those that were given as options. Other information sources indicated by the respondents as having provided them with useful market information include product buyers, agents of elevator companies, brokers, marketing advisors, hired crop consultants, and the Internet. Others include workshops, relationship with suppliers, family members, and direct short messages from buyers on their phones.

Table 4.3. Other sources where farmers get market information

Elevator companies (6)	Personal contact with agents (8)
Hired crop consultant (1)	Marketing advisor (9)
Organic Connections conference (3)	Grain companies contact me (5)
Chemical representatives (1)	Brokers (5)
Direct marketing contact with customers (3)	Older experience farmers and the computer
Internet (1)	Web Communications (3)
Relationship with suppliers (1)	Paid market information (4)
Workshops (4)	Marketing company (4)
Organic farming groups	Farm link Marketing (2)
Product buyers (4)	Subscribing to a professional market (2)

*Numbers in parenthesis represent the number of respondents

4.3.3 Test of independence between gross sales, education level and information sources

Mittal and Mehar (2013) have found that large farm sizes and better education tend to be associated with increased likelihood of a farmer accessing information from a more modern source of information. To ascertain the veracity of this conclusion for the current study, a chi-square test of independence was conducted between gross sales and the ten sources of information before combining them. Tables 4.4, 4.5, and 4.6 show the results of that investigation for crop specific publication, e-mail newsletter, and extension agents respectively. The rest of the test results are presented in Appendix B.

Table 4.4. Test of independence between gross sales and social media

	Never Useful	Seldom Useful	Sometimes Useful	Often Useful	Always Useful	Sum
Less than 750K	114	82	84	40	8	328
750K - 1499.99K	37	27	30	17	4	115
Above 1500K	28	32	50	19	5	134
Sum	179	141	164	76	17	577

Pearson's chi-squared test; χ-squared = 12.161, df = 8, p-value = 0.1442

Table 4.4 helps us to compute the test statistic for a chi-square test of independence between gross sales and the use of crop social media as a source of information. The result shows that the null hypothesis of independence cannot be rejected at the 5% significance level. The p-value of the chi-squared calculated is greater than the significance level. It can be concluded that the two variables are statistically independent. This means that whether the farmer is a big-sized farmer or not does not give us any indication of the usefulness of social media as a source of information for farmers to make marketing and other farm decisions.

Table 4.5. Test of independence between gross sales and e-mail newsletter

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	60	66	116	65	21	328
750K - 1499.99K	7	14	44	45	5	115
Above 1500K	12	20	49	39	14	134
Sum	79	100	209	149	40	577

Pearson's chi-squared test; χ-squared = 32.67, df = 8, p-value = 7.061e-05

The chi-squared test based on Table 4.5 suggests that the null hypothesis of independence can be rejected at the 5% significance level. The p-value is less than the significance level. This means that size of operation and usefulness of email newsletter as source of information are statistically related. However, the strength of association and the direction of association would have to be determined through further analysis.

Table 4.6. Test of independence between gross sales and marketing information websites

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	43	54	110	93	28	328
750K - 1499.99K	5	12	40	51	7	115
Above 1500K	9	17	46	42	20	134
Sum	57	83	196	186	55	577

Pearson's chi-squared test; χ-squared = 23.593, df = 8, p-value = 0.0027

From Table 4.6 gross sales and marketing information websites are statistically dependent at the 5% significance level. In all, two sources of information were found to be associated with the size of operations. The other source that was found to have statistical association with farm size is email newsletter. Social media was marginally related to farm size. Similar tests were conducted between educational attainment of respondents and usefulness of information sources. It was found that crop specific publication, extension agents, general farm publication, television, radio, subscription to marketing information websites are all not statistically associated with the sources of market information. Result of the chi-squared test of independence between educational attainment and usefulness of the ten sources of market information is presented in Appendix C.

Producers were asked to rate the sources according to how regularly they get useful information from each. Table 4.2 showed the distribution of ratings for each source. The ratings were then ranked according to the proportion of respondents who indicated the sources always provide useful information. The ranked evaluations are shown in Table 4.7.

4.3.4 Ranking of market information sources

Table 4.7. Ranking of the sources based on farmers evaluations

	Never Useful 1	Seldom Useful 2	Sometimes Useful 3	Often Useful 4	Always Useful 5
Other farmers	3.83	9.17	33.00	38.17	15.83
Telephone call/text (elevator)	8.67	14.00	30.66	33.50	13.17
Marketing info Websites	10.17	14.33	33.67	32.33	9.50
Crop-specific Publication	10.33	13.33	43.83	24.33	8.17
Direct mail/email newsletter	13.83	17.00	36.33	25.83	7.00
General farm publication	5.33	13.33	45.50	29.67	6.17
Extension agent	18.83	22.83	34.50	17.83	6.00
Radio broadcast	9.33	22.50	40.83	21.50	5.83
Television broadcast	12.33	24.50	37.67	21.17	4.33
Social Media	31.00	24.50	28.67	12.66	3.17

* Numbers represent percent of the respondents who rated the information sources. n=577

It is seen from the ranking in Table 4.7 that the two most useful sources of market information are other farmers and telephone calls or text from trading partners and/elevator companies. Subscription or use of marketing information websites, crop specific publications and direct mail or e-mail newsletter subscription are ranked third, fourth and fifth respectively. Most of the traditional sources like television, radio, extension agents and general farm publications were less useful source of market information. Social media, which is comprised of Facebook, Twitter, Instagram, WhatsApp and other platforms, was the least preferred source. This is not surprising considering the fact that social media is not regulated and that anybody can put any information out there. As such people might see information on social media as lacking credibility. This realization implies that although farmers need accurate and credible information to make decisions, they cannot rely solely upon social media to deliver such information to farmers. A plausible explanation to this observation is that in many instances, the originators of information on social media cannot be verified; therefore, farmers cannot authenticate the information for use to make critical farm decisions.

4.4 Empirical modeling

From the literature, several factors influence farmers' evaluation of usefulness of information sources. However, not all of the documented sources are considered in this study. The focus for this study is on six of such factors, which has been mentioned in almost all the papers that have dealt with the topic (Ford & Babb, 1989; Gloy et al., 2000; Mittal & Mehar, 2013). These factors are age of operators or farmers, the level of education of the operators, the size of cultivated land, the use of the Internet for market information purposes, gross sales from previous year, and whether or not the operators use modern farm technology in their operations. These factors are explored in the current study to determine their influence on Saskatchewan farmers' evaluation of usefulness of information sources. Table 4.8 is a summary of the independent variables included in the probit regression model.

