PSYCHOLOGICAL DETERMINANTS OF FARMERS’ INTENTION TO ADOPT IMPROVED AGRICULTURAL INNOVATIONS: A STUDY AMONG SMALLHOLDER FARMERS IN THE GUSHEGU DISTRICT OF NORTHERN GHANA

BY

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DEPARTMENT OF PSYCHOLOGY

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Psychological determinants and innovation adoption

DECLARATION

I, Richmond Acquah-Coleman, the author of this dissertation do hereby declare that except for references to other people’s work, which I have duly acknowledged, the study herein presented is the first of its kind to be carried out in the Department of Psychology, University of Ghana, Legon, under the objective supervision of Prof. C. Charles Mate-Kole, Dr. Maxwell Asumeng and Dr. Benjamin Amponsah. This work has never been submitted in any form, whole or part for a degree in this University or elsewhere.

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This work has been submitted for examination with our approval as supervisors.

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(CO-SUPERVISOR)
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DEDICATION

To my family whose encouragement and companionship I have always enjoyed.
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First, I am truly thankful to the almighty Jehovah God for His unlimited grace, loving-kindness and mercies extended to me, and for granting me peace and the privilege of life throughout my education.

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ABSTRACT

The extent and speed to which farmers adopt available innovations/technologies can significantly improve crop production and promote food security locally, nationally and globally. However, there is evidence that farmers do not easily adopt farming innovations. In an attempt to understand and predict farmers’ innovation adoption behaviour, recent studies have focused on farmers’ background and economic factors with little attention to psychological factors, particularly within the African context. Using an exploratory sequential mixed methods design, this study contributes to this knowledge gap by examining the psychological factors that influence intention to adopt improved agricultural innovations especially row planting, improved seeds and fertilizer.

Two Hundred and Eighty-Two (282) smallholder farmers from the Gushegu district participated in Study 1 and 2. Thematic analysis of data in Study 1 revealed that social motives motivate smallholder farmers in Northern Ghana than economic motives. Study one (1) also identified twenty salient beliefs that smallholder farmers have about improved agricultural innovations. These beliefs include increasing farm yield and producing attractive farm products. Study 2 used the beliefs identified in Study 1 to construct three new measures and used them in addition to other existing measures to determine the factors that influence adoption intention. The results of Study 2 showed that adoption referents, perception about social pressure (subjective norm) and evaluation of improved agricultural innovations (attitude) strongly influence farmers’ adoption intention. The results also showed that attitude mediated the effect of behavioural beliefs on adoption intention whereas subjective norm mediated the influence of normative beliefs on adoption intention. Similarly, control beliefs indirectly affect adoption intention through perceived behavioural control. Besides, the study found that gender, household size, risk attitude, psychological wellbeing and farm size have a significant
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effect on the salient beliefs about improved agricultural innovations, which in turn
influence adoption intention. These findings show that adopting a psychological approach
to agricultural innovation adoption programs would ensure farmer effectiveness,
satisfaction, quality of work life and farmer commitment.

Keywords: Improved Agricultural Technologies, Smallholder Farmers, Innovation
Adoption, Adoption Intention, Adoption Behavior, Gushegu District, Northern Ghana, Africa
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CHAPTER ONE

INTRODUCTION

1.0 Background

Generally, scholars have conducted research on innovation adoption behaviour of farmers in both developed and developing countries (Borges, Foletto & Xavier, 2015). While such studies have contributed significantly to knowledge and agricultural development, they, however, seems to be insufficient in providing a deeper understanding of all the determinants of farmers’ innovation adoption behaviour.

Social psychological theories, particularly the Theory of Planned Behaviour (TPB) (Ajzen, 1991) and Theory of Reasoned Action (TRA, Fishbein & Ajzen, 1985), have been used to explain farmers’ innovation adoption behaviour as a result of the realisation that farmers are dynamic, have a different motivation for farming and behave differently even in similar situations (de Aragao Pereira, 2011). To this end, agricultural research worldwide, especially in developed countries has focused on psychological and social factors inherent in farmers’ decision-making (de Aragao Pereira, 2011). Hence, the need for understanding the various psychological factors underpinning the uptake of agricultural innovations to ensure effective and sustainable adoption among farmers in developing countries.

Agricultural research in developing countries has focused largely on small-scale or smallholder farmers, as they constitute the majority of farmers and they are relevant for policymaking (Calcaterra, 2013). Smallholder agriculture can enhance the livelihood of many people especially, the rural poor and ensure household, national and global food
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security (Prakash-Mani, 2013). However, the productivity of smallholder farmers in developing countries including Ghana is very low [Food and Agricultural Organization of the United Nations (FAO), 2017; Rapsomanikis, 2014]. To address this issue, farmers may have to change their work attitude and decisions regarding the adoption of good agronomic technologies and be motivated to adopt these innovations to enhance crop production. Therefore, it is important to study the adoption behaviour of farmers to promote the right adoption attitude.

This chapter presents general issues relevant and related to the study. It begins with some key issues, including a discussion on improved agricultural innovations, Smallholder farmers in Ghana as well as Psychology and agricultural research in Ghana. Next in this chapter is the problem statement, general research questions and objectives of the study. The final section in this chapter is the scope of this research and an outline of the dissertation.

1.1 Key Issues of Relevance to the Study

Three main issues provide the necessary background to this research: (1) improved agricultural innovations; (2) smallholder farmers in Ghana; as well as (3) Industrial and Organisational (I-O) Psychology and agricultural research in Ghana. The first issue discusses the concept of innovation and improved agricultural technology in the context of this study. The second issue looks at smallholder agriculture in Ghana. It defines smallholder farming in the context of this study as well as the contribution of smallholder farmers to the global and local economy. The final section establishes the link between I-O Psychology and agricultural research.
1.1.1 Improved Agricultural Innovations

Innovation is a specific case of technology, which is new (de Aragao Pereira, 2011). According to Rogers (2003), an innovation is “an idea, practice, or project that is perceived as new by an individual or another unit of adoption” (p. 12). Innovation may have been invented a long time ago, but if people perceive it as new, then it may still be an innovation for them (Sahin, 2006). Thus, the person perceiving it determines the newness of a specific innovation or technology. For example, if an individual uses a particular technology for the first time, it is an innovation for that user, regardless of the time of launching or introducing the innovation to society.

Other definitions of innovation may exist in the literature. For instance, Evans (1991) defines innovation as the ability to discover new relationships, of seeing things from new perspectives and to form new combinations from existing concepts. Hurley and Hult (1998) define innovation in the context of organisational operations. In their view, innovation is the process whereby an organisation engages in the continuous implementation of ideas, methods, products or services in order to maintain a competitive advantage. Similarly, Knox (2002) defines innovation as a process that provides benefit and a degree of novelty to the organization, suppliers and customers, developing new procedures, solutions, products and services and new ways of marketing. Thus, the application of innovations adds value and brings benefits to people.

The field of agriculture has witnessed the introduction of several improved innovations for many decades to enhance farming efficiency (Pisante, Stagnari & Grant, 2012; Von Braun, 2014). There are three broad categories of improved agricultural innovations. These are production-oriented, environmental-friendly and farm management
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Innovations (de Aragao Pereira, 2011). Production-oriented innovations mainly improve crop quality and quantity. Examples include no-tillage farming, pest/disease management, irrigation farming, fertilizer application, improved seeds, and row planting (de Aragao Pereira, 2011). Environmental-friendly technologies, on the other hand, tend to conserve natural resources as well as mitigate the environmental impacts of agriculture. They include soil conservation practices such as crop rotation, mulching, terrace and contour farming (de Aragao Pereira, 2011). Furthermore, farm management innovations essentially aid farm decision-making, farm business administration and the marketing of farm produce. For example, budgeting, record keeping and managing sales (de Aragao Pereira, 2011). It is beyond the scope of this research to investigate the adoption of all types of innovations. Hence, this research focuses on production-oriented innovations.

Scholars expect agricultural innovations to evolve rapidly in developing economies in the coming years. This is because changes in population and urbanization threaten both domestic and global food security (Von Braun, 2014). Again, agriculture remains the engine of growth in most emerging economies (Chamberlin, 2008). There is also evidence of production gaps in developing countries (Ragasa & Byerlee, 2015). For instance, the Ministry of Food and Agriculture in Ghana (MoFA, 2011) reports that yields for staple crops are generally below the average economically attainable yields. Production increases from these crops are more through land expansions than the use of improved agricultural innovations (Ragasa & Byerlee, 2015). This approach to agricultural growth seems unsustainable because it could have serious consequences on the country’s forest reserves.
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According to Ragasa and Byerlee (2015), low productivity is due to the low adoption rates of improved agricultural innovations such as improved seed varieties, fertilizer application and soil management practices. For example, varietal turnover for maize is around 13 years, which means that maize farmers continue to use old seed varieties as well as the high use of recycled seeds (Ragasa et al., 2013; Ragasa & Byerlee, 2014). In spite of the active promotion of fertilizer use through government subsidies over the last four decades, fertilizer adoption in Ghana is 5kg nutrient per hectare, which is substantially below the average for Africa (FAO, 2005). Furthermore, there is limited adoption of soil management practices such as row planting, no-tillage and soil conservation practices, which have the potential to improve crop productions significantly (Ragasa & Byerlee, 2014). Farmers could be encouraged to intensify their adoption of these productivity-enhancing innovations through behavioural and attitudinal change. This requires research into the behavioural factors that influence adoption decisions regarding these innovations.

Studies on improved agricultural innovations have focused on their separate adoption without considering that adoption of these innovations are interdependent (Ogada, Mwabu & Muchai 2014; Olwande, Sikei & Mathenge, 2009; Wekesa et al., 2003). However, there is evidence to suggest that these innovations are jointly adopted (Ogada et al., 2014). In other words, these improved agronomic practices seem to have simultaneous adoption effect. For example, a farmer who adopts improved seeds is more likely to adopt fertilizer because of their complementary benefits. As a result, farmers may adopt improved agricultural innovations “as a package” (Ogada et al., 2014, p. 2), namely row planting, improved seeds, fertilizer and agrochemicals. Hence, this study specifically considers improved agricultural innovations to include row planting,
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improved seeds and fertilizer application and focus on the psychological factors that influence their combined adoption.

1.1.2 Smallholder Farming in Ghana

The term ‘smallholder’ is often interchanged with ‘small-scale’, ‘resource poor’ and ‘peasant farmer’ (Chamberline, 2008). It connotes smallness in farm size and seems to be the main characteristic of small-scale farmers in developing countries including Ghana. However, some studies have suggested that other equally important factors such as limited capital, limited access to credit and type of crop produced should feature in the conceptualization of smallholder farmers (e.g., Asuming-Brempong et al., 2004; Chamberlin, 2008; Von Braun, 2005). It suggests that a more comprehensive definition of a smallholder farmer is somehow elusive. Nevertheless, available working definitions of a smallholder farmer reveal certain important themes, namely, market orientation, wealth, the level of vulnerability to risk, landholding size among others (Chamberlin, 2008).

Inasmuch as the inclusion of these variables is important to our understanding of smallholder farmers, they also tend to obscure the identity of a smallholder farmer. In the case of farmer size, two farmers, one producing a cash crop for the market and the other producing a staple for home consumption with similar farm sizes are not the same in terms of wealth and income because the production of cash crops will generate more income than just producing for household consumption. However, farm size seems to be the single defining variable in describing smallholder farmers. Chamberlin (2008) rightly argues that land is the most important productive asset and that its size is indicative of
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other dimensions such as wealth, market orientation, access to credit and inputs. Thus, the definition of smallholder agriculture often revolves around the size of land cultivated.

The Directorate of Cooperative and Enterprise Development (D: CED) (2012) of the Department of Agriculture, Forestry and Fisheries in South Africa defines smallholder farmers as farmers who cultivate subsistence crops and one or two cash crops with reliance on family labour on a small-size plot of land (D: CED, 2012). According to Ekboir, Boa and Dankyi (2002, p.2), a “small-scale farmer in Ghana has less than 5 hectares [ha]” of farm size. On the other hand, the Ministry of Food and Agriculture (MoFA) (2012) in Ghana, states, “agriculture is predominantly on a smallholder basis in Ghana. About 90% of farm holdings are less than 2 hectares in size” (P.5). Similarly, in the view of other researchers, smallholder farmers refer to marginal and sub-marginal farm households that own/ or cultivate two (2) hectares of land or less (Singh, Kumar & Woodhead, 2002). This requires a consensus to establish the exact farm holding size that is representative of smallholder farming. Besides, variation in landholding size is dependent on context, country and ecological zone. For the purposes of this study, smallholder farmers are farmers that own and/or grow less than 5ha of farmland. This is to ensure that operationalized meaning of a smallholder farmer in the context of the current study is consistent with the extant literature.

In view of the subtlety of an accurate quantitative definition of smallholder farming and the fact that landholding size appears to be the most direct and easy parameter of a smallholder (Chamberlin, 2008), the current study predicates its definition of a smallholder farming on landholding size even though it is inadequate.
Smallholder farmers are critical to the global economy and the fight against food insecurity. Globally, there are about 500 million smallholder farmers managing about 85% of the world’s farms (Calcaterra, 2013; Graeub et al., 2016; Lowder, Skoet, & Raney, 2016). These smallholder farms are responsible for about 2.5 billion people and provide jobs for 1.3 billion smallholder farmers (Calcaterra, 2013). According to Prakash-Mani (2013), 25% of food produced in the world comes from smallholders in Latin America, Asia and Africa. Besides, the Food and Agricultural Organization (FAO) expects smallholder farmers to produce 80% of the food consumed in many developing countries in Asia and sub-Saharan Africa (FAO, 2012). In Ghana, smallholder farms makeup roughly 90-95% of farms and contribute about 80% toward the total agricultural production (Asuming-Brempong et al., 2004). This suggests the importance of smallholder farmers to agricultural and economic development in Ghana.

Scholars expect that smallholder agriculture can enhance the livelihood of many people especially the rural poor and ensure household, national and global food security (Prakash-Mani, 2013). However, the productivity of smallholder farmers particularly in Ghana is very low (Barnett & Srivastava, 2017; FAO, 2015). The poor crop yield may be due to many factors including low investment in improved agricultural technologies such as the use of fertiliser, improved seeds, and row planting among others. To increase agricultural production, it is imperative to pay more than the usual attention to smallholder farmers’ technology adoption attitude and behaviour. This requires behavioural research on smallholder farmers to understand the psychosocial factors that influence their decision to adopt or not to adopt improved agricultural technologies. Against this background, Industrial and Organisational Psychologist could spearhead
behavioural research on smallholder farmers to improve the efficiency of their agricultural enterprises.

1.1.3 Industrial and Organisational (I-O) Psychology and Agricultural Research

Psychology is the field of science noted for the study of human behaviour and mental processes (Coon, & Mitterer, 2013). Psychology is arguably one of the few fields of study that can lay claim to a multiplicity of applications in the social, economic, political, health and organisational settings. The extensive application of psychological principles underscores its importance and success in understanding human behaviour. The field of psychology concerned with the application of psychological theories, concepts and principles to work and organisation related issues is known as Industrial and Organisational (I-O) Psychology (Landy & Conte, 2016). Thus, to the extent that farming is work, it could benefit from the applications of I-O Psychology.

Behaviour change among farmers could facilitate the process of agricultural modernization. That is agricultural productivity depends on the extent to which farmers adopt existing agricultural technologies (Santoyo Rio, 2012). However, agricultural innovation adoption is an uncommon phenomenon among farmers (Diederen, Van Meijl, Wolters & Bijak, 2003). This situation of low uptake of innovation is no different among Ghanaian smallholder farmers (Akudugu, Guo & Dadzie, 2012). Therefore, it is important to unearth the behavioural determinants necessary for efficiency in Ghanaian farm businesses.

In recent times, researchers have called for the use of behavioural models in the study of farmer’s behaviour because of the realization that farmers are not only influenced by
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economic motives but also psychological, social and cultural factors (Santoyo Rio, 2012). Several studies have associated farmers’ adoption behavior to psychological factors such as attitudes, beliefs, perceptions, motives and values (Beedell & Rehman, 2000; Borges et al., 2014; Burton, 2004; Deressa, Hassan & Ringler, 2011; Poppenborg & Koellner, 2013, Rehman, McKemey & Yate, 2007). This suggests that understanding farmers’ decision-making in Ghana requires a good appreciation of these psychological variables (Santoyo Rio, 2012). Other researchers also indicate that farmers’ quest for social approval influence their technology adoption behaviour. According to Burton (2004), an individual’s disregard for group norms could lead to social disapproval, which could lead to a loss of identity and a reduction in self-esteem. The question is, what are the social pressures that interfere with the work of smallholder farmers in Ghana? I-O Psychological research within the Ghanaian context could better explain these situations.

The aim of I-O Psychology is to improve employee wellbeing and enhance the effectiveness of work. The involvement of psychology in agriculture may help a great deal to unearth the psychological underpinnings of adopting farming innovations and provide useful suggestions for improving the agricultural sector. It is, therefore, imperative to extend I-O psychological research and practice to the agricultural sector since effective farming practices and the quality of work life of the farmers is vital to agricultural productivity in Ghana.

Despite the strong psychosocial content in agricultural practices, psychological research in this area is woefully inadequate especially in developing countries (Landini, Benítez & Murtagh, 2010; McIlveen, 2015; Murtagh & Landini, 2011). Most of the studies on the adoption of agricultural innovations in developing countries have used economic
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models which assume that farmers’ behaviour can only be modelled in terms of profit
maximization (e.g. Asfaw & Admassie, 2004; Jara-Rojas, Bravo-Ureta & Díaz, 2012;
Kassie, Jaleta, Shiferaw, Mmbando & Mekuria, 2013; Khan, Amudavi, Midega,
Wanyama & Pickett, 2008; Mazvimavi & Twomlow, 2009; Wubeneh & Sanders, 2006).

The relative neglect of psychology on the issues associated with farming and agriculture
goes to suggest that few I-O Psychology researchers either conduct research in this field
or appreciate that their research is relevant to the work of farming. This may indicate a
lack of a clear understanding of how I-O Psychology can be relevant to agriculture.
Casper and Swanberg (2011) rightly argue that the absence of I-O Psychology from the
field of agriculture is a loss in two ways. First, I-O Psychology like all other disciplines
must exhibit its importance to society and there is no better way than to improve a sector
that provides the food and fibre of life. Second, I-O Psychology’s absence in agriculture
is a loss to the world of work that requires more research and interventions geared towards
understanding the role of workers and enhancing the quality of work in the lives of
people, especially work that is regarded as informal and fairly important.

The agricultural industry today is not the same as it used to be three or more decades ago.
“Its levels of technological advancement and productivity are inconceivably different”
(McIlveen, 2015, p.158). However, I-O Psychology has not adequately monitored the
scientific progress of agriculture. Therefore, the Ghanaian agricultural industry requires
an intensive and extensive stream of psychological research to keep pace with the
behavioural issues in modern agriculture.
1.2. Statement of the Problem

The low rate of technology adoption among farmers is a major factor affecting agricultural production in Ghana (Akudugu et al., 2012; Meijer, Catacutan, Ajayi, Sileshi & Nieuwenhuis 2015). This has prompted several studies to encourage the uptake of improved agricultural innovations among Ghanaian farmers. Majority of these studies have focused on farmers’ socioeconomic background factors (Baffoe-Asare, Danquah & Annor Frempong, 2013; Dormon, Leeuwis, Fiadjo, Sakyi-Dawson & Van Huis, 2007; Martey et al., 2013), farm characteristics (Akudugu et al., 2012; Donkoh & Awuni, 2011), institutional factors (Hounkonnou et al., 2012) and the potential benefits of technology adoption (Aneani, Anchirinah, Owusu-Ansah & Asamoah, 2012; Faltermeier & Abdulai, 2009; Meijer et al., 2015). In recent time, innovation adoption studies have also focused on climate change adaptation among farmers in Ghana (Fosu-Mensah, Vlek & Maccarthy, 2012; Laube, Schraven & Awo, 2012; Limantol, Keith, Azabre & Lennartz, 2016). Despite these research efforts, the relatively low uptake of technology among Ghanaian farmers appears to persist.