Table 4.8. Summary of explanatory variables in the model

Variable	Categories	Proportion of sample
Age (continuous)		
Education	High school	33.10
	College/university	51.60
	Graduate School	7.40
	No school/other	7.90
Drone use	No drones	92.03
	Use drones	7.97
Internet use	Yes	52.70
	No	47.30
Gross sales	Less than $750K	56.80
	$750K - $1,500	19.90
	Above $1,500K	23.30

The age of operators in years (*age*) is a continuous variable. The majority of the respondents have either a two-year college or a four-year university degree. Only about 8% have either no formal education or have other forms of education. The four-level educational attainment by the respondent (*educ*) is a categorical variable with the reference category being no school or other education. Whether a farmer uses the Internet for market information purposes (*internet_use*) is a binary variable with values 1, if the farmer uses the Internet and 0 otherwise. It can be seen from Table 4.8 that 47.3% of respondents do not use the Internet while 52.7% use it to look for market information. The variable (*drone_use*) represents whether or not the respondents use more modern farm technology on the farm. Use of drones is used as a proxy for the utilization of modern farm technologies such as precision agriculture and other such technologies. If the respondent uses drone technology, it is coded as 1 and 0 otherwise. It is interesting to observe that as high as 92% of the sample do not use drone technology on their farms, probably due the cost of such technology. Lastly, (*grossales*) represents the total sales received in the previous year from the sale of harvest and program payments. The reference category is those who earned less than $750, 000. Gross sales are used to account for the effect of farm size on usefulness of information sources.

Although there are other market information sources for farmers found in the literature, only the main sources are considered in this study. Ten of such sources are grouped under three categories to represent three dependent variables. Human sources - comprise of

other farmers, including family and friends as well as telephone call or text messages from trading partners. Traditional sources - entail crop specific publications, extension agents, general farm publications, radio, and television broadcast. New media sources -comprise of subscription to marketing information websites, email newsletters, and other social media such as Facebook, Twitter, WhatsApp, and the rest. Each of these sources has five levels or categories. The five categories are denoted 1 for never useful, 2 for seldom useful, 3 for sometimes useful, 4 for often useful and 5 for always useful. If a respondent evaluated a source as often useful or always useful, it is recoded as 1 and 0 otherwise for all the three combined sources making them binary dependent variables. The *ifelse* function in R programing language was use to recode the variables. The assumption here is that if a farmer considers a particular source as often or always useful, he or she is likely going to use that source for information purposes. Since the dependent variables are now binary, probit or logit regression analysis can be used (Amemiya, 1985; Greene, 1997, 2012; Johnston, 1997; Verbeke et al., 2000). The probit model is selected, in this case, for analysis. This is based on the assumption that the error term is independently and identically normally distributed. The data had come from a normally distributed population using random probability sampling procedures.

Each of the three combined sources is taken as a separate dependent variable for the probit model estimation. Discussion of the results follows in Tables 4.9 to 4.11.

4.4.1 Human sources of information

Table 4.9 shows that the coefficient of (*age*) is negative and the marginal effects indicates that keeping the other variables in the model constant at their means, the probability of a farmer evaluating the human sources of information as useful decreases by 0.002 when farmers age increase by one year. However, age is not statistically significant at the 5% level; implying that age has no statistical influence on farmers' evaluation of usefulness of human sources.

Table 4.9. Evaluation of usefulness of human sources

	Dependent variable:	
	Human source	
	probit	*binary model (marginal effect)*
	(1)	(2)
age	-0.006	-0.002
	(0.004)	(0.001)
educ_graduate school	3.738	0.272***
	(146.954)	(0.019)
educ_high school	-0.269	-0.090
	(0.227)	(0.078)
educ_university	-0.173	-0.057
	(0.225)	(0.075)
internet_use	0.261**	0.086**
	(0.119)	(0.041)
drone_use	0.031	0.010
	(0.226)	(0.074)
grossales750K - 1499.99K	-0.041	-0.014
	(0.152)	(0.051)
grossalesAbove 1500K	0.053	0.017
	(0.143)	(0.046)
Constant	0.985***	0.326***
	(0.323)	(0.117)
Observations	577	577
Log Likelihood	-334.003	
Akaike Inf. Crit.	686.006	686.006

*p<0.1; **p<0.05; ***p<0.01 LR=11.37; Correct prediction = 60.81%
McFadden pseudo R^2 = 0.0167; Standard errors are in parenthesis

The coefficient of (*educ_graduate school)* is positive and significant at the 5% level. This means that if a farmer has a graduate school education, he/she is more likely to evaluate information from the human sources as useful to his/her farm business relative to farmers who have never been to school or have other education, keeping all the other variables in the model at their means. The marginal effect indicates that the probability of farmers evaluating information from the human sources as useful increase by 27.2%, if farmers have graduate education compared with farmers with no school or other type of education. The negative coefficient of (*educ_high school*) and (*educ_university*) show that having a high school diploma or bachelors degree makes it less likely that farmers would evaluate human sources

of information as useful compared with farmers with no school or other type of education. However, having been to high school or college has no statistical significance on farmers' evaluations.

Also, (*internet_use)* is positive and significant at the 5% level indicating that farmers who use the Internet to search for market information are more like to evaluate information from the human sources as useful compare with farmers who do not, keeping the other variables in the model at their means. The probability of such an evaluation increases by 8.6%, if the farmer uses the Internet to search for market information relative to those who do not. Use of the Internet for market information search and seeking information from other colleague farmers or elevators are not mutually exclusive. Perhaps farmers use the Internet to search for market information, but seek confirmation from their colleague farmers, friends, or elevator managers whom they know and trust. So the Internet is seen as a complementary rather than substitute for recommendation from friends and relatives (human sources).

The use of drones (*drone_use*) as a proxy for the use of modern farm technology is also positive, but insignificant at the 5% level. The positive coefficient indicates that farmers who use modern farm technology, as opposed to those who do not, are more likely to view information from human sources as useful. The marginal effects tells us that the probability of evaluating human sources as useful increase by 1.2%, if the farmer uses modern farm technology compared to a farmer who does not, keeping all other variables constant at the means.