To promote innovation adoption among smallholder farmers in Ghana, several interventions including the Value Chain Model have been introduced. The Value Chain Model describes the gamut of people, activities and processes (such as inputs from various service providers, the physical transformation of raw materials etc) involved in bringing a product or service through the various stages of production (Kaplinsky, Raphael & Michael Morris, 2000). Thus, as an agricultural intervention, farmers are linked to inputs, equipment, finance, markets and information through bigger commercial farmers who have the capacity and are motivated to invest in smallholder production (ACDI-VOCA, 2018). The aim of the Value Chain model is to facilitate the participation
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of each player in the chain to identify constraints against and opportunities for increasing productivity through innovation adoption (Webber & Labaste, 2007).

Government, policymakers and agricultural development agencies tend to focus on the Value Chain approach rather than focusing on individual farmers to encourage innovation adoption, increase productivity and improve the economic livelihoods of smallholder farmers. In their effort to devise interventions that promote innovation adoption and spur agricultural growth, policymakers have used the value chain model as a robust tool to address constraints against innovations adoption among smallholder farmers in Ghana.

According to the 2014 report of the Agricultural Development and Value Chain Enhancement (ADVANCE) Project II, the adoption of the Value-Chain approach has yielded some positive results particularly among maize, rice and soybeans farmers in Northern Ghana (ACDI-VOCA, 2018). For instance, smallholder farmers have benefited from higher yields/ha and profit as a result of access to improved seed varieties, access to quality inputs and mechanization services and markets.

However, the agricultural sector in Ghana despite the adoption of the Value Chain model and other interventions has performed below expectations in the last decade or so (Zakaria & Adams, 2018). For example, the sector’s GDP contribution dropped from 31% in 2008 to 21% in 2016 with growth rate dropping from 7.4% to 3.6% within the same period under review, indicating an annual average growth rate of 4.1% which falls short of the projected 6% annual growth rate in the Medium Term Agricultural Sector investment Plan (Ghana Statistical Service, 2017; Government of Ghana, 2017). The significant decline in the contribution of the Agricultural sector has been attributed to the
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low uptake of improved agricultural innovations (Zakaria & Adams, 2018). This suggest that the decision to adopt improve agricultural innovations is not just based on economic expectations but also informed by some psychological factors and processes (Borges et al., 2015; Martinez-Garcia et al., 2013; Reimer, Weinkauf & Prokopy, 2012; Wauters, Bielders, Poesen, Govers, & Mathijs, 2010).

According to Mzoughi (2011), the psychological processes that explain the little or no adoption of improved agricultural innovations are internal processes, intrinsic motives and cultural orientations of individual farmers. It includes values, beliefs, attitudes, motivations, personalities and the social interactions of the farmers. There are two different approaches to psychological studies on innovation adoption. Some studies seek to identify latent variables that have a bearing on adoption behaviour and measure their impact on the behaviour. Other psychological studies adopt a cognitive approach to understand the mental processes involved in technology adoption decisions (de Aragão Pereira, 2011). These types of psychological studies are very much lacking among innovation adoption studies in Ghana.

In Ghana, the literature on the psychosocial factors that influence the adoption and non-adoption of agricultural innovations among farmers is very scarce. According to Meijer et al. (2015), psychological attributes such as perceptions, attitudes and knowledge of a potential adopter towards a technology plays a key role in the innovation adoption process. Neglecting the psychosocial factors in innovation adoption and relying mainly on economic motives and external environmental factors in the adoption process results in a misinterpretation of farmers’ rationality (Edwards-Jones, 2006). Therefore, there is a lack of understanding of all the major determinants of farmers’ adoption behaviour.
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This situation is worrying because it is the sort of evidence needed to inform sound agricultural policies to improve livelihoods and ensure food security in Ghana.

Generally, adoption studies on Ghanaian farmers have focused on other factors influencing technology adoption as indicated earlier in this section. These studies to some extent informed policy decisions in the agricultural sector in Ghana. However, the exclusion of psychological variables by these studies is problematic because it provides a partial perspective and may not be sufficient for understanding the complexities of farmers’ adoption behaviour. Including psychological explanations will bring to the fore the strong psychological content inherent in the adoption decision process. This is the kind of evidence needed to encourage the participation of I-O Psychologists in the formulation and implementation of agricultural policies in Ghana. It is also the sort of evidence needed to encourage active and consistent I-O Psychological research focused on locally relevant factors within the agricultural context by other Psychologists.

In view of the problem of low uptake of improved agricultural innovations among Ghanaian smallholder farmers, this study attempts to understand the meaning of improved agricultural innovations from the perspectives of the smallholder farmers. It further seeks to explore the psychological factors that could account for the low adoption of improved agricultural innovations among smallholder farmers particularly in the Northern region of Ghana despite the introduction of economic interventions such as the Value Chain strategy.
1.3. Objectives of the Study

The main objective of this study is to investigate the psychological factors that influence smallholder farmers’ adoption or non-adoption of agricultural innovations, particularly row planting, improved seeds and fertilizer application. In order to achieve this major objective, five specific objectives were established. The study addressed the first two research objectives with a qualitative approach and addressed the last three objectives with a quantitative approach. The specific objectives are to:

1. Identify the meaning of improved agricultural innovations from the perspectives of smallholder farmers in Northern Ghana.
2. Explore the farming motivations of smallholder farmers in Northern Ghana.
3. Identify smallholder farmers’ beliefs about improved agricultural innovations.
4. Examine the psychological constructs that influence smallholder farmers’ intention to adopt improved agricultural innovations.
5. Investigate the influence of farmer characteristics on beliefs about improved agricultural innovations.

1.4. The relevance of the Study

Using psychological models to explore the determinants of innovation adoption among smallholder farmers within the Ghanaian setting and their effect on adoption intention is relevant and significant for various reasons. The study discusses these reasons later in chapter six (See Contribution of Thesis to Science).

1.5. The scope of the Study

The present study explores and examines the influence of psychological constructs (e.g., attitude, social pressure, beliefs, etc) on the innovation adoption intention of smallholder
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farmers in the Gushegu district in Northern Ghana. However, the following is the main scope of this study:

1. As indicated in previous sections, studies have shown that there are several economic, social and psychological factors associated with the decision to adopt technology among farmers. However, it is beyond the remit of this study to examine all these factors. This is to ensure that the study achieves depth, in that the main variables of interest are deeply investigated using a mixed methods approach.

2. This study attempts to investigate psychological constructs such as attitudes, beliefs, motivations, social influence and adoption intentions. By choosing these variables as well as behavioural intentions and not actual behaviour, the study emphasizes the human aspects (internal factors) of innovation adoption rather than external conditions associated with the adoption of innovation.

3. The study area is limited to the Gushegu district in the Northern region of Ghana, given that the district has a large and active population of smallholder farmers in the region. The Gushegu district is one of the districts in Northern Ghana that seems to receive attention from government and non-governmental organizations (NGOs) in terms of agricultural programs and interventions. For instance, the district is a beneficiary of the Agricultural Development and Value Chain Enhancement (ADVANCE) program, a funded project of the United States Agency for International Development (USAID). This and other characteristics make the district suitable for the current study.
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4. Within the Gushegu district, there are many smallholder farmers. Most of these farmers are beneficiaries of the ADVANCE program. However, some smallholder farmers exist within the district who are not beneficiaries of the program. While it would have been interesting to investigate the adoption behaviours of all these farmers, the study could not afford all the logistics needed to carry out such a study. Besides, using farmers of the ADVANCE program as participants were considered appropriate because they were more coordinated and accessible. Therefore, the scope of the current study in terms of participants was limited to smallholder farmers who are beneficiaries of the ADVANCE project in the Gushegu district.

1.6. Structure of the Dissertation

There are six chapters in this two-fold study. The first chapter presents the background to the study and discusses key issues such as the meaning of improved agricultural innovations, smallholder farming and the relevance of I-O Psychological research in agriculture. It also contains the statement of the problem and the objectives of the study. Chapter 2 is the literature review, which focuses on the relevant theoretical approaches and empirical studies on farmers’ innovation adoption behaviour. The chapter concludes with a conceptual model indicating the expected relationships of the variables under investigation in this study. Chapter 3 contains the methodology for the study. In this chapter, the study presents the general mixed methods procedures such as philosophical foundation, research design and sampling techniques. Chapter 4 presents the specific qualitative methods, data analysis technique, findings and discussion of study 1. Similarly, chapter 5 contains the specific quantitative methods, data analysis technique, results and discussion of study 2. Finally, Chapter 6 discusses the general findings of the
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two-part study. This chapter presents the limitations and recommendations for future
studies. It also discusses the implications of the study, contribution to science and the
overall conclusions from the study.
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction
The aim of this study is to explore the major psychological determinants of innovation adoption and to examine its effect on the adoption intentions of smallholder farmers. This chapter contains two main sections. First, the theoretical framework section, which presents the relevant theories in adoption studies to explain farmers’ decision-making behaviour. The second section provides a review of pertinent empirical studies in the research area. The chapter concludes with a summary and critique of the literature. It includes the conceptual framework, rationale, hypotheses and operational definitions of key terms in this study.

2.1 Theoretical Framework
Three broad factors (characteristics of the innovation, the potential adopter and the general environment) influence the complex process of innovation adoption (Prager & Posthumus, 2010). These factors form the basis for the theoretical framework adopted to explain innovation adoption among smallholder farmers. The theories used in this study are Social Learning Theory (SLT) (Bandura, 1986 & 2001), the Theory of Planned Behaviour (TPB) (Ajzen, 1991, & 2011) and Diffusion of Innovation Theory (DOI) (Rogers, 1995 & 2003).
2.1.1 Social Learning Theory

The Social Learning Theory (SLT) (Bandura, 1986; 2001) provides a good theoretical perspective for studying farmers’ adoption behaviour. It is a general theory of behaviour that blends learning principles with cognitive psychology. This theory “approaches the explanation of human behaviour in terms of a continuous (reciprocal) interaction between cognitive, behavioural and environmental determinants” (Bandura, 1977, p.7). It, therefore, suggests that human behaviour is guided by the triadic interaction of the cognitive (person), environmental and behavioural factors. The SLT does not only focus on learning but seeks to describe how groups of social and personal competencies (personality) develop out of the social situations within which learning transpires. It also addresses personality assessment and behaviour modification techniques in clinical and educational settings (Larsen & Buss, 2008; Marlatt & Donovan, 2005).

Researchers have extensively applied the principles of SLT to several social behaviours such as aggression, parenting, health behaviours, consumer behaviours and organizational behaviours (Akers, 2017; Chen, Hu & Wang, 2015; Wang & Yu, 2017; Winkler, 2010). Besides, in studies of agricultural technology adoption, social learning theory has been theoretically useful (Barrantes Bravo, 2015; Genuis, Koundouri & Nauges, 2013).

The theory has three elements namely cognitive, environmental and behavioural dimensions. The cognitive dimension indicates that behaviour does not simply result from a stimulus-response relationship rather the individual’s cognitive processes mediate the influence of external stimuli on behaviour (Depue, 2010). To this end, the theory suggests that conditions in the environment present the individual with information that
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is cognitively processed, and the outcome of that processing determine the overt behaviour that will follow (Maisto, Carey & Bradizza, 1999). That is, the immediate external environment does not control behaviour rather through prior experiences; people tend to anticipate that certain actions or inactions will gain the results they value whereas others will not produce any useful rewards. Therefore, the expectances of internalized behavioural outcomes guides later behaviour.

The environmental dimension of the SLT indicates that environmental situations based on prior experience gain initiates and regulates behaviour (Sumrall, 2015). As people learn by associating environmental events to certain behavioural outcomes, they regulate their behaviour by seeking out an environmental stimulus that offers positive outcomes or avoids those that produce pain. For example, going to work late from home will have very different consequences than going home late from work. Knowing the consequences associated with each situation serves as a cue, which activates and guides behaviour.

Furthermore, SLT emphasizes the idea of observational learning or modelling as part of the environmental dimension of the theory (Sumrall, 2015). This suggests that people acquire new behaviours and information by watching other people or through symbolic means such as written or spoken language (Garbharran, 2013). The theory indicates that the observation of a model who gets rewarded for his/her behaviour increases the chance of that behaviour in the observer, while observation of a behaviour that results in a punishable consequence can cause avoidance of that behaviour (Depue, 2010).

The SLT suggests that external stimuli have the potential to guide farmers’ innovation adoption behaviour. The use of media serves a key aspect of the environment in which
farmers interact. Farmers may gain information from the media platforms in their overall
environment by watching television, listening to the radio, surfing the internet and
reading billboards and posters of good agricultural practices in their environment.
Positive representations of improved agricultural practices because of the media exposure
may enhance their views on agricultural innovations and thus perceive innovation
adoption as a behaviour worth seeking or avoiding. Another key feature of the
environment that informs innovation adoption behaviour is the interpersonal
conversation among individual farmers and their households. Positive discussions about
agricultural innovations among farmers and a social network that encourages positive
attitudes towards innovation adoption may provide a useful attitudinal and behavioural
guide for adoption and non-adoption of improved agricultural technologies.

The behavioural dimension of the SCT explains that behaviour results from its
consequences (Dimopoulous, 2016). In this sense, people keep to behaviours that yield
positive consequences and avoids those that produce negative results. Reinforcement is
the process whereby people regulate their behaviour based on its consequences (Sumrall,
2015). For instance, if a farmer’s past behaviour of adopting a certain innovation usually
produce positive outcomes, then he/she is more likely to keep adopting that innovation.

Reinforcement has a strong motivational effect on behaviour because of people’s
anticipatory capacity (Schunk, 2012). The theory recognizes the significant role of
reinforcements in the behaviour modification process; however, it tends to see its role as
conveying information about the ideal response and providing an incentive for
performing a given behaviour due to its anticipated outcome. Therefore, reinforcement
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and punishment affect learners' motivation, rather than directly causing behaviour (Schunk, 2012).

The implication of reinforcement as a behaviour influencer suggest that inasmuch as environmental stimuli influence attitude and guides behaviour, so does past behaviour. No matter how many times a farmer may have seen or heard about improved agricultural practices in the media or from other farmers if his past adoption experience of a particular innovation produced positive results, then the propensity to develop a positive attitude and behavioural patterns toward that innovation will be high.

The idea of reciprocal determinism espouse by the theory suggests that cognition, environment and behaviour must be seen as intertwining determinants of each other (Schunk, 2012). That is, behaviour regulates the environment much the same way the environment also regulates behaviour. In this situation, reciprocal refers to the mutual interaction of factors perceived as causal, and determinism refers to the inevitable consequences of certain antecedent factors (Garbharran, 2013).

Despite the plausibility of SLT in explaining behaviour, it has some weaknesses. A weakness of SLT in terms of its explanation on cognition is that it places less emphasis on individual differences, which is influential in the thought process (Depue, 2010). In the application of SLT, it is important to consider how individual variables can influence the operations of thought processes. In addition, SLT argues that when individuals envisage a positive outcome of behaviour, they become more motivated and they believe in their ability to perform the behaviour. This suggests that self-efficacy and outcome expectations are mutual concepts, which the researcher must consider together in
Psychological determinants and innovation adoption research. However, few studies can integrate these inseparable concepts (Carillo, 2010). This suggests that either the researchers do not quite understand the two concepts or the effective integration of the two concepts is difficult to achieve.

Besides, Bandura (1986) indicates, “the person, the behaviour and the environment were all inseparably entwined to create learning in an individual” (p.78). This indicates that human behaviour is a function of the triadic interaction of behaviour, cognition and other personal factors (Carillo, 2010). To this end, researchers using SLT as a theoretical model need to consider both individual and environmental variables in order to predict and understand behaviour. Nevertheless, such consideration is problematic in innovation adoption studies, which focus mainly on either the individual factors or characteristics of the innovation.

In conclusion, SLT posits that cognition explains that thought processes are responsible for the execution of behaviour (innovation adoption). Besides, the association of environmental stimuli with positive or negative rewards sustain the performance of a given behaviour. Regular exposure to the media, interpersonal conversation and social networks provides an avenue through which farmers make positive or negative interpretations about agricultural innovations, which in turn guides the adoption or non-adoption of effective agricultural innovations. Inasmuch as SLT rightly account for the influences of social pressure and cognitive motivation (attitude), it does not explicitly show how behaviour eventually comes about. In other words, the idea of behaviour intention leading to actual behaviour does not find clear expression in the social learning theory and thus makes it limited in providing enough explanation of farmers’ adoption behaviour.
2.1.2 Theory of Planned Behaviour

Ajzen (1985) originally developed the Theory of Planned Behaviour (TPB) from the field of social psychology. The TPB sought to address the inability of an earlier version [the Theory of Reason Action (TRA) by Fishbein & Ajzen, 1975] to deal with incomplete volitional behaviours. Since its introduction over 30 years ago, it has become one of the most frequently cited and influential models for explaining and predicting human social behaviour in terms of behavioural intentions and actual behaviour (Ajzen, 2011).

In recent times, the theory has come under attack by some researchers, especially Sniehotta, Presseau and Araújo-Soares (2014). These researchers have argued that the TPB lacks predictive power particularly in longitudinal studies and loses its power when other participants, not university students are used. However, Ajzen (2015) and Hagger (2015) have refuted these claims of the critics and offered evidence to support the theory’s sufficiency. For example, some critics claim that the theory is static and does not account for the influence of behaviour on cognition and future behaviour. Ajzen (2015) in a reply indicated that such views are misconceptions arising from an erroneous interpretation of the graphical representation of the theory. That the theory acknowledges a feedback loop, which provides feedback to an individual after performing a behaviour. This feedback information affects cognition and encourages or prevents future behaviour.

In spite of the criticisms against the TPB, several studies have applied it to a wide range of behaviours. For instance, there is application of the TPB on health behaviour, workplace and organizational behaviour, entrepreneurial behaviour as well as pro-environmental behaviour (Awa, Ojiabo & Emecheta, 2015; de Leeuw, Valois, Ajzen &
According to the TPB, behavioural intention is the most vital predictor of a person’s behaviour and goes further to delineate that some three important psychological constructs combine to form an individual’s intention to perform a behaviour. These constructs are the attitude towards performing a behaviour, subjective norm and perceived behavioural control. (Ajzen, 2014). Together, attitude, subjective norm and perceived behavioural control lead to a positive or negative intention to perform a behaviour (Wauters et al., 2010). Thus, changing these predictors increases the likelihood that an individual will perform a given behaviour and increases the chance that the individual will perform that behaviour. The sections below detail the components of the TPB.

2.1.2.1 Components of the Theory of Planned Behaviour

The main components of the TPB are intention, attitude, subjective norm and perceived behavioural control. Behavioural intentions provide a source of motivation for actual behaviour (Conner & Sparks, 2005). It refers to the extent of “how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behaviour” (Ajzen, 1991, p. 181). The stronger the intention to perform a behaviour, the more likely it would find expression in actual behaviour if the said behaviour is under volitional control in that the individual can decide at will to engage or not to engage in that act. To develop an intention for a given action, people implicitly or explicitly obtain information about the possible consequences of their action before performing or not performing that action (Ajzen, 1985).
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As rational humans, people expect individuals to act in line with their intentions. However, several factors can cause a disconnect between intentions and behaviour. For instance, time can influence behavioural intention. The more time elapses, the more likely that unexpected events will occur and will bring about change in intentions (Ajzen, 1985). This suggests that the time interval between the measurement of intention and actual behaviour could affect the accurate prediction of behaviour. In spite of the difficulty in establishing a perfect relationship between behavioural intention and observed behaviour, the intention remains a good estimate of actual behaviour (Francis et al., 2004). Three psychological constructs namely, attitude, subjective norm and perceived behavioural control determines behaviour intention.

The TPB defines attitude towards a behaviour as the extent to which an individual evaluates a behaviour as favourable or unfavourable (Ajzen, 1991). Thus, it is an individual’s overall appraisal of the behaviour. The TPB argues that a favourable attitude towards a behaviour potentially increases the intention to perform that behaviour. On the other hand, an unfavourable attitude towards a behaviour potentially reduces the intention to perform that behaviour.

Another component of the TPB that predicts intention is the subjective norm. Subjective norm is a person’s perception of the social pressure of significant others to engage or not to engage in a behaviour (Conner & Sparks, 2005). Significant others refer to groups or individuals whose opinions about a person’s behaviour are valued. People tend to consider whether important referents in their lives think they should perform a given behaviour. Thus, subjective norm evaluates the social pressures people go through to perform or not perform a behaviour (Conner & Sparks, 2005). When people estimate
subjective norm to be positive and believe that salient referents agree that they should perform a given behaviour, it increases their intention to perform that behaviour (Ajzen, 1985).

The third determinant of behavioural intention as proposed by the TPB is the perceived behavioural control. This construct refers to the perceived ease or difficulty in the performance of a given behaviour, considering the experiences and expected challenges (Ajzen, 1991). Therefore, it is the individual’s belief in his ability to perform a given behaviour. Control is required in a range of behaviours, some of which are easily executed (such as reading an interesting novel readily available) whereas others require more resources, opportunities and skills (such as becoming a university professor) (Conner & Sparks, 2005). A lack of behavioural control minimizes intention, which explains the intention-behaviour inconsistencies (Conner & Sparks 2005; Ajzen & Fishbein, 2005).

Generally, there is a strong behavioural intention when positive attitudes and subjective norms toward a behaviour as well as a greater perceived behavioural control exist (Davis, Ajzen, Saunders & Williams, 2002). However, the relative weights of attitude towards behaviour, subjective norms and perceived behavioural control depend to some extent on the behavioural intention under consideration. That is, for some intentions, attitude towards a behaviour may be more important, whereas for other intentions, attitudinal considerations and perceived behavioural control may be enough to explain the intention and still there are other instances where all three determinants independently account for intention significantly (Ajzen, 1991).
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2.1.2.2 Salient Beliefs and the Theory of Planned Behaviour

Much as attitude, subjective norm and perceived behavioural control explain behavioural intention, salient beliefs about a given behaviour drive the development of the three TPB variables (Ajzen, 1985; Conner & Sparks, 2005). Humans receive a plethora of information about a given behaviour, yet they attend to a relatively few of this information at any point in time. It is this salient information or beliefs, which influence the prevailing intentions and behaviours of an individual (Ajzen, 1991). There are three kinds of salient beliefs namely, behavioural beliefs which provide the basis for attitude towards a behaviour, normative beliefs which determines subjective norm and control beliefs which also underpins perceived behavioural control.

Behavioural Beliefs as Determinants of Attitude towards a Behaviour

The information processing or cognitive approach offers a possible explanation for attitude formation (Ajzen, 1991). The cognitive approach assumes that beliefs about behaviour or object develop an attitude towards the object or behaviour. Thus, positive beliefs about the outcomes of behaviour develop a positive attitude towards that behaviour. However, negative beliefs about the outcomes of behaviour develop a negative attitude towards that behaviour.

According to Francis et al. (2004) attitude towards a behaviour consists of outcome beliefs about a behaviour (adopting improved agricultural innovations will increase crop quantity and quality) and the corresponding positive or negative evaluations about each aspect of the behaviour in question (increasing crop quantity or quality is… desirable/undesirable).
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For instance, a farmer may believe that adopting improved agricultural innovations increase crop yields and improve the quality of crops. The attitude towards the adoption of agricultural innovation is determined by the farmer’s appraisal of the outcomes linked with the innovation and by the strength of the association. Therefore, the multiplication of outcome beliefs and evaluations and the summation of the resultant products derives a composite measure of attitude based on beliefs (Francis et al., 2004).

**Normative Beliefs as Determinants of Subjective Norms**

Normative beliefs are concerned with an individual’s belief that significant others, groups or individuals think he should or should not undertake the behaviour (Francis et al., 2004). Essentially, an individual who is motivated to comply with the approval of salient referents regarding the performance of behaviour will be under pressure to do so. On the contrary, an individual who is motivated to comply with the disapproval of salient referents regarding the performance of behaviour will be under pressure to avoid performance of that behaviour (Conner & Sparks, 2005).

Thus, normative beliefs have two dimensions, namely, beliefs about how salient referents would like an individual to behave (e.g. feeling the pressure from extension officers to adopt improved agricultural innovations) and the positive or negative evaluations about each belief (e.g. regarding the adoption of agricultural innovations, doing what extension officers think I should do is important or unimportant to me) (Francis et al., 2004).
Control Beliefs as Determinants of Perceived Behavioural Control

Control beliefs are essentially concerned about the availability of requisite resources and opportunities. They are a set of beliefs that deals with the perception of factors likely to facilitate or prevent the performance of the behaviour (Ajzen, 1991). According to Ajzen (1991), “control beliefs may be based in part on past experience with the behaviour, but they will usually also be influenced by second-hand information about the behaviour, by the experiences of acquaintances and friends, and by other factors that increase or reduce the perceived difficulty of performing the behaviour in question” (p. 196).

Control factors can be internal or external. Internal control factors include information, personal deficiencies, skills, abilities, emotions etc. whiles external control factors include opportunities, dependence on others, obstacles etc. In effect, a strong perceived behavioural control exists when an individual believes that he/she has enough resources and opportunities to perform a given behaviour (Ajzen, 1991).

The control beliefs have two facets. The first is how much of control does the individual has over the behaviour (e.g., low control over adopting yield-increasing innovations if the farming inputs are not available). The second is how confident an individual feels about his ability to perform or not to perform the behaviour (e.g. does not have money to invest in the adoption of yield-increasing innovations). Thus, perceived behavioural control is a function of control beliefs about the power of both internal and external factors to prevent or facilitate the performance of the behaviour (Francis et al., 2004).

In recent times, the field of agriculture although not as common as in other fields have witnessed a bit of application of the TPB. Researchers use the theory to study factors that
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influence farmers’ decisions to adopt specific innovations including soil conservation practices and improved natural grassland (Borges, & Lansink, 2016; Borges, Lansink, Ribeiro & Lutke, 2014; Martínez-García, Dorward & Rehman, 2013; Price & Leviston, 2014; Wauters, Bielders, Poesen, Govers & Mathijs, 2010).

In conclusion, applying the TPB to explain the intention to adopt improved agricultural innovations will mean that intention to adopt (full or partial) is a function of farmer’s attitude, subjective norm and perceived behavioural control. In addition, farmers’ salient beliefs, that is behavioural, normative and control beliefs will influence their attitude, subjective norm and perceived behavioural control, which in turn may affect the adoption intentions of improved agricultural innovations.

2.1.3 Diffusion of Innovation Theory

Rogers (2003) developed the Diffusion of Innovation theory as an adoption theory, particularly within the context of implementation. Many researchers from a broad variety of disciplines such as political science, public health, communications, history, economics, technology, and education have used the model as a framework since its introduction (Sahin, 2006). In his review of the Diffusion of Innovation theory, Sahin (2006) identified four key dimensions to the theory namely, the innovation-diffusion process, innovation-decision process, the rate of adoption and attributes of innovation, as well as individual innovativeness.

2.1.3.1 Innovation Diffusion Process

For Rogers (2003), adoption is a decision of “full use of an innovation as the best course of action available” and rejection is a decision “not to adopt an innovation” (p. 177).
Rogers defines diffusion as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (p.5). This definition reveals four key elements critical to the innovation-diffusion process. These elements are innovation, communication channels, time and the social system.

**Innovation**- Rogers describes innovation as “an idea, practice, or project that is perceived as new by an individual or another unit of adoption” (Rogers, 2003, p. 12). Innovation may have been invented a long time ago, but if individuals perceive it as new, then it may still be an innovation for them (Sahin, 2006). Uncertainty about the outcomes of innovation is an important obstacle to the adoption of that innovation (Sahin, 2006). Awareness of the advantages and disadvantages of innovation could reduce uncertainty in potential adopters.

**Communication Channels**- The second element of the innovation diffusion process is communication channels. Rogers (2003) defines communication as “a process in which participants create and share information with one another in order to reach a mutual understanding” (p. 5). This communication occurs through channels between sources such as individuals, groups or institutions. A channel is the means by which a “message gets from the source to the receiver” (p. 204). Mass media such as TV, radio, newspapers etc. and interpersonal communication are two main communication channels in the diffusion of innovation (Ndah, 2014).

**Time** – Another element in the innovation diffusion process is the concept of time, which refers to how long it takes a potential adopter to adopt an innovation (Straub, 2009). The concept of time is an important dimension in the Diffusion of Innovation theory because
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it underpins other components of the theory. These components include the innovation-decision process and the innovation adoption process (Sahin, 2006).

**Social System** – The social system refers to “a set of interrelated units engaged in joint problem solving to accomplish a common goal” (Rogers, 2003, p. 23). The social system includes the culture, values, environment and informal groups of the potential adopter (Straub, 2009). The rapid diffusion of innovation in a given population depends on the social structure, norms and values of the social system (Sahin, 2006; Straub, 2009).

2.1.3.2 Innovation-Decision Process

Rogers (2003) referred to the innovation-decision process as “an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation” (p. 172). There are five linear stages involved in the innovation-decision process namely knowledge, persuasion, decision, implementation and confirmation. The sections below present these stages further.

**The Knowledge State**- The innovation-decision process starts with the knowledge stage. In this stage, an individual learns about the existence of a particular innovation and seeks information about that innovation. In this phase, the critical question is “What?” “How?” and “why?” (Straub, 2009). During this phase, the individual attempts to determine “what the innovation is and how and why it works” (Rogers, 2003, p. 21). As Sahin (2006) rightly pointed out, an individual may have all the necessary knowledge, but this does not mean that the individual will adopt the innovation because the attitudes of the
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individual may also shape the adoption or rejection of the innovation, hence the persuasion stage.

**The Persuasion Stage-** The individual shapes his or her attitude after he or she knows about the innovation. At this stage, the individual gains adequate awareness about the main features of the innovation and he/she is in a better position to evaluate the goodness or otherwise of the innovation (Straub, 2009). Uncertainty about innovation and social enforcement (recognition from peers, colleagues etc.) affects beliefs and opinions about the innovation (Sahin, 2006). Potential adopters often perceive the evaluations of social referents as credible and influential in the innovation adoption process (Sahin, 2006).

**The Decision Stage-** At the decision stage in the innovation-decision process, the individual chooses to adopt or reject the innovation. While adoption refers to “full use of an innovation as the best course of action available,” rejection means, “not to adopt an innovation” (Rogers, 2003) p. 177). Innovation adoption is rapid when an innovation allows for partial trials because people first want to try the innovation in their own context before taking a final decision to adopt or reject the innovation. Besides, the vicarious trial can speed up the innovation-decision process (Sahin, 2006). However, rejection is possible in every stage of the innovation-decision process (Rogers, 2003).

**The Implementation Stage-** This is the stage of innovation adoption (Straub, 2009). Application of innovation brings about newness. Uncertainty about the outcomes of the innovation can still be a problem at this stage (Sahin, 2006). The implementer may need technical assistance from change agents and others to reduce the degree of innovation uncertainty. However, the innovation-decision process ends when “the innovation loses
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its distinctive quality as the separate identity of the new idea disappears” (Rogers, 2003, p. 180).

The Confirmation Stage- Having made the decision to adopt the technology, the individual looks for evidence to support his/her adoption decision. According to Rogers (2003), when adopters experience conflicting information after adoption, they may reverse their decision. To avoid cognitive dissonance, individuals tend to stay away from contradictory messages and seeks supportive messages that confirm their adoption decision (Sahin, 2006). Therefore, depending on the support for adoption and the attitude of the individual, later adoption or discontinuance may occur.

2.1.3.3 The Rate of Adoption and Attributes of Innovations

The rate of adoption refers to “the relative speed with which an innovation is adopted by members of a social system” (Roger, 2003, p. 221). The rate of adoption measures the number of people who adopted the innovation within a given period. This suggests that innovation adoption starts slowly with a small number of people and increases as more information about the innovation becomes available. The perceived characteristics of an innovation influence the rate of innovation adoption (Sahin, 2006). Rogers (2003) identified five (5) major attributes of innovation, namely, relative advantage, compatibility, complexity, trialability and observability. An “individual’s perception of these characteristics predicts the rate of adoption of innovation” (Rogers, 2003, p. 19).

Relative Advantage- This refers to the degree to which an individual perceives a given innovation as being better than existing ones (Straub, 2009). The cost and the motivation to use the innovation are key elements of relative advantage. Relative advantage is the
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strongest predictor of the rate of innovation adoption (Rogers, 2003). For instance, the rate of adoption of improved agricultural innovation will be more likely if farmers perceived it to be significantly advantageous compared to traditional farming practices.

Compatibility - This refers to the extent to which individuals perceive a particular innovation to resonate with their needs, values and existing understanding of similar innovations (Rogers, 2003, Straub, 2009). A compatible innovation reduces uncertainty and increases the rate of adoption since it fits the current situation of the potential adopter. Some scholars have claimed that the naming of innovation is crucial to its compatibility (Sahin, 2006). The name of a particular innovation can limit or enhance its meaning to the potential adopter. Thus, the more improved agricultural innovations are compatible with the values and experiences of the farmers, the more the rate of adoption.

Complexity - Rogers (2003) defined complexity as “the degree to which an innovation is perceived as relatively difficult to understand and use” (p.15). Researchers believe that this attribute of an innovation negatively affects the rate of adoption (Straub, 2009). Complexity can be an impediment to the adoption of some innovations. However, for Rogers (2003), complexity is not as important as relative advantage and compatibility.

Trialability - This attribute is the extent to which an innovation is accessible for experimentation (Straub, 2009). The opportunity to try a particular innovation on a small scale facilitates the rate of adoption. Trialability can be direct or indirect and may lead to modifications to suit the needs of potential adopters (Sahin, 2006; Straub, 2009). Early adopters appreciate the trialability attributes of innovation than later adopters (Rogers, 2003).
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**Observability** - This refers to “the degree to which the results of an innovation are visible to others” (Rogers, 2003, p.16). The outcome of some innovations is more visible and easily communicated than other innovations (Murphy, 2014). Thus, the greater the observability, the greater the rate of adoption of an innovation. For instance, if potential adopters can observe directly or vicariously the positive outcomes of improved agricultural innovations then they will be more likely to adopt the innovation. Like relative advantage, compatibility and trialability, observability positively affects the rate of innovation adoption (Sahin, 2006).

Rogers (2003) argues that when individuals perceive a particular innovation to be rich in relative advantage, compatibility, simplicity, trialability and observability, they adopt it faster than other innovations. However, potential adopters find it difficult to adopt some innovations, even when it offers more advantages (Sahin, 2006). Therefore, the availability of all these attributes of an innovation facilitates the innovation-decision process but do not in themselves determine or prevent adoption.

**2.1.3.4 Categorization of Innovation Adopters**

The question of who adopts innovation and when is addressed in Rogers (2003) classification of innovation adopters based on their innovativeness. Innovativeness refers to the extent to which an individual is relatively quick in adopting an innovation compared to others (Rogers, 2003). For van Braak (2001) innovativeness is “a relatively-stable, socially-constructed, innovative-dependent characteristic that indicates an individual’s willingness to change his or her familiar practices” (p.144). An individual’s social interaction and familiarity with innovations shape his/her trait of innovativeness. The trait of innovativeness explains why people adopt a given innovation (Sahin, 2006).
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Based on the concept of innovativeness, Rogers (2003) identified five (5) types of adopters. These are innovators, early adopters, early majority, late majority and laggards.

**Innovators** - Innovators are a class of adopters who are more willing to experience new ideas or innovations. They are ready to cope with uncertainties and negative outcomes about the innovation. Innovators are venturesome, educated and pioneers of new technologies within the adoption context or community (Rogers, 2003). They constitute about 2.5% of the population of potential adopters.

**Early Adopters** - Early adopters hold leadership roles in society and constitute about 13.5% of the populations of potential adopters. They are educated and the most popular persons who propagate new technologies. Their role in society makes them a source of information about new ideas. Early adopters’ endorsement of a particular innovation has a far-reaching effect, in that it reduces uncertainty in the innovation diffusion process. By adopting a new idea, early adopters “put their stamp of approval” on the innovation (Rogers, 2003, p.283).

**Early Majority** - This group of potential adopters make a deliberate effort to adopt innovations but lack the leadership status of early adopters. Rogers (2003) suggests that the early majority have a good relationship with other members of the social system and are neither quick nor slow to adopt new ideas. Their innovation adoption decision often takes more time relative to innovators and early adopters. The adoption decisions of early majority depend on the convictions and assurances on the benefit of the innovation from innovators and early adopters. Early majority constitute 34% of the population of potential adopters.
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**Late Majority** - This group of potential adopters tend to approach innovation adoption with a sceptical and careful mindset and often adopts an innovation when most people have done so. Late majority adopters gather enough information from the environment to ensure that the innovation is safe to adopt. Thus, their innovation decision arises out of economic necessity and peer pressure to do so. About 34% of potential adopters are in the late majority.

**Laggard** - This refers to the category of potential adopters who are, more inclined to the traditional way of doing things. Adoption experience in the past guides their innovation decisions. Usually, they have very low social status in society, highly sceptical compared to the early majority. They tend to have a social network system consisting of members from the same category, which affects their level of exposure (low awareness-knowledge) of the benefits of a particular innovation. The innovation-decisions of the laggard takes a longer time compared to late majority adopters.

Roger (2003) later summed up the five categories into two main groups namely early adopters and later adopters. Early adopters consist of innovators, early adopters and early majority while later adopters are the late majority and laggards. Socioeconomic status, personality and communication behaviour explains the difference in innovativeness between these two groups.

2.2 Synthesization of Theories

In this theoretical framework, three (3) theories have been used to explain smallholders innovation adoption behaviour which needs to be integrated into a unified conceptual model. First, the Social Learning Theory (Bandura, 2001) which highlights the role of
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observational learning and reinforcement in innovation adoption. The theory suggests
that smallholder farmers are likely to adopt improved agricultural innovations when they
observe their colleagues apply them on their farms and make great benefits from the
application of the innovation. However, the theory does not explain which specific farmer
is likely to observe and adopt innovation and what specific innovation is likely to be
observed and adopted. Hence the introduction of the Diffusion of Innovation theory
(Rogers, 2003) to explain the personal and innovation characteristics necessary for
adoption.

The theory suggests that smallholder farmers level of innovativeness, personality type
and other personal variables will influence their decision to adopt improved agricultural
innovations. Besides, certain characteristics about innovation such as its complexity,
relative importance, trialability among others will influence its adoption. For example,
an innovation which simple and easy to apply will likely be adopted than an innovation
which is complex and difficult to apply.

The two theories mentioned above in this section do not offer any explicit explanation on
the mechanism through which observational learning, reinforcement, personal and
innovation characteristics lead to innovation adoption. Hence the introduction of the
Theory of Planned Behaviour (TPB, Ajzen, 2011). The TPB acknowledges the role of
social norms and significant others in the adoption process. However, what it brings
different from the first two theories is the idea that adoption behaviour results from
adoption intention. The theory suggests that given the ability to observe others perform a
behaviour and positive personal characteristics such as attitude and beliefs about
innovation, a smallholder farmer will develop an intention to adopt innovations and when the right opportunity arises he/she will actually adopt the innovation.

Therefore, even though the first two theories (Social Learning Theory and Diffusion of Innovation) offer a reasonable insight into the smallholder farmers innovation adoption behaviour. The TBP provides a better understanding and as such, it was adopted to form the basis of the conceptual model for the study. Another model such as the technology acceptance model (Szajna, 1996) could have been adopted as it seems to offer some contemporary insight. However, the researcher did not adopt it because it lacks the belief component inherent in the theory of planned behaviour. To the extent that the study had as part of its objectives to investigate the effect of farmers’ salient beliefs on adoption intentions, it was imperative to adopt a theoretical model that accommodates the role of beliefs on behavioural intentions.

2.3 Review of Related Literature

Borges et al. (2015) rightly observed that adoption studies have found broad social, economic and psychological variables that correlate strongly with innovation adoption behaviour. These factors include farmers’ background factors, beliefs, motivation, attitude and perception as well as intention and other psychological variables. It is important to stress that the extant literature on innovation adoption is huge and not easily compressed. Hence, this section reviews studies closely related and relevant to the current study. The review begins with studies on farmers’ background factors, farmer motivation, and psychological determinants of technology adoption before moving to review adoption studies in Ghana.
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2.3.1. Farmers’ Background Factors and Innovation Adoption

As will be evident in the following literature review, several types of research abound on farmers’ background characteristics and their influence on innovation adoption. Studies group these background factors into four, namely, farmer characteristics (e.g. age, gender, years of experience), farm characteristics (e.g. farm size, income) farming context factors (e.g. access to credit, subsidies) and acquisition of information (e.g. social networks, farmer association membership) (Borges et al., 2015). These variables are summarised as follows.