The coefficients of gross sales (*grossales750K - 1499.99K*) and (*grossalesabove 1500K*) are both negative and insignificant at the 5% level. This indicates that gross sales have inverse relationship with farmers' evaluation of usefulness of human sources of information.

4.4.2 Traditional sources of information

Table 4.10 Evaluation of information from traditional sources

	Dependent variable:	
	Traditional source	
	probit	*binary model (marginal effect)*
	(1)	(2)
age	0.006	0.002
	(0.004)	(0.002)
educ_graduate school	3.847	0.377***
	(92.126)	(0.021)
educ_high school	-0.035	-0.013
	(0.210)	(0.080)
educ_university	-0.023	-0.009
	(0.207)	(0.078)
internet_use	0.358***	0.136***
	(0.113)	(0.043)
drone_use	0.378*	0.134*
	(0.217)	(0.071)
grossales750K - 1499.99K	-0.087	-0.033
	(0.146)	(0.056)
grossalesAbove 1500K	-0.101	-0.039
	(0.134)	(0.052)
Constant	-0.173	-0.065
	(0.300)	(0.114)
Observations	577	577
Log Likelihood	-375.040	
Akaike Inf. Crit.	768.081	768.081

*p<0.1; **p<0.05; ***p<0.01; LR=15.99; Correct predictions=54.16%;
McFadden pseudo R^2 = 0.0209; Standard errors are in parenthesis

Table 4.10 shows results for the traditional information sources model. The traditional sources are comprised of crop-specific farm publication, general farm publication, extension agents, television, radio, and newspapers. We observe that the coefficient of (*educ_graduate school*) is positive and significant at the 5% level. This means that being in the highly educated farmers category is associated with increased likelihood of viewing traditional sources of information as useful. The marginal effect shows that the probability of a positive evaluation of traditional sources of information increases by 37.7%, if a farmer has a graduate

degree compared with farmers with no schooling or other forms of education. The result might be due to the ability of people with higher education to analyze complex information form different sources. Likewise, the positive and significant coefficient of (*internet_use*) shows that farmers who use the Internet to search for market information compared with those who do not use the Internet are more likely to view information from traditional sources as useful. Farmers who use modern farm technology (*drone_use*) compared with those who do not are more likely to view traditional sources of information as useful. Age of farmers, size of the farm land in terms of acreage, having completed high school or college, and the level of sales of farmers from previous year's operation have no statistical significance on evaluation of usefulness of traditional sources of information. While age and gross sales from last year have direct relationship with the probability of a favourable view of usefulness of traditional sources, completion of high school or college as well as farm sales have inverse relationship. Earlier studies have found farm size to be a significant factor in influencing farmers' evaluation of usefulness on information from traditional sources (Foltz et al., 1996; Ford & Babb, 1989; Ortmann et al., 1993).

4.4.3 New media sources of information

Table 4.11 shows that the coefficient of age is not statistically significant at the 5% level. This means that the age of farmers is not statistically important factor in the evaluation of usefulness of new media information sources. The negative sign of the estimated coefficient indicates that when age increases by one year, it is less likely for a farmer to evaluate information from new media sources as useful keeping all the other variables in the model constant at their means. Social media, subscription to marketing information websites, and email newsletters represent the new media sources. These sources may not be as appealing to people, as they get older, perhaps due to non-familiarity with modern information and communication technology and investment in information retrieval (Schnitkey et al., 1992; Mittal & Mehar, 2013). People who are not used to modern means of communication might want to source their information using channels, which they are more familiar with such as radio, television, or newspapers. Gloy et al. (2000) also found age to be generally unimportant in explaining information preferences.

The marginal effects of having a graduate school education as opposed to having other type of education or no school at all increase the conditional probability of farmers evaluating new media as useful sources of information by 44.3%. Having graduated from high school or

the university, compared to the reference category, have no significant impact on farmers' views about new media sources of information, although there appears to be an inverse relationship between the two variables.

Farmers' use of the Internet for market information search purposes is positive and significant at the 5% level. This shows that, as was the case of human sources and traditional sources, farm operators who have adopted the Internet to search for market information, relative to non-adopters, are more likely to find new media sources as useful. The results suggest that as people become more familiar with a particular source of information, they are likely to have a positive view of such a source.

Conversely, the coefficient of (*drone_use*) is insignificant at the 5% level indicating that the model did not distinguish between adopters of modern farm technology and non-adopters with regards to evaluation of usefulness of new media sources of information. Use of modern farm technology has no impact on farmers' views on information from new media sources.

Similarly, farmers with sales of $0.75 to $1.5 million and those with more than $1.5 million are not statistically significant at the 5% level. The marginal effects coefficients mean that earning a farm sales of between $0.75 million to $1.5 million and also earning more $1.5 million increase the probability of evaluating new media sources as useful. However, the differences in probabilities are not statistically significant, indicating that the size of farm size does not have an impact on usefulness of information from new media sources.

Table 4.11. Evaluation of information from new media sources

	Dependent variable:	
	New media source	
	probit	*binary model (marginal effect)*
	(1)	(2)
age	-0.004	-0.002
	(0.004)	(0.002)
educ_graduate school	3.857	0.443***
	(146.954)	(0.030)
educ_high school	-0.182	-0.072
	(0.222)	(0.088)
educ_university	-0.174	-0.069
	(0.218)	(0.086)
internet_use	1.244***	0.463***
	(0.118)	(0.041)
drone_use	0.025	0.010
	(0.222)	(0.087)
grossales750K - 1499.99K	0.204	0.079
	(0.155)	(0.060)
grossalesAbove 1500K	0.022	0.009
	(0.141)	(0.056)
Constant	-0.171	-0.067
	(0.316)	(0.125)
Observations	577	577
Log Likelihood	-326.862	
Akaike Inf. Crit.	671.724	671.724

*p<0.1; **p<0.05; ***p<0.01; LR=140.92; Correct predictions = 62.00%

McFadden pseudo R^2 = 0.1773; Standard errors are in parenthesis

It is important to point out that in arriving at these final results, other models were explored to see how the analysis would differ. Ordinary logit model was explored in the analysis. The logit model results are not so much different than what has been presented here. The logit model results are shown in Appendix D.

CHAPTER 5: SUMMARY, CONCLUTIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the objectives of the study, the source and type of data used for the analysis, the methodology employed in the analyses. The results obtained from the analyses as well as conclusions and recommendations.