2.3.1.1 Farmer Characteristics and Innovation Adoption

One of the most investigated farmer characteristics in the last decade is the level of education of farmers. Olwande et al. (2009) conducted a study to examine the determinants of fertilizer adoption and use among farmers in Kenya. Using a double hurdle model on a ten-year panel household survey data of 1,275 households, econometric estimate results suggest that education level of farmers is a significant predictor of adoption. Similarly, Oyekale and Idjesa (2009) embarked on a study with the objective to assess the adoption of improved seeds and efficiency of farmers in Nigeria. The results showed a significant influence of education on the adoption of the innovation. These studies indicated that as the years of education increases, the rate of technology adoption also increases. Recent studies have corroborated these findings.

In their study to identify types of farms most likely to use technology management practices and production systems (TMPPS), Gillespe, Nehring and Sitienei (2014) found that farmers with college degrees are more likely to adopt these innovations. Furthermore, the relative impact of socio-economic factors on technology uptake was examined by
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Kolade and Harpham (2014) using a survey of 326 farmers in Nigeria. The study revealed that the impact of education is positive for the adoption of fertilizer and high-yield maize.

Additionally, Corner-Thomas et al. (2015) in a more recent study investigated the influence of demographic factors on the adoption of farm management systems. The findings indicated that the use of farm management tools was associated with the educational level of farmers. Farmers with high school certificate used a farm management tool whiles farmer with a certificate/diploma and those with a degree/postgraduate qualification used 4 and 16 farm management tools respectively. Thus, farmers with higher education adopt more improved farming innovations compared to those with little or no education.

Besides, Gebrezgabher, Meuwissen, Kruseman, Lakner and Oude Lansink (2015) investigated the role of farmer characteristics in the adoption of mechanical manure separation technology. Using survey data collected from 111 Dutch dairy farmers, the findings showed the educational level of farmers as one of the important variables explaining the adoption of the technology. Education is important in technology adoption because it enhances the ability of farmers to appreciate the benefits of innovation. According to Asfaw and Admassie (2004), education increases the likelihood of innovation adoption because it helps farmers to acquire, synthesize and quickly respond to uncertainties.

Another important farmer characteristic well investigated in the adoption literature is gender. Olwande et al. (2009) found gender to be among the strongest predictors of fertilizer use intensity with male-headed household associated with 6.6kg of additional
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fertilizer per acre. Similarly, Ragasa (2012) conducted an integrated review on existing studies to identify demand and supply-side constraints and opportunities in access, adoption and impact of innovations. The study observed that women have a much slower adoption rate than men. According to her, this is attributable to differential access to complementary inputs and services. Kolade and Harpham (2014) reported the influence of gender to be significant in predicting the adoption of fertilizer, pesticides and other farm management innovations with more male adopters than female. The researchers argue that the physical requirement of fertilizer application tend to favour males than females and that explains the relatively high male adopters.

In contrast, Ogada et al. (2014) investigated factors that influence the adoption of inorganic fertilizer and improved maize variables. The gender of the household head did not significantly influence the adoption of the two innovations independently. However, it had a moderate effect on the joint adoption of the two technologies. Besides, the results show that households with male heads had 4% more chance of adopting both organic fertilizer and improved maize variety than households with female heads. This is due to the limited resources and opportunities available to female-headed households relative to their male counterparts (Ogada et al., 2014).

In a recent study, Kalungu and Filho (2018) investigated the level of awareness and adoption of some appropriate technologies. The researchers employed a mixed methods approach to 20 focused group discussions and 722 randomly selected households. The results confirmed previous findings, in that gender positively correlated with adoption of appropriate technologies. There was a significant difference in adoption between male-headed households and female-headed households.
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Thus far, it is evident that trends in the adoption of agricultural innovations assume gender inequality. According to Tanui, Feng, Li, Wang and Kipsat (2012), this male hegemony in innovation adoption is indirectly associated with male farmers having permanent land ownership. The assumption is that males have a greater chance of obtaining information about new technologies and are likely to engage in risky business ventures than females (Asfaw & Admassie, 2004).

Farmer awareness and experience is another background variable, well researched in connection with innovation adoption. Mannan, Nordin, Rafik-Galea and Rizal (2017) examined the influence of innovation attributes and farmer awareness on green fertilizer innovation. The study used a survey methodology with 366 paddy farmers in Malaysia. The multiple regression analysis revealed that farmers level of awareness and information about technology influence green fertilizer adoption. The researchers suggested that there should be more education, training and extension services at the grassroots to improve technology awareness.

However, Kalungu and Filho (2018) in their study on appropriate agricultural technologies adoption found high levels of technology awareness, but the low rate of adoption in all the research regions. This suggests that farmer’s awareness of technology may not necessarily increase adoption without the presence of other important factors.

In terms of farming experience, Oyekale and Idjesa (2009) found that improved seed adoption and farming experience has a significant positive correlation with adoption. That is the rate of adoption increases as farmers’ experience increases. Similarly, Ainembabazi and Mugisha (2014) examined the relationship between farming experience
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and adoption of agricultural technologies in Uganda. Using parametric and non-
parametric estimations on data from rural farmers in Uganda, the study found an inverted
U-relationship between farming experience and adoption of agricultural technologies.
They concluded that experience is beneficial within the initial stages of adoption when
farmers are experimenting with the potential benefits of the technology.

According to Oyekale and Idjesa (2009) “experienced farmers may be able to understand
the nature of risk associated with each of the technologies, having practised or seen some
of them used over time” (p.47). Farming experience influence adoption positively
because it enhances the ability of farmers to acquire, process and apply relevant
information about an innovation (Boages et al. 2015; Adesina & Baisdu-Forson, 1995).

Farmers’ age is another socio-demographic variable associated with innovation adoption.
Olwande et al. (2009) investigated the determinants of fertilizer adoption and found that
farmers’ age predicts fertilizer adoption significantly. Fertilizer adoption was reduced by
0.02% for each additional year of farmers ‘age. This goes to certify that high rate of
adoption of innovation, in this case, fertilizer, is associated more with younger farmers
than older ones.

Another study by Gillespe et al. (2014) found the age of farmers to influence the usage
of technology management practices and production systems among cattle farmers in the
USA. Analysis of available data from 2005 to 2010 shows a significant increase in the
percentage of milk produced by farm using embryo transfer and/or sexed semen
technology from 15.7% to 24.3% respectively. Among the greater adopters of this
technology were young farmers.
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Studies that are more recent have established similar findings. For example, Corner-Thomas et al. (2015) examined the influence of demographic factors on the adoption of farm management tools. They found that farmers’ age was associated with the use of 20 farm management tools. There was a negative correction between farmers’ age and adoption of farm management tools in that as the age category increased the number of farm management tools adopted decreased. Likewise, Gebrezgabher et al. (2015) examined farmer characteristics that influence the adoption of mechanical manure separation and found farmers’ age to explain the adoption of the technology with adoption in favour of young farmers.

Despite the established relationship between farmers’ age and innovation adoption, some scholars have maintained that the relationship is not clear (e.g. Adesina & Baidu-Forson, 1995; Boages et al., 2015). Their argument is that older farmers are experienced and in a better position to evaluate the characteristics of innovation than younger farmers, hence their high likelihood of adoption. Alternatively, it could be that younger farmers are high-risk takers than older farmers and therefore have a higher chance of adopting new technologies (Adesina & Baidu-Forson, 1995; Boages et al. 2015). Thus, there is a need for caution when interpreting the effect of farmers’ age on adoption decisions and behaviour.

2.3.1.2 Farm Characteristics and Innovation Adoption

Farm characteristics such as availability of resources, income, farm size, land tenure, distance to markets, labour and plot access are commonly assessed variables in the innovation adoption literature. In a literature review on the impact of technology adoption on agricultural productivity among smallholder farmers in sub-Saharan Africa, Muzari,
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Gatsi and Muvhunzi (2012) found that assets, income from crop sales and higher labour requirements of new technologies are the main factors affecting agricultural innovation adoption. In another literature review to identify demand and supply-side constraints and opportunities in access and adoption of technology, Ragasa (2012) noted a much slower rate of agricultural innovation adoption due to differential access to complementary inputs and services.

Gillespe et al. (2014) assessed the types of farms most likely to adopt technology management practices and systems and found that factors such as farm size, land tenure and location of the farm were influential in the usage of the innovations. In another study, Corner-Thomas et al. (2015) in a survey on the adoption of farm management tools found farm size to be associated with the use of farm management tools. In addition, Gebrezgabher et al. (2015) found farm size to be an important variable in explaining adoption among Dutch dairy farmers.

There is a link between farm size and other farm characteristics such as access to inputs and income (Chamberlin, 2008). Brown et al. (2013) reviewed the literature on the influence of farm size and observed that farm size is critical in influencing adoption decisions in relation to agricultural innovation. They suggested that farm size is a measure of the farmer’s future ability to raise adequate income from the farm as well as a basis to borrow capital from financial institutions and other sources. In addition, larger farms are less susceptible to several environmental and economic situations. Thus, larger farm size is associated with decreased risk aversion. According to Brown et al. (2013), larger farms tend to have access to more resources and are more likely to adopt improved agricultural innovations.
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2.3.1.3 Farming Context Variables and Innovation Adoption

Another strand of farmers’ background factors that influence innovation adoption is farming context variables. These variables include access to credit, subsidies, agro-climate conditions, pest and diseases. Fan, Gulati and Thorat (2008) did a review paper on the trends in government subsidies and investment in Indian agriculture. The study found that subsidies in credit, fertilizer and irrigation are crucial to smallholder farmer adoption of new technology. The authors recommended that agricultural investment in research, education and rural roads are effective in promoting agricultural growth.

Moreover, Uaiene, Arndt and Masters (2009) in a survey among farmers in Mozambique found that households with access to credit are more likely to adopt new agricultural innovations. Also, in examining the determinants of fertilizer adoption and use, Olwande et al. (2009) found that availability of credit, distance to fertilizer market and agro-ecological potential of the farm are significant predictors of adoption. They concluded that improving access to agricultural credit and investment in rural infrastructure promotes fertilizer use.

Again, Fisher and Kandiwa (2014) investigated how Malawi’s Farm Input Subsidies Program (FISP) has affected the adoption of modern maize. The results showed that the receipt of subsidies input coupons had no discernible effect on modern maize adoption for male farmers. Besides, receiving a subsidy for both seeds and fertilizer increased the probability of modern maize cultivation by 222% especially for female households. The researchers observed that the Farm Input Subsidy Program (FISH) reduced the gender gap in the adoption of modern maize. Another study by Ogada et al. (2014) on the


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predictors of fertilizer and improved seeds adoption found that market imperfections such as limited access to credit and input markets are associated with innovation adoption. Thus far, it is evident that all the farming context variables reviewed have a clear relationship with technology adoption. For instance, agro-climatic conditions such as rainfall influence farmers’ adoption decisions because favourable rainfall is likely to impact positively on decisions to adopt technologies (Kassie et al., 2013). Besides, access to credit and subsidies are justified as adoption determinants because they enhance the creditworthiness of the farmer and his/her ability to venture into risky businesses (Asfaw & Admassie, 2004). Furthermore, the presence of pest and diseases such as armyworms will influence the adoption decisions of farmers (Kassie et al., 2013).

2.3.1.4 Information Acquisition and Innovation Adoption

The last major component of farmers’ background factors under this review is farmers’ acquisition of information or learning process. This group of variables include contact with extension officers, participation in on-farm trials, membership in farmers’ group or associations etc. In this section, capacity enhancement and farmer group membership were relevant for review.

Uaiene et al. (2009) used a cross-sectional survey to determine the factor that affects the adoption of agricultural technologies in Mozambique. Data analysis of agricultural technology adoption indicated that farming households who are members of agricultural associations are more likely to adopt new agricultural innovation. Besides, Kolade and Harpham (2014) survey 326 farmers to identify the relative impact of cooperative membership and other personal factors of technology adoption in Nigeria. They found that cooperative membership has a high impact on technology adoption compared to
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other socio-economic factors such as land access, gender and educational status. In this regard, they suggested that efforts should be geared towards strengthening farmers’ group and associations to ensure better diffusion and adoption of improved agricultural innovations.

Apart from membership of farmers’ associations, access to extension services that enhance the capacity of farmers also influence innovation diffusion and adoption. Mugonola, Deckers, Poesen, Isabirye and Mathijs (2013) examined the adoption of soil and water conservation technology in Uganda. Using a logit model and a cross-sectional survey of 271 smallholder farmers, the study found that access to extension services was a positive and high significant predictor of adoption. Holding other variables constant, the odds ratio of adopting soil and water conservation technologies increased by 2.9 in the adoption model when access to extension services increased.

Moreover, Suvedi, Ghimire and Kaplowitz (2017) did a study to investigate the factors affecting farmers’ participation in extension programs and adoption of improved seed varieties in Nepal. The study used a cross-sectional survey design and sampled 198 farm households. The findings showed that extension related variables such as training, membership in a farmers’ group and off-farm employment affect innovation adoption decision. In view of the differences in a regional and national context, the study recommended that extension services providers should create social conditions that are conducive for innovation adoption within the community.

To improve farmer capacity, farmers must not only join associations but to actively participate in capacity building programs. Howley, O’Donoghue and Heanue (2012)
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investigated the farmer and farm variables that influence the adoption of artificial insemination (AI) among dairy farmers in Ireland. Using national survey data from 1995 to 2009, the results showed that having a successor and participating in on-farm advisory program positively influence the adoption of the technology.

On the other hand, Shahin (2004) studied innovation adoption among dairy farmers in Egypt. Using data collected through the questionnaire, the study found that extension services did not have any significant influence on the adoption of most dairy production innovations. This contradictory result could be due to contextual factors such as the type of innovation, nature of extension service, farmer educational level etc.

In conclusion, there is a vast literature on farmer background characteristics in relation to innovation adoption. The variables often investigated include education, age, experience, and farm size, access to credit, subsidies, extension services and membership of farmers’ association. This resonates with Burton (2014), who observed that studies on farmers’ innovation adoption behaviour consistently include farmers’ background variables such as age, gender, experience and education. In his view, these socio-demographic variables tend to influence farmers’ adoption decisions. They also provide insight into the adoption decisions that a group of farmers (younger, women, men, more educated, more experienced etc.) will take in relation to a given innovation. Pannell et al. (2006) have also emphasized the importance of farmer background variables in adoption studies by suggesting that they potentially influence farmers’ goals and capacity to adopt improved agricultural innovations. The expectation is that various individual characteristics may influence a farmer’s decision to adopt an innovation since adoption is mostly a personal decision (Boz, Akbay, Bas & Budak, 2011).
2.3.2 Farming Motivations and Innovation Adoption

Farming motivation in this study refers to the reasons for farming and the broader long-term goals that a person seeks to achieve as a farmer. The role of farming motivation or goals have been examined explicitly and implicitly in relation to technology adoption and results suggest motives for farming are instrumental to farmers’ innovation adoption.

Bergevoet, Ondersteijn, Saatkamp, van Woerkum and Huirne (2004) tested the hypothesis that differences in farmers’ goals and objectives are a determinant of entrepreneurial behaviour among Dutch dairy farmers. They used the theory of planned behaviour (TPB) as the theoretical framework. The researchers replaced intentions in the TPB model with farmers’ goals to suggest that the goals originate from attitude, subjective norms and perceived behavioural control and entrepreneurial behaviour results from farmers’ goals. The results from a survey data of 257 farmers showed a significant relationship between farming goals and farming behaviour. Specifically, the motive to own a large and modern farm was positively associated with milk quota while the motive for a breeding farm and extra source of income negatively relates to milk quota. The authors conclude that instrumental or economic motives explain positive farmer behaviours compared to social, non-economic motives.

It is worthy of note that farming motivations or goals are heterogeneous. Pannell et al. (2006) in a literature review to understand farming goals and its influence on the adoption of conservation practices found several goals among rural landholders. The goals include material wealth and financial security, environmental protection and enhancement (beyond that related to personal financial gain), social approval and acceptance, personal integrity and high ethical standards as well as the balance of work and lifestyle. This is
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like many other farming motivations previously identified in the literature. For instance, Bergevoet et al. (2004) provides a list of farming goals, which include having a large and modern farm, quality of life, and status, farming with an extra source of income, farming as a way of life, having a family farm, high productive farm and realizing high income. Thus, the identified farming motivations suggest a range of economic and non-economic goals that influence farmer’s behaviour.

Studies have classified farmers in various categories based on their farming motivations or goals. For example, Stofferahn (2009) conducted a study to assist organic farming agencies and organizations in developing programs targeted at potential adopters of organic farming in North Dakota State, USA. In so doing, the researcher classified farmers as either organic or conventional. The results indicated that the three most important classificatory factors were environmental-ethical motives, production orientation and farming orientation. Environmental-ethical motivation factors were more important in explaining the classification of farmers into organic and conventional categories than economic and mandated reasons. In another study, Greiner, Patterson and Miller (2009), explored whether and to what extent motivations and risk perceptions influence the adoption of Best Management Practices (BMPs) in Australia. The study found a significant correlation between farmers classified as having the motivation of conservation and lifestyle and the adoption of BMPs.

Similarly, Lincoln and Ardoin (2016) classified 128 farmers in south Kona, Hawai’i by assessing their reasons for farming. Based on the reasons gathered, they identified five different farmer typologies. These are, classic farmers (primary employment and income is from farming), hobby farmers (generate most of their income from non-farming
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sources), leisure farmers (occupy agricultural land because of land benefits etc.), progressive farmers (rely on farming as their livelihood) and subsistence farmers (prioritize growing food to feed themselves, their family and friends, and the community). The authors discussed the farming typologies in relation to five categories of farming practices namely, environment, economics, education, community and culture. The results showed that farmer types explained a significant amount of variance seen in each category.

In a recent study, Hammond et al. (2017) attempted to elucidate the motivational factors that influence farmers’ willingness to adopt sustainable farming practices in China based on a survey of 1015 households. They identified six farming motivational types, provided in the order of the most to least likely to adopt sustainable agricultural practices: aspirational innovators, conscientious, copycats, incentive-centric, well settled and change-resistant. They suggested that these motivational typologies relate to the farming motives of the classified farmers.

In the same vein, Nordhagen, Pascual and Drucker (2017) conducted a study to understand farmers’ reasons for growing diverse crop portfolios among semi-subsistence rural farmers in Papua New Guinea. The results identified various types of farmers including the marketer-consumers (highly motivated by crop sales), an exhibitionist (priorities the show values of crops), pragmatists (mainly motivated by consumption and diverse diet) and novelty seekers (seek new crops and willing to change crop portfolios). In view of these classifications, the authors suggested better targeting to seek out farmers who are more willing to adopt new practices.
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Among the various goals of farming, economic goals seem to be more important in determining innovation adoption among farmers. Ostwald, Jonsson, Wibeck and Asplund (2013) examined the motivational factors that serve as drivers of and barriers to the cultivation of various energy crops among Swedish farmers. Using a meta-analysis approach, it found that economic motivations for changing production systems are strong predictors. However, factors such as values (e.g. aesthetic), knowledge (e.g. habits and knowledge of production methods) and legal conditions (e.g. cultivation licenses) are crucial for the change to energy crops.

In a related study, Koutsoukos and Iakovidou (2013) researched farming motivations, attitudes and problems with the adoption of organic and conventional farming in two rural communities in Greece. Using a mixed methods approach, the results indicated several reasons for adoption and non-adoption of organic farming in the two communities. The motivations for organic farming include among others the belief in producing high-quality crops, the expectation of a better income, environmental awareness and the belief that organic farming suits the region.

Additionally, Leite, Castro, Jabbour, Batalha and Govindan (2014), investigated the adoption level of innovations associated with more sustainable agriculture and environmentally friendly practices among farmers in Brazil. The results show that financial motivation to be associated with farmers adopting new and more sustainable technology. Another study by McDonald, Heanue, Pierce and Horan (2016) evaluated the main factors influencing grazing system technology adoption and to determine the extent to which economic factors influence decision-making among new entrant (NE) dairy farmers within Europe and Irish pasture-based industry. Multivariate analysis of the

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data revealed that new entrant (NE) dairy farmers whose technology adoption decisions are primarily motivated by financial considerations reported higher rates of adoption in relation to grazing, artificial insemination and financial management technology.