5.2 Summary

The goal of this study was to determine the usefulness of market information sources for farmers in Saskatchewan. Specifically, effectiveness of the Market Prospects program in terms of approval and use as well as the demographic backgrounds of farmers who use the program as a source of market information for decision making were investigated. Other sources of market information for Saskatchewan farmers and their attitudes towards the different sources with regards to usefulness of the information obtained through these sources were also investigated. The analysis proceeded under the assumption that with the introduction of the Internet and other modern means of information transmission, farmers' reliance on the traditional channels of information such as radio bulletins and television reports, newspaper publications, magazines, extension officers and field days have dwindled; and that farmers now turn to more modern media like the Internet, email newsletters, and short messaging systems (SMS) for most of their market information needs.

First, Market Prospects – a segment within CTV's *Farmgate* program, was analyzed using data from a sample of 577 farmers in Saskatchewan to see if the program is of benefit to farmers in terms of meeting their information needs. Farmers were asked to indicate how beneficial the program has been to them by way of getting useful information from the program as it related to their farm operations. Farmers were also asked to indicate how often they watch the program and through which medium they watch it.

Second, ten major market information sources, based on reviewed literature, were used to represent all the sources of information to farmers in Saskatchewan. The ten sources were reduced to three by grouping the sources according to the characteristics of the sources. Human sources comprise of telephone call/text from trading partners and other farmers in the same business. Traditional sources comprise of crop-specific publication, general farm publication, television, radio, and extension agents. And the new media sources is made up of email newsletter, subscription to marketing information websites, and use of social media.

Probit regression was used to estimate the parameters of the model as to whether farmers get useful information from these sources, based on the socio-economic characteristics of the farmers.

5.3 Conclusions

It can be concluded upon analyzing data dealing with farmers and their information sources that the Market Prospects program has a mixed appeal to farmers in Saskatchewan. Fifty-three percent of those interviewed do not watch the program while 47% watch it. The majority of the farmers who indicated they watch it have positive view of the program, if we consider those who said the program sometimes provides them with useful information as a positive rating. Discussions of output prices, weather, farmland values, input prices, research and development, market transparency and rental rates on Market Prospects, farmers who watch or listen to the program indicated they receive useful information. However, if we consider a response of *sometimes useful* as an unfavourable evaluation, Market prospect is not as useful in the data.

As to where Saskatchewan farmers get their market information from, it can be concluded based on the findings from the data that they get their market information from other farmers, which include friends and family members. The next source of market information mostly used by the farmers is their interaction with trading partners through telephone calls or text messages sent to them on their phones or other such communication equipment. The least useful source of information was found to be social media.

It is important to point out that each information source has some appeal to a segment of the farmers. Depending on the characteristics of the farm on one side and that of the operator on the other, farmers choose a source or combination of sources of market information suitable for their unique circumstances. Explanatory variables that appeared to have a direct relationship with usefulness of information sources include, first, the use of the Internet to search for market information. It was found that farmers' use of the Internet for market information purposes has significant impact on their evaluation of usefulness of information from all sources.

Regardless of the source of information, the use of the Internet for market information search has significant impact on farmers view about the usefulness of the sources. Secondly, having completed advanced education has a direct relationship with farmers' views on usefulness of all information sources. A third factor found to have a positive relationship with

usefulness of information from the traditional sources is the use of modern farm technology. Farm size is an important determinant of usefulness of information source only with regard to new media sources. Education is an important factor in influencing farmers' evaluations, especially, if farmers have graduate school education. Age was found to be unimportant factor in the evaluation of usefulness of all sources so was farm sales.

5.4 Recommendations

First, based on the results obtained from analyzing data with regards to Market Prospects, it is recommended that policy makers in the province find a way of instituting programs that aim at educating and furnishing farmers with the right information to make informed decisions. It appears the Market Prospects program does not appeal to the majority of the farmers interviewed. From the ranking of information sources by farmers, television program does not seem to appeal to the majority of farmers.

Second, the majority of the farmers studied prefer using market information obtained from family members and other farmers in their neighborhood, therefore, programs that aim at bringing farmers together to share experiences and knowledge such farmers conference can be encouraged and supported by the major players in the industry, including local and provincial governments.

Third, although social media is found to be the least preferred source of market information among the sample surveyed, there should be continuous effort at encouraging the the farmers to use these tools to receive and share market information since they are relatively faster and cheaper means of diseminating information to a wider population.

Lastly, it appears not many farmers in the sample use the internet to search for market information. With many organisations making their information available on the internet, sometimes for free, the Saskatchewan Ministry of Agriculture should do more to attract farmers to their website and encourage them to use the site to get market updates.

5.5 Limitations of the study

Agricultural business information encompasses a broad spectrum of topics including weather, production, financial, and marketing. This study has looked at only market information sources of crop farmers in Saskatchewan without considering other aspects of the business such as production and financing. It is possible that the conclusions reached in this

research would be different if production and financial information sources were also included.

Second, the analyses presented here do not include livestock farmers. It is possible the information needs of crop farmers may differ from that of livestock farmers and therefore different results and conclusion could be reached, if all types of farmers are included in the sample.

Third, not enough very large farms are included in the sample, for instance those in the range of 5,000 or even 10,000 acres, and larger crop farmers may have answered differently. Data used was gathered from 600 operators, but the analysis was based on 577 of them because of missing values. Although random probability sampling methodology was used, generalizations based on this study should be done with caution since the period of data collection might have introduced some sampling bias.

Fourth, timing of survey could influence respondents' answers as survey was done in February and March time of year when farmers may be thinking about spring seeding and making production choices instead of thinking about marketing.

Finally, difficulty in obtaining data on certain variables means that some important explanatory variables might have been omitted and this might introduce specification bias in the results obtained. For instance, the number of crops in which a farmer is engaged in production and whether marketing of the products is through the cash market or by contract are determinants of farmers' information preference. Omitted variables may have affected the results obtained.

5.6 Suggestions for future research

There are a number of areas of possible future research that are related to or can arise from this topic. It may be useful in the future for related studies examining information sources to look at production, marketing and financial information sources. Such comprehensive investigation would reveal insights that this study might have missed. Both independent and dependent variables used can be expanded to include more variables in the future. Data collection for similar studies should consider asking farmers to make choices as to which of the many sources that are available to them they use frequently in their operations.

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APPENDICES

Appendix A: Descriptive statistics of farmers evaluations of market prospects information

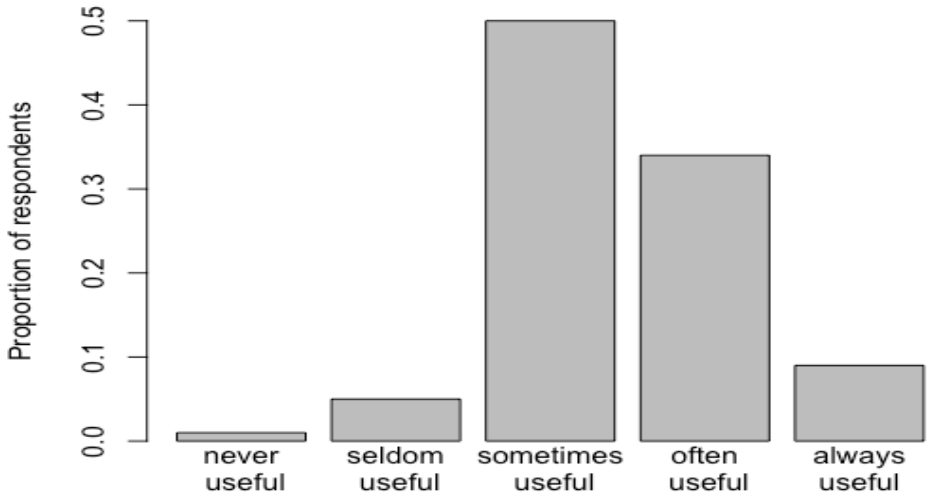

Figure A1. Farmers' ratings of output price information on Market Prospects

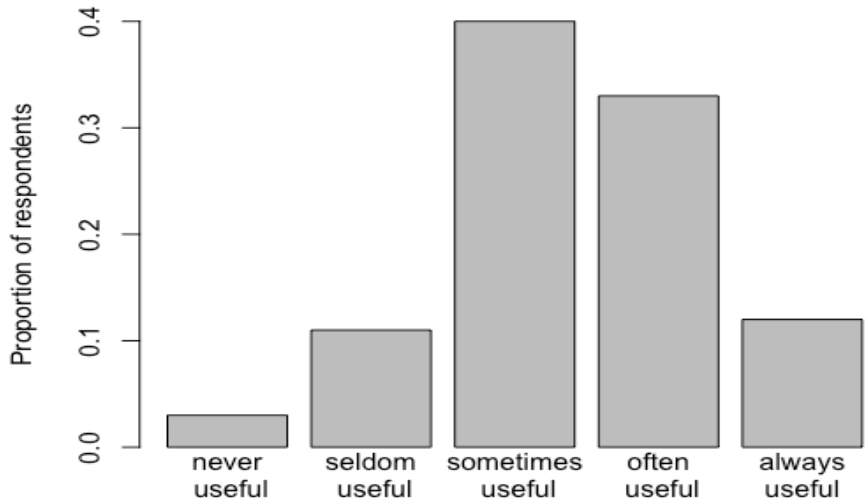

Figure A2. Evaluation of weather information on Market Prospects

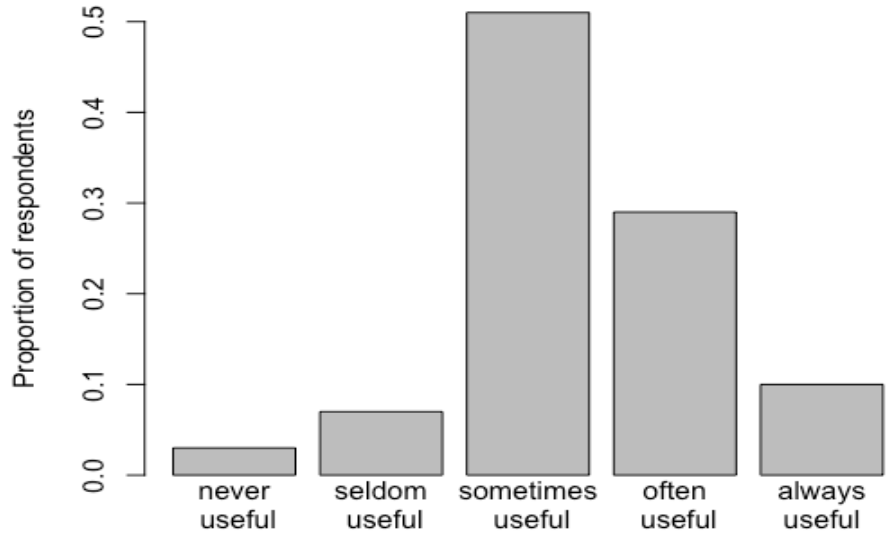

Figure A3. Evaluation of farmland values information on Market Prospects

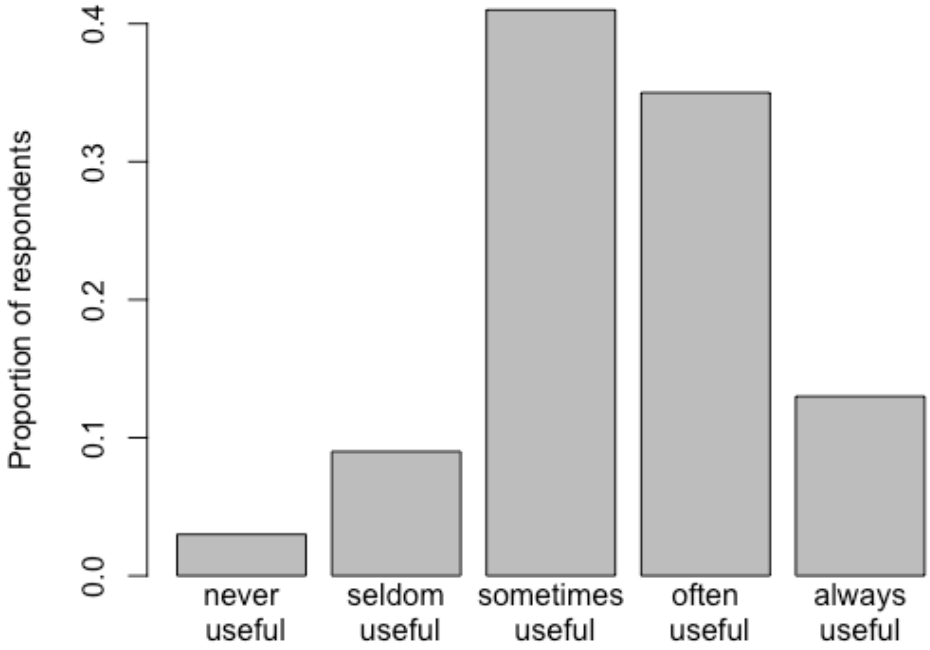

Figure A4. Evaluation of input prices information on Market Prospects

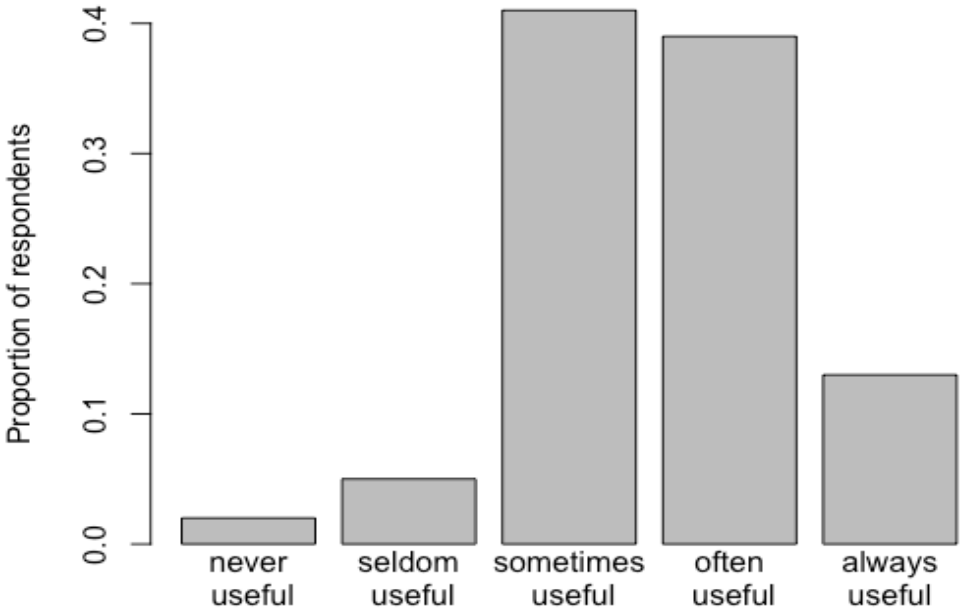