Xiong, Li and He (2016) analysed farmers’ adoption motivation of pollution-free vegetable farming among 420 vegetable farmers in China. The study largely suggested economic, informational and moral incentives as the main farming motivations. However, economic incentives play a greater role in the adoption of the farming practice relative to informational and moral incentives. They thus recommended a profit-driven approach to innovation adoption promotion.

Recently, Veisi, Carolan and Alipour (2017) explored the motivations and problems associated with the adoption of organic farming in Iran using a survey methodology. The results indicate that economic motivations, health, safety concerns and environmental issues motivate conversion to organic farming while social and ethical motives are of lesser importance.

The above studies suggest that inasmuch as economic motivation is instrumental in the adoption of new technologies, other non-economic motives (social and environmental) are also important. However, behavioural economists perceive farmers as solely motivated by economic motives (Borges et al., 2015). This assumption suggests that farmers would adopt agricultural innovations that have the potential to increase their profit margins. Adoption studies using economic models confirm this assumption (Borges et al., 2015). The overreliance on economic motivation to explain technology
adoption behaviour limits understanding and effort to investigate the plausible impact of non-economic factors.

2.3.3 Perceptions, Beliefs, Psychological Constructs and Innovation Adoption

Farmers’ perceptions about innovation have been included in explanations of adoption decisions particularly among studies predicated on economic models. In this regard, perception is examined in two ways namely, perceptions about the attributes of the innovation and perceptions about the benefits, risks and cost associated with the technology. For example, Wubeneh and Sanders (2006) analyzed the adoption of Striga resistant sorghum variety on small subsistence farms in Ethiopia to identify the determining factors of farmers’ adoption decisions. The study used separate Tobit regression models to estimate survey data of a random sample of 90 farm households conducted in 2001. The findings show that access to information, soil type, and farmers’ perceptions of innovation characteristics and rainfall risk were the factors associated with the adoption of new sorghum cultivars.

In another study, Khan et al. (2008) evaluated farmers’ perceptions of the pests, “pull-push” technology (PPT) attributes and factors influencing the likelihood of its adoption in 15 districts in Western Kenya. The study interviewed a random sample of 923 farmers with 478 having adopted the technology, (practising) and 445 not yet adopted but attending PPT field days (visiting). The researchers asked farmers about the benefits of using ‘push-pull’ technology for pest control. Results indicate that farmers’ perceptions of PPT’s attributes have a highly significant effect on adoption.
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On the perception of innovation attributes, Asfaw, Shiferaw, Simtowe and Haile (2011) examined the driving forces behind farmers’ decisions to adopt agricultural technologies in Ethiopia using a cross-sectional survey of 700 farmers. The study revealed that knowledge of existing seed varieties, perception about the attributes of improved varieties, household wealth and availability of active labour force are major determinants for the adoption of improved agricultural technologies.

These findings have been further confirmed by Wang, Gao, Wang and Li (2016) who evaluated the perceptions of eco-friendly soil management practices and land degradation in relation to adoption attitudes and final adoption decisions among 646 small-farm households in China. Their findings revealed that perceptions of land degradation and eco-friendly soil management practices are one of the most important factors influencing adoption.

The cited studies (e.g., Asfaw et al., 2011; Khan et al., 2009) clearly show that the perception that farmers hold about an innovation tend to influence their intention to adopt that innovation. Thus, farmers will adopt improved agricultural innovations when they perceive that attributes of the innovation resonate with their circumstance.

The other group of perception studies assume that the perceived benefits, risks and costs associated with innovation are most relevant to farmers. Studies have found clear associations between the perceived benefits of innovation and adoption decisions. Roberts et al. (2004) studied the adoption of site-specific information in cotton precision farming. The study hypothesized that farmers who are more knowledgeable about an innovation, perceive higher profits and lower cost are more likely to adopt that
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innovation. The results of the study confirmed the research hypothesis. The study measured the hypothesized variables by asking farmers to indicate their perceptions about the profitability of the innovation (benefits), the cost associated with the innovation (costs) and their perceived future usefulness of the innovation.

In a related study, Ghadim, Pannell and Burton (2005) examined the role of risk and uncertainty in the adoption of chickpeas in Western Australia. The study conceptualized adoption as a “dynamic decision process involving information acquisition and learning-by-doing by growers who vary in their managerial abilities, risk preferences, and their perceptions of the profitability and riskiness of the innovation” (p.1). The study conducted a three-year annual face-to-face survey was conducted with over 100 farmers and used farmers’ perceptions of the riskiness of the innovation as part of the explanatory variables on adoption decision. The results highlighted the importance of economic risks in the adoption decision process. The two risk-related factors with the greatest impact on the adoption decision were risk aversion and relative riskiness of the innovation.

Recently, Simha, Lalander, Vinnerås and Ganesapillai (2017) examined the factors that encourage or discourage negative and positive attitude toward human waste recycling among farmers in southern India. They conducted a face-to-face interview of 120 farmers and reported that the main factors the motivated farmers to respond positively to re-use of urine, improved soil quality and potential cost savings from reduced use of chemical fertilizer. Fear of crop die-off ridiculed and uncertainty over consumer marketplace behaviour were significant factors among farmers with a negative attitude towards innovation. These variables were all measures by asking farmers about their perceived
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benefits and cost of human waste reclining technology. These findings suggest that both strands of farmers’ perception are significant in predicting innovation adoption.

In studies that use psychosocial models as a theoretical framework, perceptions about the cost, benefits and attributes of the innovation are not explicitly investigated (Borges et al. 2015). The reason could be that attitude towards innovation and perception about than innovation overlaps. To illustrate, a positive attitude towards an innovation arises when a person perceives that adopting a given innovation will result in more positive outcomes (benefits) than negative ones (cost). Lapple and Kelly (2013) argue that attitude is equivalent to the perception of utility. Therefore, in an interdisciplinary framework by Borges et al. (2015), they treated attitude and perceptions about cost and benefits as similar concepts.

Instead, psychological studies on innovation adoption focus explicitly on beliefs, intentions, attitudes, subjective norms and perceived behavioural control (Burton, 2004). To identify possible variables that explain behaviour in the adoption of agricultural technologies among farmers of the Southern Moravian region of the Czech Republic, Herath (2013) used the theory of planned behaviour (TPB) as a theoretical framework for explaining the farmers’ behaviour. The results showed that intention significantly explains adoption behaviour. On the other hand, attitudes, perceived behavioural control, farmers’ age and farmers’ education also show a significant relationship with adoption behaviour. Studies highlight the relative strength of the main TPB variables namely attitude, subjective norm and perceived behavioural control.
Subjective norm is one of the most cited predictors of adoption intention as shown in the following studies. Martinez-Garcia et al. (2013) conducted a study to investigate the factors that influence the uptake of innovation by smallholder farmers in Mexico as a way of achieving food security and rural development. A detailed study was conducted with 80 farmers who are already engaged with the use of this innovation to better understand the process of adoption and identify socioeconomic and farm variables, cognitive (beliefs), and social – psychological (social norms) factors associated with farmers’ use of improved grassland. The study used the TRA as a theoretical framework. Most farmers (92.5%) revealed a strong intention to continue to use improved grassland (which requires active management and investment of resources) for the next 12 months. Despite farmers’ experience of using improved grassland (mean of 18 years) farmers’ intentions to continue to adopt it was influenced almost as much by salient referents (mainly male relatives) as by their own attitudes.

In another study, Borges, Lansink, Ribeiro and Lutke (2014) analysed the factors that affect the adoption of improved natural grassland among cattle farmers in biome Pampa, Brazil. The study sought to determine the effect of attitude, subjective norms and perceived behavioural control on the intention to use improved natural grassland. Using a sampled of 214 cattle farmers, results suggested significant positive correlations between attitude, subjective norms and perceived behavioural control on the intention to adopt the technology.

Another study by Ambrosius, Hofstede, Bock, Bokkers and Beulens (2015) attempted to develop a framework that models farmers’ strategic decision-making among Dutch pork farmers. The study employed a theoretical framework comprising the TRA, Innovation
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Diffusion Theory and the Theory of Structuration. Their framework revealed that personal characteristics, social influence related to reference groups and institutional context strongly influence farmers’ decision-making.

Borges and Lansink (2016) confirmed the findings of earlier studies on the importance of social pressure in predicting adoption intentions and behaviour. They conducted a study to identify the psychological factors that influence farmers’ intention to adopt improved natural grassland in Brazil. The study used the TPB as a theoretical framework and a sample of 214 Brazilian cattle farmers. It was found that the intention of framers to use improved natural grassland was mainly determined by their perceptions about the social pressure to use the innovation (subjective norms), followed by their perceptions about their own capability to use the innovation (perceived behavioural control) and their evaluation of the use of improved natural grassland (attitude toward innovation). These findings suggest that future studies should focus on identifying the main social referents that influence farmers’ decision to adopt an innovation.

Related to the subjective norm are the variable of social network and social capital. Few studies have investigated the impact of social networks and social capital on farmers’ adoption decisions. For example, Matuschkea and Qaim (2009) investigated the impact of social networks on the adoption of modern seed technologies among smallholder farmers in developing countries. The focus of the survey was on the adoption of hybrid wheat and hybrid pearl millet in India. The findings supported the earlier study in that individual social networks played an important role in the technology adoption decision.
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A recent, Hunecke, Engler, Jara-Rojas and Poortvliet (2017) examined the impact of social capital on the adoption of irrigation technology and irrigation scheduling among wine producers in central Chile. The study measured seven different dimensions of social capital. These are general trust, trust in institutions, and trust in water communities, norms, informal networks, formal networks and size of networks. Results indicated that trust in institutions, formal and informal networks have a positive impact on the adoption of both technologies.

The above-cited studies emphasize the importance of subjective norm in technology adoption. However, others have also cited attitude as a stronger predictor. Wauters et al. (2010) conducted a study to elicit the factors explaining the adoption of soil management practices in Belgium. Following a socio-psychological approach, the theory of planned behaviour (TPB), adoption of cover crops, reduced tillage and buffer strips is evaluated using linear regression techniques. Results show that the most explaining factor is the attitude towards soil conservation practice.

Gebrezgabher et al. (2015) in their study on the role of farm and farmer characteristics as well as farmer attitudes toward key technology attributes found among other variables significant effects of farmer attitude toward different attributes of manure separation technology on the likelihood of adoption. Similarly, Lalani, Dorward, Holloway and Wauters (2016) used the TPB to understand factors driving farmers’ intention to adopt conservation agriculture in Mozambique. Regression estimates from the data analysis revealed that the TPB provides a valid model of explaining farmers’ intention to use conservation agriculture. The TPB constructs of attitude, subjective norms and perceived
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behavioural control accounted for 80% of the variation in intention with attitude being the strongest predictor of adoption intention.

In another study, Borges, Tauer and Lansink (2016) used the TPB to test the hypothesis that attitude, subjective norm, and perceived behavioural control determines adoption intention. Results from the study show that among the three psychological constructs attitude is the strongest predictor of intention relative to the subjective norm and perceived behavioural control.

Attitude and subjective norm seem to be strong predictors of adoption intention. Hansson, Ferguson and Olofsson (2012) confirm this claim as they sought to explain how underlying psychological constructs influence farmers’ decisions to extend their farm business to income-generating ventures outside conventional agricultural production among Swedish farmers. The study used an official Swedish Farm Economic Survey based on 929 farmers. Results indicated that psychological variables in the TPB, that is attitude, subjective norms and perceived behavioural control influence farmers’ decisions regarding the strategy of adoption. Besides, the study found attitudes and subjective norms to be particularly significant in these decisions.

Beliefs about an innovation influence attitude, subjective norm and perceived behavioural control towards that innovation, which in turn influence adoption intention (Ajzen, 2015). However, there seem to be few studies investigating the influence of salient beliefs on farmers’ adoption intentions through the three components of the TPB. To this end, very few evidence exists on how behavioural, normative and control beliefs of farmers influence their attitude, subjective norm and perceived behavioural control respectively.
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(Lalani et al., 2016; Lapple & Kelly, 2013). Yet available studies show that these salient beliefs strongly correlate with attitude, subjective norm and perceived behavioural control.

To illustrate, Borges et al. (2014) analysed the salient beliefs, which drives attitude, subjective norms and perceived behavioural control using the TPB as a theoretical framework and a sample of 214 cattle farmers. The study found six behavioural beliefs namely, increase cattle weight gains, increase the number of animals per hectare, have pasture throughout the year, increase pasture resistance, prevent soil erosion, and decrease feeding costs drive attitude towards improved natural grassland. Seven normative beliefs, which include family, friends, fellow farmers, and cattle traders, workers in the place where they buy their inputs, extension agents, and government, are responsible for subjective norms. Besides, three control beliefs that are, sufficient knowledge, sufficient skills, and availability of qualified technical assistance create perceived behavioural control towards the improved natural grassland. The authors concluded that drivers of attitude, subjective norms and perceived behavioural control should be the focus of policy intervention to encourage the adoption of the innovations.

Borges, Tauer and Lansink (2016) examined beliefs that influence the use of improved natural grassland among farmers in biome Pampa, Brazil. The study tested the hypothesis that attitude, subjective norm, and perceived behavioural control predicts adoption intention. The study further hypothesized that attitude, subject norm and perceived behavioural control predicts behavioural, normative and control beliefs respectively. Results show that the degree to which farmers’ belief the innovation would increase cattle density, the degree to which they think family and cattle traders approves their use of the
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innovation and the degree to which farmers’ belief that they have adequate technical and material resources to allow for adopting the innovation. Influence their intention to use the innovation.

Another interesting variable in psychological studies of technology adoption is personality. Very few studies have investigated the influence of personality on farmers’ adoption decisions. He and Veronesi (2017) examined the role played by personality traits in the adoption decision of renewable energy technologies in China. Using a case study approach, the researchers examined a biogas technology adoption and conducted a large-scale household survey of 597 farmers. They found that farmers with a higher level of openness to experience were more likely to adopt biogas technology. Openness was found to influence adoption through perceived ease of use of the technology. However, farmers with a lower level of confidence in influencing outcomes they experience were less likely to adopt the biogas technology. The authors concluded that including personality traits into adoption studies could give a better understanding of individual differences in the adoption process.

2.3.4 Technology Adoption Studies in Ghana

In the last decade or more, several agricultural economists and scientists have conducted studies on farmers’ innovation adoption decisions in Ghana. As would become evident in the following review, most of these studies focus mainly on socioeconomic variables and their role in the technology adoption process. Besides, these studies have not focused on a specific innovation or crop rather scholars have studied different crops and innovations within the Ghanaian context.
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Donkoh, Tiffin and Srinivasan (2011) investigated how socio-economic factors contribute to the adoption of Green Revolution Technology (GRT) in Ghana. Using a maximum likelihood estimation of a probit model, the study found that the proportion of GRT adoption was greater for a household with formal education, higher levels of nonfarm income, access to credit and labour as well as living in urban centres.

In a related study, Owusu and Donkor (2012) explored the adoption of improved cassava varieties among smallholder farmers. The study analysed the effect of the determinants on adoption with the Tobit model. The results suggest that age and education of the farmer, household size, membership of the farmer-based organization, access to credit tend to have a positive correlation with the rate of adoption of improved cassava varieties of farmers. The study found the age of the farmer to have a negative effect on the adoption of innovation. This suggests that younger farmers are more likely to adopt improved cassava variety that older farmers.

In another study, Akudugu et al. (2012) examined the factors that influence the farm household’s modern agricultural technology adoption decisions. The researchers administered three hundred (300) household questionnaires to farmers in the Bawku West District. Using logit model to ascertain the factors, the study found that farm size, expected benefits from technology adoption, access to credit and extension services are the factors that significantly influence technology adoption decisions of farm households. Based on the findings, it may be that the farmer’s agricultural technology adoption is contingent on their sociodemographic situation and institutional effectiveness.
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Namara, Hope, Sarpong, Fraiture and Owusu (2013) examined the adoption patterns and constraints pertaining to small-scale water-lifting technology adoption. The study assumed that smallholder farmers could play a vital role in achieving the national irrigation development plan if they have access to water lifting technologies, specifically small-motorized pumps. The study observed that water lifting technologies are currently accessible to well-to-do farmers. The factors preventing wider adoption are poorly developed supply chains, lack of access to finance, high operational and maintenance costs, high output price risks and lack of institutional support.

Furthermore, Chapoto and Ragasa (2013) provided empirical evidence on the responsiveness of maize yield to fertilizer use and use intensity and the economics of fertilizer use with or without subsidy. The study employed a cross-sectional data on 630 maize farmers and 645 maize plots. Results indicate that fertilizer prices appear not to be the binding constraints in greater fertilizer adoption and productivity increases in maize. However, other factors such as access to modern seed varieties, mechanization, and hired labour are major inhibitors to the adoption of fertilizers and productivity increases.

In addition, Agyare, Asare, Sogbedji and Clottey (2014) investigated the challenges that farmers face in their attempt to adopt fertilizer to improve maize production. Using a farm level survey and a four-stage randomized sampling procedure, the study interviewed 168 maize farmers using a formal questionnaire. The results show that access to credit, the high cost of fertilizer, mode and distance needed to transport fertilizer to the farm are crucial to the adoption of fertilizer to improve maize production.
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Bruce, Donkoh and Ayamga (2014) set out to investigate the factors that influence the adoption of improved rice variety and its effects on rice output. They used a treatment effect model involving a probit equation and production function to conduct the analysis. The study revealed that the adoption of improved rice variety had a positive effect on farm output. Other inputs such as farm size, fertilizer and labour also had a significant positive impact on rice output. Besides, the probability of adopting rice variety was high for farmers with formal education, farmers who had bigger household sizes, and farmers with smaller farmers. However, farmers who had access to extension services had a lower probability of adoption.

Likewise, Natal, Mjelde and Boadu (2014) conducted a study to address the link between food security and the adoption of soil improvement practices. Using survey data, the study estimated two logit models to determine the likelihood of soil-improving practices adoption and the relationship between technology adoption and food security. In the adoption model, they found that being a food secure household, the use of insecticide and seasonal lease land tenure increase the probability of adopting such soil-improving practices. Farming income together with the use of chemical fertilizers, farming on better soil and the use of commercial seeds increase the probability of households being food secure. However, household characteristics such as income, age, education level, and household size are not significant factors influencing adoption decisions or improving household food security.

To answer the question, what factor could have influenced a small fraction of farmers to adopt organic production practices, whilst the majority continue in conventional cocoa production? Djokoto, Owusu and Awunyo-vitor (2016) conducted a survey on 280
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organic cocoa farms and 378 conventional cocoa farms from Suhum cocoa district in the eastern region of Ghana. Using a probit model, the results indicated that being male and smaller households positively influenced the adoption of organic cocoa production. Besides, access to credit, access to extension services promotes the adoption of organic cocoa technology. However, the farming experience had a significant negative relationship with the adoption of organic cocoa production, meaning, farmers with less cocoa farming experience are more likely to adopt organic cocoa production practices.

Apart from the socioeconomic characteristics of farmers, a few studies have investigated the impact of social learning on technology adoption. For example, Stephens (2008) examined the relationship between social learning network connections and profitability of a newly introduced agricultural commodity in Ghana. The author used a vector autoregression to demonstrate the bi-directional causality between the dynamics of profits earned from a new agricultural crop and information acquired from one’s social network. The findings show that farmers’ profitability in the new commodity thrives on greater information from the social network. This suggests that more-connected farmers have a greater chance of success with a new crop and their information networks influence their profit margins and vice versa. Stressing the need to spread the benefit of innovations through existing social networks of farmers.

In similar research, Conley and Udry (2010) investigated the role of social learning in the diffusion of new agricultural technology in Ghana among pineapple farmers. The study used unique data on farmers’ communication patterns to define each individual information neighbourhood. Results reveal that farmers adjust their inputs to align with those of their information neighbours who were surprisingly successful in previous
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periods. The authors concluded that the relationship between these inputs adjustments to experience further indicates the presence of social learning.