Figure A5. Evaluation of research and development information on Market Prospects

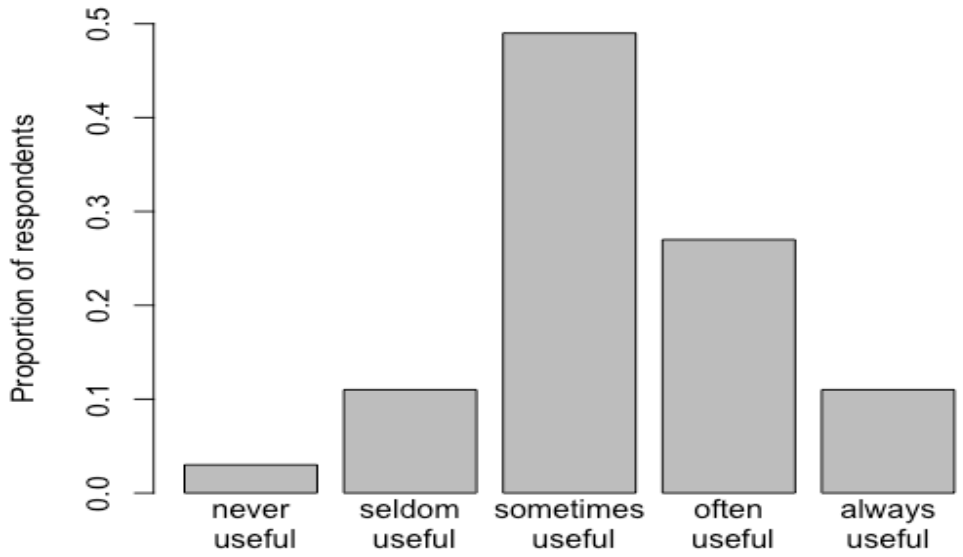

Figure A6. Evaluation of market transparency information on Market Prospects

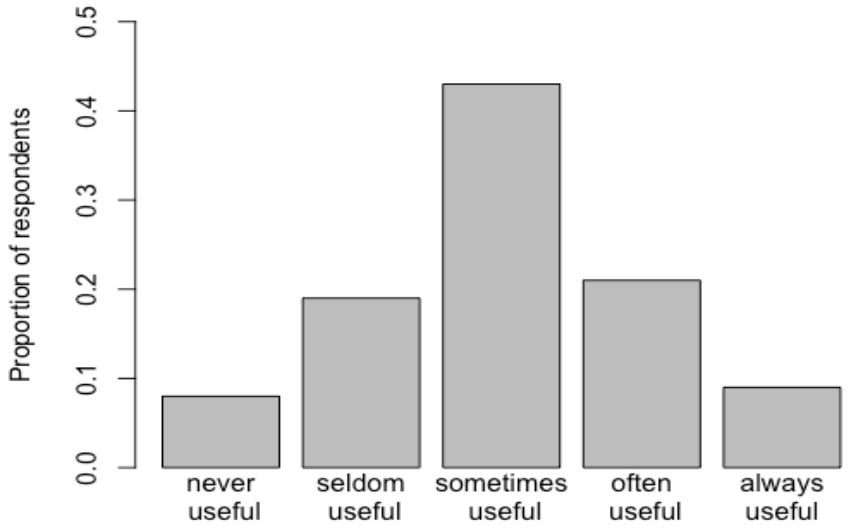

Figure A7. Evaluation of rental rates information on Market Prospects

Appendix B: Test of independence between farm size (gross sales) and information sources

Table B1. Gross sales and crop specific farm publication

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	32	56	144	74	22	328
750K - 1499.99K	13	9	47	33	13	115
Above 1500K	11	12	63	36	12	134
Sum	56	77	254	143	47	577

Pearson's chi-squared test; χ-squared = 13.07, df = 8, p-value = 0.1095

Table B2. Gross sales and telephone call/text from elevator companies

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	37	50	100	102	39	328
750K - 1499.99K	4	11	42	40	18	115
Above 1500K	10	18	36	52	18	134
Sum	51	79	178	194	75	577

Pearson's chi-squared test; χ-squared = 12.846, df = 8, p-value = 0.1173

Table B3. Gross sales and extension

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	77	82	105	48	16	328
750K - 1499.99K	11	28	45	22	9	115
Above 1500K	21	25	49	30	9	134
Sum	109	135	199	100	34	577

Pearson's chi-squared test; χ-squared = 17.866, df =8, p-value = 0.2698

Table B4. Gross sales and general farm publication

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	20	43	145	98	22	328
750K - 1499.99K	2	19	53	37	4	115
Above 1500K	6	17	67	35	9	134
Sum	28	79	265	170	35	577

Pearson's chi-squared test; χ-squared = 7.3322, df = 8, p-value = 0.5013

Table B5. Gross sales and other farmers

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	10	30	103	125	60	328
750K - 1499.99K	5	10	42	43	15	115
Above 1500K	7	11	45	52	19	134
Sum	22	51	190	220	94	577

Pearson's chi-squared test; χ-squared = 4.037, df = 8, p-value = 0.8583

Table B6. Gross sales and radio

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	34	78	118	76	22	328
750K - 1499.99K	5	28	55	22	5	115
Above 1500K	15	29	59	26	5	134
Sum	54	135	232	124	32	577

Pearson's chi-squared test; χ-squared = 10.664, df = 8, p-value = 0.2215

Table B7. Gross sales and television

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
Less than 750K	34	78	118	76	22	328
750K - 1499.99K	5	28	55	22	5	115
Above 1500K	15	29	59	26	5	134
Sum	54	135	232	124	32	577

Pearson's chi-squared test; χ-squared = 6.2816, df = 8, p-value = 0.6157

Appendix C: Test of independence between education and information sources

Table C1. Education level and crop specific publication

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	24	31	82	45	9	191
College	10	15	56	34	19	134
University	8	19	79	47	11	164
Grad school	4	6	17	11	5	43
No school	2	0	0	0	0	2
Other education	8	6	20	6	3	43
Sum	56	77	254	143	47	577

Pearson's chi-squared test; χ-squared = 44.583, df = 20, p-value = 0.001257

Table C2. Education level and email newsletter

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	35	40	66	39	11	191
College	10	15	54	39	16	134
University	19	31	56	49	9	164
Grad school	2	8	20	9	4	43
No school	0	0	1	1	0	2
Other education	13	6	12	12	0	43
Sum	79	100	209	149	40	577

Pearson's chi-squared test; χ-squared = 41.024, df = 20, p-value = 0.003699

Table C3. Education level and extension agents

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	46	44	63	28	10	191
College	18	33	49	25	9	134
University	25	41	62	28	8	164
Grad school	3	11	14	12	3	43
No school	1	0	0	0	1	2
Other education	16	6	11	7	3	43
Sum	109	135	199	100	34	577

Pearson's chi-squared test; χ-squared = 34.335, df = 20, p-value = 0.02395

Table C4. Education level and general farm publication

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	15	31	83	54	8	191
College	3	15	66	42	8	134
University	3	25	78	49	9	164
Grad school	1	4	20	13	5	43
No school	0	0	1	1	0	2
Other education	6	4	17	11	5	43
Sum	28	79	265	170	35	577

Pearson's chi-squared test; χ-squared = 27.356, df = 20, p-value = 0.1255

Table C5. Education level and other farmers

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	7	24	71	62	27	191
College	3	6	32	67	26	134
University	9	16	61	58	20	164
Grad school	2	3	12	16	10	43
No school	0	0	1	1	0	2
Other education	1	2	13	16	11	43
Sum	22	51	190	220	94	577

Pearson's chi-squared test; χ-squared = 29.514, df = 20, p-value = 0.07811

Table C6. Education level and radio

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	20	40	78	41	12	191
College	12	32	54	27	9	134
University	15	46	68	31	4	164
Grad school	6	7	12	16	2	43
No school	0	0	1	1	0	2
Other education	1	10	19	8	5	43
Sum	54	135	232	124	32	577

Pearson's chi-squared test; χ-squared = 21.957, df = 20, p-value = 0.3428

Table C7. Educational level and television

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	20	49	74	38	10	191
College	14	34	46	35	5	134
University	27	47	58	28	4	164
Grad school	6	6	16	13	2	43
No school	0	0	2	0	0	2
Other education	4	9	19	8	3	43
Sum	71	145	215	122	24	577

Pearson's chi-squared test; χ-squared = 18.799, df = 20, p-value = 0.535

Table C8. Education level and telephone

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	18	28	66	59	20	191
College	9	11	37	52	25	134
University	17	28	50	49	20	164
Grad school	4	8	9	19	3	43
No school	0	0	2	0	0	2
Other education	3	4	14	15	7	43
Sum	51	79	178	194	75	577

Pearson's chi-squared test; χ-squared = 23.884, df = 20, p-value = 0.2475

Table C9. Education level and marketing information websites

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	26	26	67	58	14	191
College	12	19	38	46	19	134
University	11	27	59	50	17	164
Grad school	1	4	16	18	4	43
No school	0	0	1	1	0	2
Other education	7	7	15	13	1	43
Sum	57	83	196	186	55	577

Pearson's chi-squared test; χ-squared = 21.181, df = 20, p-value = 0.3866

Table C10. Educational level and social media

	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful	Sum
High school	63	44	56	23	5	191
College	34	32	47	17	4	134
University	49	49	38	23	5	164
Grad school	14	7	13	8	1	43
No school	0	0	1	1	0	2
Other education	19	9	9	4	2	43
Sum	179	141	164	76	17	577