2.4 Summary and Critique of Related Literature

This chapter used three psychological theories to explain farmers’ innovation adoption behaviour. These theories are the Social Learning Theory (Bandura 1971; 2001), Theory of Planned Behaviour (TPB) (Ajzen, 1991, 2011) and Diffusion of Innovation Theory (DOI) (Rogers, 1995; 2003). These theories underpin the assumption that innovation adoption is a function of individual characteristics, technology characteristics, social learning, attitude and behavioural control. Whereas all the theories provide a good foundation for the study of technology adoption, the Theory of Planned Behaviour (TPB) offers a better explanation. The Theory of Planned Behaviour (TPB) assumes that adoption behaviour originates from a strong intention to adopt a given innovation and in turn, attitude, subjective norm and perceived behavioural control predicts intention. Moreover, three salient beliefs namely, behavioural, normative and control beliefs drive the three psychological constructs.

The review also brought to light studies conducted in the area of technology adoption among farmers in both developed and developing countries. Generally, the major variables studied in connection with innovation adoption include socioeconomic factors, farming motivations, perceptions, attitudes, social pressure and behavioural control. The study generally shows that certain socioeconomic factors such as education, age, experience, farm size, access to subsidies and credit, income are significantly associated with farmers’ innovation adoption (Corner-Thomas et al., 2015; Gebrezgabher et al.,
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2015; Ainembabazi & Mugisha, 2014; Gillespie et al., 2014; Ogada et al., 2014; Muzari et al et al., 2012).

Furthermore, the motivations or goals for farming are associated with technology adoption (Veisi et al., 2017; Xiong et al., 2016). The review highlighted that scholars use farmers’ motivation for farming to classify them into various typologies of farmers such as value/culture, environmental and business-driven farmers (Nordhagen et al., 2017; Lincoln & Ardoin, 2016; Hammond et al., 2017). Additionally, the study reviewed the role perception in farmers’ adoption decision. This review shows that adoption studies investigating the impact of farmers’ perception focus on two dimensions. First, the perception of innovation characteristics (Asfaw et al., 2011; Wang et al., 2016) and second, the perception of cost and benefit of innovation (Ghadim et al., 2005; Simha et al., 2017).

Other variables reviewed in this chapter include beliefs, intention, attitude, subjective norm and behavioural control. These variables are the main psychological constructs represented in the Theory of Planned Behaviour (TPB). Studies confirm that these psychological constructs are significantly associated with farmers’ adoption behaviour (Lalani et al., 2016; Borges & Lansink, 2016; Borges et al., 2016; Borges et al., 2014).

Having reviewed broadly studies in developed and developing countries, the chapter reviewed adoption studies in Ghana. This review shows that many Ghanaian studies on farmers’ adoption behaviour exist. These studies have all converged at the conclusion that perception and socioeconomic factors of farmers are the major determinants of adoption intention and behaviour (Djokoto et al., 2016; Bruce et al., 2014; Agyare et al.,
While this review provides a good overview of scholarship in the area of technology adoption among farmers across developed and developing countries including Ghana, it exposes major gaps in the literature.

First, the review suggests some theoretical gaps in the literature. Two main sets of models namely, economic and socio-psychological models provide a theoretical basis for adoption studies. The economic models support the assumption that farmers’ adoption decisions aim at profit maximization (Borges et al., 2015). With this assumption, economic motivation for farming is the main incentive for adopting improved agricultural innovations. Studies using economic models such as logit, probit and Tobit to investigate the impact of various variables on farmers’ adoption decision subscribe to this orientation (e.g., Gillespie et al., 2014; Mariano, Villano & Fleming, 2012; Jara-Rojas et al., 2012; Kassie et al., 2013). Using economic models, the argument is that farmers compare new technologies with existing ones and decides to adopt it if the expected benefits from adoption outweigh the utility of the old technology (Batz et al., 1999).

However, economic explanations alone are not adequate in understanding fully the complexity of farmers’ technology adoption decision (Borges et al., 2015; Mzoughi, 2011; Pannell et al., 2006). Economic models fail to recognize that economic motive is not the only predictor of farmer behaviour but also other social, environmental and intrinsic motives. That is, social and psychological factors influence farmers’ work decisions much as economic factors. Approaches that are a more psychological need for innovation studies among farmers to understand the complex process of adoption decisions.
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Socio-psychological models use psychological constructs of individual internal processes and social influence to explain the adoption behaviour of farmers (Hansson et al., 2012; Burton, 2004; Martínez-García et al., 2013; Reimer et al., 2012; Wauters et al., 2010). The most relevant socio-psychological theory that helps to explain farmers’ behaviour is the Theory of Reason Action (TRA) and its successor, the Theory of Planned Behaviour (Fishbein & Ajzen, 1975; Ajzen, 1991). Some studies exist which investigate various psychological factors that influence farmers’ adoption behaviour at least in developed counties and Latin American regions (Bergevoet et al., 2004; Guillén Pérez, Sánchez Quintanar & Mercado Doménech, 2004; Martínez-García at al., 2013; Moyano-Diaz, Cornejo & Gallardo, 2011; Rocha, Batista de Albuquerque, Peçanha de Miranda Coelho, Dias & Marcelino, 2009; Reimer et al., 2012). Yet, to the knowledge of the researcher, little or no empirical study has been conducted in developing countries particularly Ghana to explore and examine the psychosocial determinants of farmer behaviours and decision-making.

Furthermore, economic-based studies do not consider pressure from significant others such as family members, fellow farmers. To adopt or not to adopt an innovation. The TPB addresses this limitation. However, psychological studies using the TPB as a theoretical framework do not explicitly account for the role of background or socioeconomic factors and cultural factors. There is, therefore, a need to include these missing variables into any psychological study to provide a more comprehensive appreciation of farmers’ innovation adoption behaviour.

After reviewing previous studies in the adoption literature, the study identified some methodological gaps. Quantitative approaches have dominated most of these studies (e.g.
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Bruce et al., 2014; Djokoto et al., 2016; Khan et al., 2008; Martinez-Garcia et al., 2013; McDonald et al., 2016). While this approach has some advantages, it also presents some major challenges. For instance, the over-reliance on quantitative methods may limit the contextual meaning of farmers’ adoption decisions and attempt to generalize findings to other cultures. The farming context may have some inherent cultural factors that are relevant to understanding technology adoption, yet previous studies have given little attention to a more pragmatic research approach. Since the farming context influence farmers’ adoption behaviour, examining cultural underpinnings is vital, particularly using a qualitative methodology or a mixed methods approach.

Few studies have used a qualitative approach and the findings cannot be generalized to other settings in view of the small sample size involved (Bantilan & Padmaja, 2008; Boages et al., 2014; Kalungu & Leal Filho, 2018; Koutsoukos & Lakovidou, 2013). It is understandable therefore to use both approaches to compensate for the shortcomings of each research approach. In so doing, the study does not only offer a comprehensive understanding of the phenomenon but also offers the basis to generalize findings to a wider sample.

Practically, the scarcity of psychological studies in technology adoption in Ghana and Africa is problematic for the following reasons. First, adoption studies in Ghana have predominantly used economic models as shown in the literature. This suggests the assumption that Ghanaian or African farmers act with the sole purpose of profit maximization, allowing little room for psychological explanations of innovation adoption behaviour. Perhaps, economic explanations may be preferred because of the lack of psychological explanation on the mental orientations of Ghanaian farmers toward
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improved agricultural innovations. However, by neglecting psychological explanations, these studies only offer a limited understanding of the issues affecting adoption behaviour.

Besides, as shown in this review, Ghanaian studies on technology adoption have focused more on the socioeconomic variables that affect technology adoption to the desertion of psychological variables. While some studies support the claim that farmers’ adoption behaviour is influenced by personal, social, and economic factors, others also confirm that psychological variables such as beliefs, attitude and perceived social pressure play a significant role in the process of innovation adoption (Borges et al., 2015). A good appreciation of the role of these factors is necessary for effective agricultural intervention policies.

Furthermore, in this review, it is evident that some studies examined farming motivations or goals and its role in innovation adoption. These studies classified farmers into various groups based on their farming motivations to allow for targeting in the provision of effective interventions. However, in view of the lack of studies on farming goals in Ghana, there are no classifications of farmers in terms of those who are business minded, socially motivated and tradition keepers. These types of classifications assist in identifying farmers who are more likely to adopt improved agricultural innovations and appropriate interventions directed at them.

2.5 Rationale for the Study

The rationale of this study is to generate a theoretical framework to enhance farming. Specifically, to explain the relationships between farmers’ background factors, salient
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beliefs, psychological constructs and intention to adopt improved agricultural innovations. Previous technology adoption studies have left out beliefs and psychological variables. Besides, these studies are yet to address the methodological gaps identified in the review. Furthermore, the study seeks to demonstrate the contribution of psychology, particularly I-O psychology in agricultural research and development in Ghana. Now, psychological research in technology adoption among farmers to the knowledge of the researcher is notoriously absent.

The study specifically seeks to examine the certainty about attitude, subjective norm and perceived behavioural control in explaining intention to adopt improved agricultural innovations among smallholder farmers in Northern Ghana. Several factors that are economic, social and psychological explain technology adoption. Given that studies have extensively researched the economic factors to the neglect of social and psychological determinants, this study focuses on determining the relative impact of the three psychological constructs on the intention to adopt agricultural innovations. Furthermore, the study is focused on knowing the extent to which salient beliefs (behavioural, normative and control beliefs) influence the psychological constructs to explain adoption intention. Previous research in Ghana has not filled this gap yet.

Another purpose of this study is to adopt a suitable theoretical framework for examining the determinants of adoption intentions among smallholder farmers in Ghana. In line with previous research suggesting the suitability of the TPB in examining behavioural intentions and actual behaviour (Borges et al., 2015; Borges et al., 2016), the study sought to use the TPB as the main social-psychological model to examine and better understand
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the relationship between salient beliefs, psychological constructs and intention to adopt improved agricultural innovations.

When using the TPB as a theoretical framework, most studies have explicitly ignored the role of farmers’ background factors in the adoption decision process. However, studies adopting economic model have included farmers’ background characteristics such as socioeconomic variables and risk attitude (e.g. Chapoto & Ragasa, 2013; Khan et al., 2008; Natal et al., 2014; Wubeneh & Sanders, 2006). The current study integrates both farmers’ background and psychological variables to examine their interaction in the adoption process. Furthermore, the study aims to approach the study from an epistemological and methodological viewpoint that considers the African-Ghanaian context by adopting a mixed methods approach. The study explores the beliefs of smallholder farmers about improved agricultural innovations and their influence on farmers’ adoption behaviour in a two-part qualitative-quantitative study.

Study 1 focuses on the elicitation of locally/culturally relevant beliefs namely, behavioural, normative and control beliefs that influence the attitude, subjective norm and behavioural control of smallholder farmers. It seeks to identify the specific significant referents, opportunities and challenges that prevent or enhance the adoption of agricultural innovation. In addition, the study will explore the farming motivations of smallholder farmers. Investigating the various farming motivations of Ghanaian smallholder farmers would help design effective interventions that consider adoption-friendly farming motives. On the other hand, Study 2 focuses on examining the relationship between variables such as socioeconomic characteristics, personality,
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psychological health, risk attitude, salient beliefs, attitude, subjective norm, perceived behavioural control and intention to adopt improved agricultural technologies.

2.6 Statement of Hypotheses

Considering the above discussions on the theories underpinning this study, review of related literature, research problem and the study objectives, this current study proposed the following hypotheses. The study expects attitude, subjective norm and perceived behavioural control to predict intention to adopt improved agricultural innovations.

1. The TPB variables will predict intention to adopt improved agricultural innovations. Specifically,
   a. Attitude toward improved agricultural innovations will predict adoption intention.
   b. Subjective norms will predict the intention to adopt improved agricultural innovations.
   c. Perceived behavioural control will predict the intention to adopt improved agricultural innovations.

2. Beliefs about improved agricultural innovations will predict intention to adopt improved agricultural innovations. Specifically,
   a. Behavioural beliefs about improved agricultural innovation will directly predict intention to adopt improved agricultural innovations.
   b. Normative beliefs about improved agricultural innovation will directly predict intention to adopt improved agricultural innovations.
   c. Control beliefs about improved agricultural innovation will directly predict intention to adopt improved agricultural innovations.
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3. **Beliefs about improved agricultural innovations will influence adoption intention through their respective TPB variables.** Specifically,
   a. Attitude towards improved agricultural innovations will mediate the relationship between behavioural beliefs and adoption intentions.
   b. Subjective norms will mediate the relationship between normative beliefs and adoption intentions.
   c. Perceived behavioural control will mediate the relationship between control beliefs and adoption intentions.

4. **Farmers’ background factors (e.g., age, gender, years of farming experience, etc) will significantly affect the behavioural, normative and control beliefs about improved agricultural innovations.** Specifically,
   a. The six farmer background factors will significantly affect behavioural belief about improved agricultural innovations.
   b. The six farmer background factors will significantly affect normative belief about improved agricultural innovations.
   c. The six farmer background factors will significantly affect control belief about improved agricultural innovations.

5. **Risk attitude and psychological well-being will significantly affect the behavioural, normative and control beliefs farmers have about improved agricultural innovations.** Specifically,
   a. Psychological well-being and risk attitude will significantly affect the behavioural belief about improved agricultural innovations.
   b. Psychological well-being and risk attitude will significantly affect the normative belief about improved agricultural innovations.
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c. Psychological well-being and risk attitude will significantly affect the control belief about improved agricultural innovations.

2.7 Conceptual Model

From the conceptual model in Figure 2.1 below, intention to adopt improved agricultural innovation is a function of three psychological constructs, beliefs and background factors. That is, intention to adopt improved agricultural innovation originates from attitude, subjective norms and perceived behavioural control. In turn, three salient beliefs, namely behavioural, normative and control beliefs drive the three psychological constructs. Furthermore, farming motivation, socioeconomic factors and personality characteristic of farmers could affect the salient beliefs. Thus, the combined effect of these variables can be significant in determining the strength of the intention to adopt improved agricultural innovations by smallholder farmers. Figure 1 below depicts the hypothesized relationships in a conceptual model.
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Figure 1: Hypothesized Relationships among Study Variables

H1a
H2a
H3a
H3b
H3c
H4
H5

Psychological Wellbeing & Risk attitude

Farmer Background Factors
(Age, experience, gender, household size, farm size and)

Behavioural Beliefs

Normative Beliefs

Control Beliefs

Attitude

Behavioural Belief Measure

Subjective Norm

Normative Belief Measure

Perceived Behavioural Control

Control Belief Measure

Intention to Adopt Improved Agricultural Innovations
(Row Planting, Improved Seeds and Fertilizer Application)
2.8 Operational Definitions

1. **Intention to Adopt**: refers to the plans made to adopt improved agricultural innovations. In the present study scores on the intention to adopt a scale developed by Ajzen (2006) is defined as the intention to adopt.

2. **Attitude**: contextualize as the positive or negative evaluation of improved agricultural innovations. In the present study scores on the attitude scale designed by Ajzen (2006) is defined as attitude.

3. **Subjective Norm**: perceptions of social pressure to adopt or not to adopt improved agricultural innovations. In the present study scores on the subjective norm scale designed by Ajzen (2006) is defined as attitude.

4. **Perceived Behavioural Control**: refers to the extent to which a farmer feels capable to adopt improved agricultural innovations. In the present study scores on the perceived behavioural control scale designed by Ajzen (2006) is defined as attitude.

5. **Behavioural Beliefs**: refers to the possible outcomes of improved agricultural innovations adoption and the positive or negative evaluation of these outcomes. In the present study, test scores on the behavioural belief scale that would be developed later in the study are defined as behavioural beliefs.

6. **Normative Beliefs**: refers to the perceived pressure from significant others to adopt or not to adopt improved agricultural innovations as well as the motivation to comply with the pressure from significant others. In the present study, test scores on the normative belief scale that would be developed later in the study are defined as normative beliefs.

7. **Control Beliefs**: refers to the perceived ability to use improved agricultural innovations and the confidence to adopt agricultural innovations. In the present
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study, test scores on the control belief scale that would be developed later in the study are defined as control beliefs.

8. Psychological wellbeing – In the present study, test scores on the brief psychological wellbeing scale developed by Su, Tay and Diener (2013) is defined as psychological wellbeing. The scale focuses on interest and engagement in daily life activities, meaning and purpose in life and a sense of mastery and accomplishment.

9. Risk Attitude- In this study, risk attitude is defined as the test scores on the risk orientation questionnaire (ROQ) which assesses individual attitude towards risky decisions (Rohrmann, 2002).
CHAPTER THREE

GENERAL METHODOLOGY

3.0 Introduction

This chapter discusses the methodological approaches adopted by the current study. The chapter consists of three main sections that are, general methodology, and Study 1 and 2 methodologies. The general methodology highlight issues such as philosophical foundation, research design, research setting, data sources, study population and the sampling procedure. The second major section covers data collection procedures relating to Study 1, which is qualitative. They include justifications, inclusion/exclusion criteria, data collection and procedure, reliability and validity as well as qualitative data analysis. The last major section of this chapter covers research processes for Study 2, which is a quantitative study. They are sample size, inclusion/exclusion criteria, survey instruments, data collection and analysis procedures. The chapter concludes with a discussion on the ethical principles observed in undertaking this psychological study.

3.1 Philosophical Foundation

Philosophical worldviews need early identification in a research plan because it inherently influences the practice of research through the selection of a research approach, design and method (Creswell, 2013). To this end, the study is located in the philosophical paradigm of pragmatism, pioneered by the works of Peirce, James, Mead and Dewey (Cherryholmes, 1992). Other recent contributions include the works of Murphy (1990), Patton (2002) and Rorty (1990).
Pragmatism is a philosophical paradigm that looks for workable applications and solutions to a problem (Patton, 2002). Pragmatist philosophers or researchers pay more attention to the research problem and employ all available approaches to understand the problem (Creswell, 2013). Cherryholmes (1992), Creswell (2013) and Morgan (2007) summarized pragmatism as a research foundation as follows:

- Pragmatism does not subscribe to any one system of philosophy and reality. Researchers with this worldview are free to combine assumptions from both quantitative and qualitative when doing research.

- Given the focus on the research problem, pragmatists liberally choose research methods, techniques and procedures that meet the need and purpose of the research.

- Pragmatism is not concerned with whether reality is independent of the mind or within the mind. It embraces workable ideas and solutions that work at the time. In this way, individual researchers use both qualitative and quantitative data because they work to produce a fuller understanding of the research problem.

- Pragmatist researchers are preoccupied with the ‘what’ and ‘how’ to research with a focus on the intended consequences. Thus, inquirers need to have a purpose for using both qualitative and quantitate data and justify their reasons.

As a philosophical worldview, pragmatism thus allows for the use of different worldviews, assumptions, approaches, methods and different forms of data collection and analysis (Creswell, 2013). A major research approach that emanates from this research paradigm is the mixed methods research.
3.2 Mixed Methods Approach

The main research approach used for this study is mixed methods. The mixed methods research approach finds its basis in pragmatism (Morgan, 2007; Patton, 2002; Tashakkori & Teddlie, 2010). Research methods Scholars use different terms to describe this approach. For example, synthesis, integrating, quantitative and qualitative methods, multimethod and mixed methodology. However, the term mixed method is widely accepted (Bryman, 2006; Tashakkori & Teddlie, 2010).

Mixed methods approach demonstrates the importance of paying attention to the research problem and then “using pluralistic approaches to derive knowledge about the problem” (Creswell, 2013, p.11). As a research approach, it involves the collection of both qualitative (open-ended) and quantitative (close-ended) data and combining these forms of data using different designs and theoretical frameworks in response to a research problem. A major assumption of this approach is that the integration of qualitative and quantitative data provides a synergistic advantage in that it affords the inquirer the best understanding of the research problem (Creswell, 2013; Johnson, Onwuegbuzie & Turner, 2007).

Creswell (2013) provides three broad reasons for choosing a mixed methods research approach. First, a general reason why studies employ mixed methods is that it mitigates the limitations of both qualitative and quantitative research by drawing on both approaches. Second, a practical reason in which mixed methods becomes the ideal approach is that the researcher has access to both qualitative and quantitative data and can integrate the two. Third, a procedural benefit in which the researcher gains a better understanding of the research problem. For example, to develop a culture-specific
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instrument, the researcher may first collect and analyze qualitative interview data of a small sample and then administer the instrument to a larger sample.

There are three basic design strategies for a mixed methods approach (Creswell, 2013). They are convergent parallel mixed methods, explanatory sequential mixed methods and exploratory sequential mixed methods. With the convergence parallel mixed methods, the researcher merges qualitative and quantitative data to ensure holistic analysis of the research problem. In this vein, the researcher collects both forms of data concurrently and then converge the information into a holistic interpretation of the results. Explanatory sequential mixed methods, on the other hand, requires the investigator to first collect and analyse quantitative data and then build on the results by conducting qualitative research to explain the findings in more details. Reversely, exploratory sequential mixed methods involve first the conduct of a qualitative study in which participants’ views are explored and analyzed. Then, the results of the first study inform a second quantitative study. The purpose of an exploratory sequential mixed methods design is to identify suitable instruments to use in the follow-up quantitative study.

The purpose of this study was to explore locally relevant beliefs of smallholder farmers about row planting, improved seed and fertilizers through an initial collection and analysis of qualitative data. The study used the findings from the qualitative study to develop belief-based measures for a follow up a quantitative study aimed at examining the relationships among the study variables and generalizing the results to the population of smallholder farmers in northern Ghana. Therefore, the method adopted in the present study is exploratory mixed methods.
Generally, researchers express the procedure for the exploratory mixed methods design in a diagram using mixed methods notation. Mixed method notations are shorthand labels and symbols that indicate and communicate important procedures of mixed methods design strategy (Creswell, 2013). Figure 2 below shows a diagram of the procedures for this study. The diagram utilizes the suggestions of Morse’s (1991) mixed methods notations.

Figure 2: An exploratory mixed methods procedure

Figure 2 above shows a sequential form of data collection in which Study 1 informs study two. Thus, analysis of the qualitative data in study 1 helps to construct belief-based measures that would be used in Study 2 as part of other existing measures to examine the hypothesized relationships.

3.3 Research Setting

This study adopts the Gushegu district in the Northern region of Ghana as the research setting. The northern region of Ghana has twenty-six (26) administrative districts including Gushegu. Gushegu district is a border on the East by Saboba and Chereponi districts; the West by Karaga district; the North by East Mamprusi district and Yendi municipality; and to the South by Mion district (Ghana. Statistical Service [GSS], 2014).
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The district covers an area of about 2,674.1 square kilometres out of the area of 78,384 square kilometres of the Northern region. Gushegu district is approximately 114 kilometres from Tamale, the Northern regional capital.

Gushegu district is characterized by small valleys that can be located at Gaa, Katani, Sampemo and Sampegbiga areas. The district’s land mass topography is undulated with elevations ranging from 140 meters at valley bottom to 180 meters at highest plateaus. It is mostly a watershed of main rivers. The Ghana Statistical service (2014) reports that there are no rivers in the district, but tributaries and sub-tributaries of Nasia, Daka, Nabogu and Oti rivers run through it. Gushegu district is associated with a tropical climate with a successive change of dry and rainy seasons. The dry season begins in November and ends in March. The Northeast winds or the cold and dry Harmattan winds often signify the start of the dry season. On the other hand, the rainy season starts from May, ends in October. Usually, the Southeast winds announce the start of the rainy season.

Gushegu district has a tropical condition that is like the whole of the Northern region. Rainfall in the district varies from 900mm to 1,000mm. However, the region records heavy rains in July and August. According to the Ghana Statistical service (2014), “temperatures are high throughout the year with a maximum of 36°C recorded mainly in March and April. Low temperatures are recorded between November and February (the harmattan period)” (p. 3).

According to the 2010 Population and Housing Census (GSS, 2014), Gushegu district has a population of 111,259 which represent 5% of the population of the Northern region.
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Females constitute 51% and males constitute 49%. About three quarters (76%) of the district’s population live in rural areas. Agriculture is the main occupation of 92% of the households in the district. In this agricultural population, most of the households (98%) are crop farmers whiles 62% are animal farmers. The major crops cultivated in the Gushegu district are maize, millet, rice, yam and groundnuts.

The study used the Gushegu district as the study site because of its vast agricultural lands and farming population with intense agricultural activities (Azumah, Donkoh & Awuni, 2018). Besides, the Northern region in general and Gushegu seems to receive increased attention from government and international organizations to promote rural agricultural development (Salifu et al., 2015). Like other districts in the Northern region, Gushegu is a beneficiary of the ADVANCE-Ghana project with over 6000 registered smallholder farmers as beneficiaries in the district. These farmers tend to receive practical and technical support from extension officers on improved agricultural innovations. Despite the intensity of agricultural activities and the support from the ADVANCE project, there are sizeable yield gaps between attainable and farm-level yields in the District which could be attributed to inadequate application of improved agricultural innovations (Wood, 2013). Furthermore, the study aimed at finding out the meaning of improved agricultural innovations from the perspectives of the smallholder farmers. This requires that participants in the study have an appreciable knowledge of agricultural innovations to be able to participate meaningfully.

The study took place in Gushegu Township and five other villages in the town. The five other villages are Yishei, Kpugi, Watungu, Chidomyili and Dayudigili. The last two villages are predominantly Kokombas and the first three are mostly Dagombas. As far as
farming practices are a concern, their behaviour is homogeneous except that the Kokombas do more maize and yams whiles the Dagombas grow more maize and rice.

3.4 Population of the Study

The population of this study included all smallholder farmers within Gushegu District, specifically Gushegu town, and five Gushegu villages namely Yishei, Kpugi, Watungu, Chidomyili and Dayudigili. Gushegu Township has an estimated population of about 2000 smallholder farmers. Even though records from the Ghana Agricultural Development and Value Chain Enhancement II Project (ADVANCE- Ghana Project II) suggest this figure, the number of smallholder farmers in Gushegu may be underestimated. This is because the project registered only those farmers who were willing to be a part. Therefore, there is a reason to believe that the estimate excludes some of the smallholder farmers. Despite the agricultural programs in the district, little or no research exists to understand the psychological factors that influence technology adoption among these smallholder farmers.

The study among other things explored the farming motivations and beliefs of smallholder farmers about improved agricultural innovations. As indicated in chapter 1, the improved agricultural innovations namely row planting, fertilizer and improved seeds are complementary. The make-up of the population guided the collection of both qualitative and quantitative data.

3.5 Sampling Procedure

The study employed a non-probability sampling technique in selecting the study participants. Specifically, it adopted a purposive sampling method for both qualitative
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and quantitative studies. The use of purposive sampling technique allowed the researcher
to contact farmers whose views on the matter were instrumental and valuable to the study
(Bowling, 2014). The study used a purposive sampling strategy because it sought to
explore and examine the views of a group of farmers, which is smallholder farmers.
According to Creswell (2013), researchers deliberately choose purposive sampling to
select certain individuals or sites that can better elucidate the phenomenon under study.
In using a purposive sampling strategy, researchers practically handpick the people to be
part of the study based on their judgement (Avoke, 2005). Thus, purposive sampling
helps to tailor a sample to the needs of the study. It also allows the researcher to generalize
the findings to the population under investigations. In gathering qualitative study
participants, the researcher selected smallholder farmers who have over ten (10) years of
farming experience and are experts in their field of practice (Patton, 2002).

3.6 Ethical Considerations

Several ethical issues came up before, during and after collecting both qualitative and
quantitative data for this mixed methods research. In addressing these ethical issues, the
researcher following suggestions by the American Psychological Association (APA)
(2010), Creswell (2013), Linclon (2009), Mertens and Ginsberg (2009) and Salmons
(2010).

- **Ethical approval**- The researcher sought approval for the study from the Ethics
  Committee for the Humanities (ECH) of the University of Ghana, Legon.

- **Gain local permission from site and participants**- The researcher sought local
  approval from the lead farmers in the villages in order to have unfettered access
to farm sites and participants. Officials from ADVANCE Ghana project contacted
the farmers introduced the researcher as an official from their organization and explained the purpose of the study to them.

- **Disclosure of study purpose** - In most cases, the lead farmers and the ADVANCE officials explained to farmers the purpose of the study. The purpose was to investigate the psychological factors that underpin the intention to adopt improved agricultural innovations among smallholder farmers as well as how the use of the data.

- **Informed consent** - To avoid pressurizing participants into signing consent forms when collecting data for the study, the researcher did not demand signatures of participants before participation. Besides, the majority if not all the participants did not have adequate formal education. Participants were orally informed in clear terms that they are free to decide to opt out of the study.

- **Avoiding exploitation of participants** - To reciprocate the time and involvement of participants in the study, the researcher provided some small rewards for participation as well as endeavour to share the final research report with the farmers through ADVANCE Ghana project and the lead farmers.

- **Respect the privacy of participants** - To protect the anonymity of participants, the researcher used fictitious names or aliases to identify study participants in reporting the findings of the qualitative data.
4.0 Introduction

This chapter consists of four major sections. First, it presents the specific methods adopted for data collection and data analysis. Second, the chapter presents the findings of study one based on the first two study objectives. The third section discusses the findings in relation to literature and finally ends with a conclusion.

4.1 Methods

This section presents information on matters such as the rationale for the study, participants, inclusion/exclusion criteria and data collection procedure. It also includes issues of reliability and validity as well as data analyses technique.

4.1.1 Rationale for Study One

Generally, qualitative researchers pay regard to the social processes and the niceties of the research setting (e.g. the farming context in this study) that are of value to understanding the phenomenon under investigation (Creswell, 2013). According to Punch (2013), qualitative research seeks to provide an in-depth and holistic explanation of intricate social and organizational issues. To this end, qualitative researchers explore the rich meanings of experiences, social processes and structures that influence behaviour from the perspectives of participants (Mays & Pope, 2000). It involves close interaction with study participants, which allows the researcher to unpack locally relevant psychological variables that could help to explain the phenomenon (in this case intention to adopt improved agricultural innovations).
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Qualitative research methods fulfil the inadequacies that are characteristic of quantitative research. Quantitative research demonstrates relationships between variables using numbers, without regards to context. Quantitative investigation alone cannot provide the contextual meaning inherent in the social make-up of the Ghanaian smallholder farmers. However, qualitative research investigates social behaviours in a way that is not applicable to quantitative research (Hammersley, 1992; Pope & Mays, 2000). The usefulness of qualitative research lies in its ability to uncover locally relevant issues often neglected by quantitative researchers (Kitzinger, 1995).

Two main objectives of the study informed the use of qualitative alongside quantitative approach. First, to explore the various motivations for farming among Ghanaian smallholder farmers. Using the qualitative approach, the study sought to generate culturally relevant themes that meaningfully explain the reasons for farming among farmers. The second objective was to explore the beliefs of smallholder farmers about improved agricultural innovations, particularly row planting, improved seeds and fertilizer applications. To this end, the study used the qualitative approach to elicit these beliefs from the study participants.

Another justification for the use of a qualitative research approach is that technology adoption behaviour is complex (Borges et al., 2015) and may be influenced by a gamut of culture-specific factors. The preponderance of quantitative research in the investigation of technology adoption phenomenon could be problematic. This is because the specific farming motivations, attitudinal factors and social influence playing significant roles in technology adoption for a given population may be elusive. Thus, agricultural development programs and policy interventions that seek to address
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Smallholder farmers’ technology adoption challenges based on general motivations, attitudes and social pressure might not be successful.

Furthermore, most psychologists in Ghana have paid little regard to the farming work and its meaning to farmers. To the best of the knowledge of the researcher, very little or no research has attempted to investigate the psychological determinants of technology adoption among farmers in Africa and Ghana in particular. Therefore, the scope of psychological research in the area of innovation adoption is limited just as knowledge of psychological influences on technology adoption in Ghana is sparse.

Denzin and Lincoln (2011) describe qualitative research as “multi-method in focus, involving an interpretive, naturalistic approach to its subject matter by studying things in their natural settings, attempting to make sense of, or interpret phenomena in terms of meanings people bring to them” (p. 43). In line with this description, the researcher conducted in-depth interviews and analysed them in a structured and intuitive manner (Holloway, 2005). This enabled the researcher to generate relevant themes underlining the innovation adoption behaviour of Ghanaian smallholder farmers. Essentially, the qualitatively approach adequately explored beliefs and farming motivations of the farmers. This laid a solid foundation for developing specifically belief measures for the quantitative phase of the study.

4.1.2 Participants

Qualitative research, unlike quantitative, does not seek to generalize but to gain insight into a particular phenomenon (Punch, 2013). The big sample size is not a requirement insofar as the researcher is able to delve deep into the phenomenon of interest with a
relatively small sample. Therefore, the study interviewed twenty-two (22) smallholder farmers to elicit their beliefs about the three innovations as well as their farming motivations. The decision to stop at twenty-two (22) participants was primarily based on the idea of data saturation, that is, a point where no new information or themes were emanating from subsequent interviews (Guest, Bunce & Johnson (2006). The study participants consisted of both males and females with varied farming experiences in terms of years of farming, size of farm cultivated and type of crops produced.

4.1.3 Inclusion and Exclusion Criteria

The study based on the inclusion and exclusion criteria on years of farming experience and type of crops produced. Specifically;

- The study included smallholder farmers who had at least 10 years of farming experience of managing their own farms. This ensures that participants were knowledgeable in their field of work and can provide relevant information in the context of improved agricultural innovation adoption. However, in the case of female participants, the study considered at least 3 years of farming experience because women are not actively involved in the land preparation and planting department of farming in Northern Ghana.

- The study included smallholder farmers who grow maize, rice and soybeans. This was because these crops tend to lend themselves to the three improved innovations under investigation.

- The study excluded nucleus farmers (a commercial farmer having a number of smallholder farmers under him/her and provides them with farming inputs sometimes at barter conditions).
The study also excluded other smallholder farmers who cultivate other major crops in the district such as yam, groundnuts etc.

In sum, the study was open to all smallholder farmers who met the inclusion criteria with no sex or gender discrimination.

### 4.1.4 Data Collection and Procedure

The study conducted interviews for twenty-two (22) selected smallholder farmers. Using interviews as a data collection technique is effective in exploring the views of informants (Van den Berg, 2008). The interview allows qualitative researchers to probe and unearth understanding of a specific issue by engaging a small number of participants (Boyce & Neale, 2006). The study conducted two different interviews which are, focus group and individual interviews. Two focused-group discussions (FGD) took place in Gushegu town with nine (9) participants in each group. The constitution of the FGDs was an all-male group and all-female group for the two interviews. This arrangement was in recognition of the patriarchal culture existing in the northern region of Ghana. It was to avoid a situation where the men will dominate the discussion at the expense of the women who may have rich experiences to share.

The study conducted four (4) face-to-face interviews with lead farmers in the study communities namely Yishe, Watungu, Kpugi, Chidomyili and Dayudigli, all in the Gushegu District. A lead farmer is a smallholder farmer who rallies other smallholder farmers around the adoption of new technologies by providing land for demonstration farms. The study conducted these individual interviews to confirm responses raised in the focus group discussions regarding farming motivations and beliefs about the three improved innovations as well as to ensure data saturation.
As prescribed by Creswell (2013), the study used a semi-structured interview guide in the two forms of the interview to explore the behavioural, normative and control beliefs as well as farming motivations of the smallholder farmers. For details about the interview guide used in this study, see Appendix B. According to Conroy (2010), “a semi-structured interview is typically conducted with a series of questions in the general form of an interview schedule however the sequence of questions can be varied”. The semi-structured interview allows the interviewer to probe and ask additional questions from relevant responses given by the informants (Bryman, 2006). The prepared questions with prompts were to guide the interviewing experience. However, to ensure the effective interactive experience with the informants, the interviewer did not follow the exact wording and order of questions on the interview guide. This flexibility afforded the researcher the opportunity to delve into the social and personal experiences of the informants concerning their motivation and beliefs about agricultural innovations.

The individual interviews lasted between 30-45 minutes while the FGDs lasted for about 60 minutes. The researcher conducted the individual interviews at the residence of the informants for the sake of convenience and accessibility. The study recorded the individual interviews in English since all the four lead farmers could speak and understand English pretty well. However, the researcher and an interpreter co-facilitated the focus group discussion. The use of an interpreter was needful because the researcher could not speak or understand Dagbani (the language mainly spoken in Northern Ghana). The interpreter is a native of the region, fluent in English and a lead farmer. The Interpreter was calm, friendly and well received by all the participants in the focused group discussions. The researcher used the interpreter as a medium for asking questions and receiving responses from the informants. Theoretical saturation guided the number
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of individual interviews. That is, the interviews stopped at a point where no additional information was generated (Patton, 2002; Strauss & Corbin, 1998). All the interviews were audio-recorded for later transcription and analysis.

Dodge (2011) maintains that relationships, rapport and trust must be established when conduction qualitative interviews. To engender the good relationship between the researcher and the participants, the researcher started the interview process by telling participants about himself and the purpose of the study. The interview began with background questions about the informants. This strategy sought to eliminate any anxiety participants were experiencing about the study prior to the interview and helped in collecting demographic data about the informants. The researcher conducted the interviews in a relaxed and conversational manner to encourage genuine participation.

According to Patton (1980), the purpose of interviewing is to find out what is in and on someone else’s mind. We interview people to find out from them those things we can’t observe” (p.196). To achieve this, the researcher showed personal interest in each of the participants through active listening and avoided any judgmental behaviour sensitive to the informants and which could prevent them from saying what is on their minds.

4.1.5 Validity and Reliability

The notion of validity and reliability in qualitative research is different compared to quantitative studies. Qualitative validity refers to the accuracy and truthfulness of research findings (Creswell, 2013; Silverman, 2000). Validity in qualitative research seeks to ensure the accuracy of the findings from the viewpoint of the researcher, the interviewees, and/or the readers of the report (Creswell, 2013; Creswell & Miller, 2000). It, therefore, determines the extent to which data collected reflect the true state of social
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reality. Quantitative validity, on the other hand, refers to the extent to which a data collection instrument measures what it is purported to measure (Punch, 2013). This suggests that in quantitative studies, researchers generally assess validity through the inferences drawn from data evidenced in the measurement instrument.

Reliability in a quantitative sense refers to the ability of a measurement instrument to record the same results conditions in the subsequent administration of the instrument (Fields, 2013). Thus, to be reliable, scores of a measure must be interpreted consistently across various situations. On the contrary, “qualitative reliability indicates that the researcher's approach is consistent across different researchers and different projects” (Gibbs, 2007 as cited in Creswell, 2013). That is, reliability is about whether participants will alter their responses during an interview or they will alter their responses when different people interview them. To be reliable, qualitative research must minimize researcher bias.

To achieve validity for qualitative research, the study used two major validity strategies. These include a triangulation of data sources and member checking (Bryman, 2007; Creswell, 2013). As indicated earlier, the study gathered data through personal interviews and focus group discussions. Using the triangulation strategy, evidence for justifying the existence of a theme came from these different sources of information. In the case of the member checking strategy, there was a second interview session where the researcher reported the analyzed data to the participant. This allowed the researcher to determine the accuracy of the findings from the perspective of the participants.
To establish the reliability of the qualitative study, the researcher ensured accurate documentation and reporting of the procedures of the case study. This strategy is consistent with suggestions by Gibbs (2007), Opare-Henaku (2006) and Yin (2009) who maintain that qualitative research requires accurate reporting and proper documentation of events. In keeping with this, the interview sessions with the farmers were audiotaped with their permission to capture exactly what the participants said. To ensure the accuracy of the data collected, the researcher went back to the participants after data analysis to verify the authenticity of the findings. Besides, a detailed case study protocol and database was set up, so that others can follow the procedures. In addition, the researcher crosschecked codes independently generated by the research assistants to ensure inter-coder agreement (Creswell, 2013; Guest et al., 2012; Miles & Huberman, 1994).

4.1.6 Data Analysis

Generally, data analysis in qualitative studies is not separate from the data collection. According to Creswell (2013), the qualitative analysis proceeds side-by-side with data collection. Thus, the study creates this section just for the purpose of clear and logical presentation of the thesis rather than a separation of data collection and analysis procedures.