Pearson's chi-squared test; χ-squared = 21.181, df = 20, p-value = 0.3866

Appendix D: Results of logit model estimation

Appendix D1. Results for the human sources

	Dependent variable:	
	Human source	
	logistic	*binary model (marginal effect)*
	(1)	(2)
age	-0.010	-0.002
	(0.007)	(0.002)
educ_graduate school	11.787	0.272***
	(535.411)	(0.019)
educ_high school	-0.459	-0.092
	(0.390)	(0.087)
educ_university	-0.301	-0.059
	(0.387)	(0.080)
internet_use	0.424**	0.083
	(0.199)	(0.053)
drone_use	0.051	0.010
	(0.388)	(0.075)
grossales750K - 1499.99K	-0.068	-0.014
	(0.254)	(0.051)
grossalesAbove 1500K	0.086	0.017
	(0.241)	(0.047)
Constant	1.625***	0.318*
	(0.551)	(0.173)
Observations	577	577
Log Likelihood	-334.125	
Akaike Inf. Crit.	686.249	686.249

*p<0.1; **p<0.05; ***p<0.01; McFadden R^2= 0.0164

Appendix D2. Results for the traditional sources

	Dependent variable:	
	Traditional source	
	logistic	*binary model (marginal effect)*
	(1)	(2)
age	0.010	0.002
	(0.006)	(0.002)
educ_graduate school	12.325	0.377***
	(535.411)	(0.021)
educ_high school	-0.058	-0.013
	(0.341)	(0.080)
educ_university	-0.043	-0.010
	(0.336)	(0.078)
internet_use	0.579***	0.135**
	(0.184)	(0.052)
drone_use	0.619*	0.133
	(0.364)	(0.083)
grossales750K - 1499.99K	-0.134	-0.032
	(0.237)	(0.057)
grossalesAbove 1500K	-0.160	-0.038
	(0.218)	(0.053)
Constant	-0.285	-0.066
	(0.486)	(0.115)
Observations	577	577
Log Likelihood	-375.045	
Akaike Inf. Crit.	768.090	768.090

*p<0.1; **p<0.05; ***p<0.01; McFadden R^2= 0.0208

Appendix D3. Results for the new media sources

	Dependent variable:	
	New media source	
	logistic	*binary model (marginal effect)*
	(1)	(2)
age	-0.007	-0.002
	(0.007)	(0.002)
educ_graduate school	12.003	0.441***
	(535.411)	(0.024)
educ_high school	-0.295	-0.073
	(0.372)	(0.092)
educ_university	-0.286	-0.070
	(0.367)	(0.090)
internet_use	2.025***	0.463***
	(0.199)	(0.052)
drone_use	0.034	0.008
	(0.378)	(0.092)
grossales750K - 1499.99K	0.353	0.085
	(0.264)	(0.064)
grossalesAbove 1500K	0.033	0.008
	(0.238)	(0.058)
Constant	-0.271	-0.067
	(0.529)	(0.131)
Observations	577	577
Log Likelihood	-326.877	
Akaike Inf. Crit.	671.755	671.755

*p<0.1; **p<0.05; ***p<0.01; McFadden R^2= 0.1773

Appendix E : Survey questionnaire

We would want you to help us better understand your marketing information needs in the future, your sources of risks and risk management strategies by answering the following questions to the best of your knowledge.

Consent to Participate: I have read and understood the description provided above and consent to participate in the study. I understand that by completion of this survey, I give permission for the researcher to use the data gathered in the manner described

□ I accept

□ I decline

A. Do you produce grains or oilseed crops?

[If yes, continue]

[If no, thanks and terminate]

B. Do you have any role in decision-making in your farm operation?

[If yes, continue]
[If no, thanks and terminate]

1. Your farm is a ..... (Check one box only)

□ Sole proprietorship

□ Family owned corporation

□ Partnership

□ Corporation with outside investors

Market Prospects is a 15-minute interview segment within the *Farmgate* program on CTV aimed at making high quality and timely market information, analysis and education available to Saskatchewan farmers. We would like to seek your views on the program.

2. Do you watch Market Prospects?

□ Yes □ No

If yes, where do you watch it?

□ TV □ Website

3. How regularly do you watch Market Prospects?

□ Always

□ Very Often

□ Sometimes

□ Rarely

4. On approximately what percent of your total crop acres do you use the following technologies? *Fill in the appropriate percent of acres.*

Technology	% of crop acres
Computerized field mapping	
Satellite imagery	
Soil sampling with GPS	
Variable rate application	
Variable seeding	
Yield monitor without GPS	
Yield monitor with GPS	

5. On average, approximately what percentage of your total production (in terms of gross sales) is produced under contract in which the buyer specifies items such as the product characteristics, time of delivery, pricing formula, etc.? *Fill in the percentages indicating "0" if none.*

Total crop production ☐ %

Total livestock production ☐ %

6. Which of the following statements describe your farm's use of computer? *Check all that apply.*

☐ Use a computer for keeping financial records

☐ Use a computer for production planning

☐ Use a computer for communication (internet, fax, etc.)

☐ Do not own or use a computer on my farm

7. How often do you use the Internet for marketing information as they relate to your farm business? Please c*heck one.*

- ☐ Almost always
- ☐ Often
- ☐ Sometimes
- ☐ Seldom
- ☐ Never

8. You receive information about marketing your farm products from a variety of sources. Please evaluate the following sources of information according to how often you get useful information from each. *Check one box in each row.*

Source of marketing information	Never useful	Seldom useful	Sometimes useful	Often useful	Always useful
Crop/livestock specific publication	□	□	□	□	□
E-mail newsletter	□	□	□	□	□
Extension	□	□	□	□	□
General farm publications	□	□	□	□	□
Other farmers	□	□	□	□	□
Radio	□	□	□	□	□
Television	□	□	□	□	□
Telephone call/text	□	□	□	□	□
Marketing information websites	□	□	□	□	□
Social media	□	□	□	□	□
Other (specify)	□	□	□	□	□

We would like to know you and your farm business operations. The following questions are designed to tell us a little about you and your farm operations

9. Please indicate your gender

- □ Male
- □ Female

10. Which year were you born?

11. What is the highest level of education you have completed?

□ High school

□ College education

□ University education

□ Graduate school

□ Never attended school

□ Other please specify

12. How many years have you been working as a farmer?

□ Less than 10 years

□ 11-20 years

□ 21-30 years

□ 31-40 years

□ Over 40 years

13. Which of the following best describe your gross sales from your farm business in the past year?

Less than $100K	$100K to $249K	$250K to $499K	$500K to $749K	$750K to $1,000K	$1,000K to $1,500K	Greater than $1,500K	Don't know/ Refused
◯	◯	◯	◯	◯	◯	◯	◯

14. Do you use drone technology in your farm operations?

□ Yes □ No