Qualitative data are textually rich and dense. The analyses focus not on all the information but on the aspects of the data relevant to the study (Guest, et al., 2012). The researcher aggregates qualitative data into a few numbers (five to seven) of themes (Creswell, 2013). Qualitative data analysis typically involves organizing persons, things and events according to their shared characteristics (Schatzman & Strauss, 1973). To do this, the
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analysis of the qualitative data proceeded according to the prescriptions of Creswell (2013).

Notwithstanding the above recommendations, the research adopted the thematic analysis technique (Braun & Clarke, 2008). Thematic analysis is a qualitative method of data analysis that seeks to identify, analyze and report themes or patterns within data. It reduces, organizes and describes qualitative research data in a rich detail (Braun & Clarke, 2008). According to Taylor and Ussher (2001), thematic analysis requires the active involvement of the researcher in order to discover the overriding themes inherent in the data since anything short of this could undermine the purpose of the research. Thematic analysis like other methods of analysis seeks to explain themes within qualitative data. Thus thematic analysis pays exceptional attention to the manner in which people meaningfully define their experiences as well as how the world at large shapes those meanings, taking into account the focus of the data and the constraints imposed by reality.

The data was organized and prepared for analysis through transcription, sorting and arranging of audio-recorded interviews and field notes. This allowed the researcher to appreciate the nature and meaning of the entire data. For instance, the researcher has to know what the smallholder farmers are saying about their farming motivations and beliefs about improved agricultural innovations. Thus, the researcher formed an impression concerning the general depth, credibility and relevance of the information gathered.

Next, all the data was coded. Coding is the process of organizing the data into categories (or text or image segments) and labelling a category in the margins (Creswell, 2013;
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Rallis & Rossman, 2012). There are two types of codes namely, emerging and predetermined codes (Creswell, 2013). Emerging codes refer to codes used to label text segments that emerge from the actual language of participants. Nevertheless, predetermined codes are external labels used by the researcher to fit the data. The study used both emerging and predetermined codes during the coding stage of the qualitative analysis.

The coding proceeded by highlighting potential patterns within the data together with some surrounding data in order to keep the context in which the data were presented. Next, all the initial codes generated were collated together with their supporting extracts. The subsequent phase of the analysis was the search for themes relating to farming motivation and beliefs about agricultural innovations. In doing this, the researcher sorted out all the coded data through constant comparison by looking out for the patterns and similarities among the codes to generate the themes (Charmaz, 2006; Miles & Huberman, 1994). The researcher clustered themes that were similar together. Following from this, the researcher labelled the themes generated in the context of the data collected. Moreover, the researcher showed the relationships between the themes at different levels. Thus, the researcher organized the texts from the various interviews according to the similarity of themes to create main and sub-themes, with the view of indicating shared meanings.

To the extent that the researcher aggregated the responses into themes with the aim of suggesting shared meanings, the researcher would inevitably claim some patterns in the analytic process. However, aggregation of common patterns/themes is not a deviation from the context of the data because the patterns and themes draw strength from the data
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(Cassell & Symon, 2004; Cassell, Close, Duberly & Johnson, 2000). Therefore, the patterns in the responses, themes and categories came out of the context of the participants’ responses, which reflected their farming context and experiences.

The themes reflected multiple perspectives from the farmers, supported with different quotes from the data. The researcher interpreted the results with reference to theory, literature and in the context of farming and smallholder farmers. For the sake of fairness, the researcher represented all participants with at least one interview extract to ensure fair representation. The study used the interview extracts as instances to indicate and validate the existence of a theme/sub-theme.

4.2 Findings of the Study
The qualitative study addressed two main objectives. First, to identify the farming motivations of smallholder farmers in northern Ghana. Second, to explore the beliefs of smallholders’ farmers about the three improved agricultural innovations (row planting, improved seeds and fertilizer applications). The study presents the findings in four major sections. The first section captures the meaning of improved agricultural innovations from the perspective of the smallholder farmers. Next, the study presents findings on the farming motivations of the smallholder farmers. The chapter continues, by showing the relevant beliefs of smallholder farmers about the improved agricultural innovations. The last section discusses the findings in relations to extant literature.

For easy identification of sources of interview quotes, the researcher used certain codes to label the responses. The initials ‘LF’ meaning “Lead Farmer” is used together with figures ranging from 1 to 4 to represent participants’ responses. For example, ‘LF 1’
4.2.1 Meaning of Improved Agricultural Innovations

The smallholder farmers indicated their understanding of improved agricultural innovations by suggesting that they are modern ways of farming. According to the farmers, the modern way of farming does not require the cultivation of large farmlands to increase yield rather, with the right practice farmers can increase yields with relatively small farm size. Thus, smallholder farmers evaluate improved agricultural innovations as superior to the traditional ways of farming. A Lead farmer with 20 years of farming experience expressed his views as:

…the traditional way of farming was that you must do more acres to get more yields and it is not like that again and that is why I am happy. You can do one acre and get more yields than someone doing five acres gets. Like if someone plants in rows, plant with these improved seeds and apply the right quantity of fertilizer and the plants are like that, (very attractive and good) you will be very happy and when you come home in the evening, you can sleep well (LF 1).

The narrative of the lead farmer suggests the extent of appreciation some farmers have about improved agricultural innovations with respect to its place in modern agriculture and its overall benefits. They even believe that adopting improved agricultural innovations affects their quality of work life, which can go a long way to improve their general life satisfaction.

Smallholder farmers identify the key components of improved agricultural innovations. These are row planting, improved seeds, fertilizer and agrochemicals applications. While these are separate agricultural practices, the farmers, however, perceive them as
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mutually inclusive and complementary innovations. Specifically, the smallholder farmers view row planting, improved seeds and the use of fertilizers as improved agricultural innovations, which are inseparable. Thus, the farmers are of the view that to maximise the benefits of improved agricultural innovations, these three practices (row planting, improved seeds and fertilizers) must go together. Another lead farmer with 25 years of experience eloquently narrated:

...I mentioned three, row planting, improved seed and fertilizer application. These three must go together. If you do one or two and leaving the other, I think you will not get the desired results that you are looking for. So any farmer who thinks he will select the one, which will suit him, he is just wasting his time. So, I do all the three that will give me the yield that I am expecting from one acre. (LF 3)

Among all the good agronomic practices, the above participant emphasized the three keys ones, which are responsible for increasing crop yields. Contrary to the views that some farmers may hold, fertilizer application alone is insufficient to stimulate crop yields. Rather it is the combination of row planting and improved seeds, which ensures good germination and bounty harvest. Another lead farmer (22 years of experience) corroborated the view shared the previous participants as follows.

...when you use the row planting and you apply the right quantity of fertilizer to the field you get more yields as compared to the traditional way of planting. Even if you apply the quantity... (That is) three bags of fertilizer to 1 acre you cannot get the yields that you would have to get from the use of row planting. (LF 2)

Most of the farmers who have adopted improved agricultural innovations in their prescribed form have reaped desired benefits in terms of getting more yield to feed their families and ensuring household food security. The first participant concluded his views about improved agricultural innovations as:

...there is now an abundance of food in the house. The time that we were not using row planting, improved seeds and fertilizer the maize that we will get from the farm we will not eat up to four months but right now we will eat it till we get new crops or grains again. Previously when we were not using role planting and the
The views of the above participant come from a careful analysis of yields gained from traditional farming methods as against using improved agricultural innovations. The farmers have observed how long it takes to feed on food acquired from the adoption of improved agricultural innovations compared to the food obtained from the use of traditional farming methods. Farmers’ observation about row planting, improved seeds and fertilizer application as complementary innovations justify the focus of the current study. In this study, improved agricultural innovation refers to the adoption of row planting, improved seeds and fertilizer. The study’s definition of improved agricultural innovations is very much in harmony with the understanding of the smallholder farmers. In conclusion, the smallholder farmers indicated their understanding of improved agricultural innovations as modern agricultural practices mainly involving row planting, improved seeds and the application of fertilizer that ensures yield increase when used jointly.

4.2.2 Framing Motivations of Smallholder Farmers

Three major themes emerged from the analysis, which indicates the farming motives of the farmers. These themes are household survival, excess income generation and cultural heritage. The following sections present the themes with their supporting subthemes and interview extracts.

4.2.2.1 Farming to Ensure Household Survival

Household survival in this context refers to the smallholder farmers’ desired to ensure enough food at home from his/her farming activities. In this regard, the smallholder
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farmer prefers to store foodstuffs harvested from the farm at home for the primary purpose of consumption. This idea was dominant in the all-male focus group discussion.

...our main purpose is to feed the family and take care of them but you know farming these days, we also take it as a business and every businessman have to eat before you can do anything else that is why we say that our primary responsibility is to feed the family. (FG 1).

The second lead farmer in the personal interview with the researcher stressed this theme.

... Farming is a good occupation but people do not see it because there is a saying that, we must eat to live and where do we get our food? From farming. I do not think if we do not farm well we can get enough food to eat and the good food you eat, the healthy you are and that makes you very healthy. (LF 2)

The above narratives clearly espouse “we live to work” philosophy in that, the farmers main motive is survival before anything else. The findings suggest that even though smallholder farmers may have several reasons for taking farming as an occupation, they see the need to produce for household consumption as critical. The study generated two subthemes in support of the household food security theme. These are farming to feed family and farming to support other family needs. The argument is that ensuring household survival is not just about providing food but also addressing pertinent needs in the family.

**Farming to Feed the Family**

Analyses of the participants’ interview reveal that smallholder farmers’ main priority for farming is to feed their households. The theme ‘farming to feed the family’ suggests that the smallholder farmers plant for food and not necessarily for commercial purposes. The ability of smallholder farmers to meet the family food supply has a link with their satisfaction and happiness in life. To illustrate, this is what the farmers said in one of the focus group discussions:
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...we have a passion for it but the only time that we are not happy is when we don’t get good yield...like if there is drought or floods, we will be thinking of how to feed the family. So that is the only time that we are not happy. (FG 1)

Another comment from the male discussion indicates how the farmers feel when there is no food to feed their family:

We are proud to be farmers. The only time we feel discouraged is when we do not get good yield because we begin to think of how to feed my family since we don’t have any hope. So our main motivation for farming is to feed our family first before anything else. (FG 1)

The female farmers corroborated the joy to have sufficient food to feed the family. When there is no food in the house, they need to buy some from the market, which comes with some financial commitments. The female farmers are happy because they do not only go to the market looking for foodstuffs to buy but save money to care for other pertinent issues in the family. They are therefore happy to farm to ensure enough food supply in the family. The statements below illustrate this point.

...we are happy with what we are doing because we no more go to the market to buy anything like maize to come and feed the family again. (FG 2)

...We enjoy the farming work because we no more go to the market to buy foodstuffs since we now produce them by ourselves and save something. (FG 2)

The findings appear to suggest that crops produced by the men are the ones that are kept for home consumption and what is harvested by the female farmers are used partly to supplement the food at home if not enough and the remaining are sold for income. The household uses the income generated to address issues such as paying medical bills and school fees. It is important to note that, typically the male farmers produce more on a relatively larger scale than the females. This stresses the importance to ensure food security among farming household in the region under study.

...My husband is a farmer and my motivation is that when I get my farm produce, after using some to feed the family the leftover or the rest we will sell it to support the children’s school fees and medical bills. (FG 2)
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...Our husbands are mainly farmers and we have seen that what they are doing (farming) is not enough to cater for the children’s education and other family needs. So that is why we have also joined them. So when we get our farm produce we can sell and support our husbands. Our husbands will use theirs as food in the house and ours (women) will sell as cash to support the children’s school. (FG 2)

The above expressions do not suggest that the farmers are not interested in generating income for themselves. The findings point to the view that they are open to other off-farm jobs that can serve as a source of income but are more interested in their core mandate which to have enough food at home. The comments below suggest this perception.

...if I get a part-time job to add to the farming, I will do it…. buying foodstuffs, I just hate it. So I like to have my foodstuffs and where I will be getting cash to supplement the food that I have. (LF1)

...in addition, I have found that all the learned people, if you are a doctor, a nurse, a teacher, what have you and you are working, when it’s time for a break you have to go and eat, and so that is why I am a farmer. I will do the farm practice to feed the family and the leftover I will sell to the doctors and the other people who are workers. (FG 1)

...they have experience in the farming, if you know something and you do not do it you cannot feed your family, you cannot take care of your health, other needs in the world, so they cannot stop farming. (FG 1)

In general, all the above interview responses go to suggest that smallholder farmers are primarily motivated to feed their families. They are also open to off-farm jobs that can be an alternative source of income generation. Typically, the male smallholder farmers own relatively larger farm sizes and produce more than females. However, what is interesting about this farming motivation is that the foodstuffs produced by the male farmers serve as food for the family and those by the female farmers sold to cater for other family needs. To ensure household survival, farmers must address other needs of the household. Therefore, smallholder farmers are motivated to farm with the intention to raise a little income to support the family in this regard.
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Farming to Support Other Family Needs

The analysis of the qualitative data suggests that as part of the need to ensure household survival by feeding the family, smallholder farmers are also motivated to farming to gain some income in order to provide for other needs in the household. These other needs may include school fees, health bills, and community as well as extended family dues. Regarding this theme, the following are the narratives shared by some female participants in the group discussion:

...again, many of us women are into groundnut cake processing but the market is not active. So I have decided to go into farming to get little money to help my husband take care of the needs of the family. (FG 2).

...Our husbands are mainly farmers and we have seen that what they are doing (farming) is not enough to cater for the children’s education and other family needs. So that is why we have also joined them. So when we get our farm produce we can sell and support our husbands. Our husbands will use theirs as food in the house and ours (women) will sell as cash to support the children’s school. (FG 2)

The result confirms that, apart from growing food to feed the family through farming, smallholder farmers can general some income by selling surplus foodstuffs from the farm to keep the household alive. The examples below encapsulate these thoughts:

...they have experience in the farming, if you know something and you do not do it you cannot feed your family, you cannot take care of your health, other needs in the world, so they cannot stop farming. (FG 1)

...My husband is a farmer and my motivation is that when I get my farm produce, after using some to feed the family the leftover or the rest we will sell it to support the children’s school fees and medical bills. (FG 2)

The above expressions suggest that other needs such as health, children’s education are also important to the smallholder farmers. The farmers find delight and satisfaction in their ability to meet the pressing needs of the household. In terms of supporting other needs of the family, the female farmers within the household often take the lead. From
the interview, it appears that the female farmers engage in farming to raise some income to deal with these family needs.

Concluding from the above comments made by the smallholder farmers, the motivation to ensure household survival involves farming to feed the family and farming to support other family needs. There is a division of labour of a sort, in that the male farmers in the household farm for home consumption whereas the female's farm to generate a little income to help deal with other family needs.

4.2.2.2 Farming to Generate Excess Income

Another major motivation for farming that emerged from the data is that farmers in northern Ghana farmed to generate income. The “farming to generate income” motivation in this context refers to the desire to accumulate excess income and wealth to ensure a high standard of living. For example, saving from farming proceeds to acquire capital-intensive agricultural equipment (e.g. tractors, combine harvesters etc.), buy personal vehicles and build modern accommodations.

...farming is the leading occupation now so that even motivate us to engage in farming. You can build a beautiful house from farming and buy cars...the richest man in our district here is even a farmer, we know him. He is a big-time farmer. He has buildings around in the capital here, Tamale. He has story buildings here through farming. (LF 1 & FG 2)

...farming is business and every businessman would have to enjoy the fruitage of his work like buying big tractors and becoming rich. You see, you get many properties like car and houses through farming work. (FG 2)

Two subthemes underpin the motivation to generate wealth. These are farming as a business venture or as a source of employment and farming to feed non-farmers. The argument for this motivation is that smallholder farmers take to farming to make money knowing very well that the practice of farming is an appropriate avenue for wealth
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creation since there are more people out there who are not farming and need farm produce to survive. Thus, the perceived market for agricultural produce makes the business of farming viable to smallholder farmers.

Farming is a Source of Employment

Smallholder farmers say they are into farming because they see it as a respectable source of employment and a business venture. They expressed their view as:

...farming apart from providing you food also provide an avenue for business and because people respect farmers and view farming as a noble profession...farming is an interesting job. I will say that it is a good business venture. Doing agriculture is very interesting. (FG 1 & FG 2)

First I am into farming because I want to be self-sufficient, second is to get the income and to improve my livelihood....also the earnings from the petty trading we do are not enough to cater for our family that is why we have decided to enter into farming to make to improve our lives. (FG 2 & LF 4)

According to the farmers, farming provides a form of employment that is stress-free as compared to formal work employment. They do not have any structured system of reporting and work at their own pace. Thus, smallholder farmers perceive the farming context to offer a friendly psychosocial work environment that is good for their wellbeing. The statements below echoes these views.

...when you are into farming you are self-employed. Any day that you feel like not going to the farm you will not go. And if you get your proceeds no one will say that I’m taxing you this thing. You will have to give it out as your own wish not by anybody forcing you and they will not punish you for not going to farm on a particular day. I think that is the reason why many people will go into farming. (LF 4)

Smallholder farmers view farming as ethically and morally acceptable apart from being a source of viable and stress-free employment. The farmers believe that the farming context does not provide the opportunity to be corrupt rather encourage ‘clean’ work behaviour. To appreciate the ethics of farming, they compare farmers with politicians...
who the community largely perceive as corrupt. These are comments to show that farming is ‘clean’.

*I have chosen to be a farmer because I know farming is a clean occupation because farming work is not like that of a politician where you engage in corruption and others. How do you corrupt in your farming? The tractor will come and plough your land and you will pay him then you will work on your farm then you will get your harvest, store your produce and then sell for income that is it. Therefore, farming is good especially growing trees together with cropping is very good and that is what some of us do.* (LF3)

All the above comments from the interviews suggest that smallholder farmers are motivated to generate income from farming because they see it as a sustainable employment opportunity which is stress-free and ethical. Smallholder farmers believe they can engage in farming as a business venture and maintain positive wellbeing.

**Farming to Feed Non-Farmers**

The findings show that smallholder farmers are into farming because they also perceive a huge prospect for agricultural products. The farmers find other professionals such as teachers, health professionals and lawyers who may lack the capacity to farm but must survive on foodstuffs from agriculture as their potential market. They have also observed that some of these non-farmers with little experience in farming even engage in farming. This goes to underscore the high need and demand for agricultural products by non-farmers. By farming with the view to supply the needs of non-farming professionals, smallholder farmers intend to generate income to enhance their personal standard of living. The following comments are in evidence of the above observations.

*...moreover, people working in other fields and doing other occupations need food to sustain them. We, therefore, engage in farming to be able to provide other people such as Doctors, Lawyers and the like with food and make money out of that...Looking at the world, farming is the leading business.* (FG 1)
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...in addition, I have found that all the learned people, if you are a doctor, a nurse, a teacher, what have you, and you are working, when it’s time for a break you have to go and eat, and so that is why I am a farmer. I will do the farm practice to feed the family and the leftover I will sell to the doctors and the other people who are workers to generate enough wealth. (LG 2)

It is evident from the responses above that the motivation to make money is subservient to the motivation to feed the family. For instance, the above farmer indicates that he is into farming first to feed his family and to sell to non-farmers to generate income. Besides, the farmers are excited to be engaged in an occupation that is humanitarian and generates income.

_Farming is a good occupation but people don’t see it because there is a saying that “we must eat to live”, and where do we get our food? From farming. I do not think if we do not farm well we can get enough food to eat and the good food you eat, the healthy you are and that makes you very healthy...Yes, we have a passion for it because we have not acquired any skills aside from the farming business. Therefore, we are proud to be farmers. (FG 1)_

Thus far, the above responses from the smallholder farmers have shown that two factors underscore the motivation to generate income to improve smallholder farmers’ standard of living. These factors are first, farming is a business venture and second, farming helps to provide food for non-farmers. Even though this motivation is a major one, it appears to come second to the motivation to ensure household survival.

4.2.2.3 Farming to Keep a Traditional Heritage

The last major farming motivation mentioned by the smallholder farmers is to keep a cultural heritage. Farming to keep a traditional heritage refers to the perception that farming is a rural occupation handed over to farmers by their parents and grandparents. Thus, smallholder farmers continue to farm to make farming a relevant community occupation out of respect for tradition. The focus group discussion brought out this point.
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...Also, we were born and trained in farming work to become farmers in the future. So, it's like we are continuing a tradition...I am a farmer because I was born into it. We have to farm because that is what we have in the community and that is what our fathers and great grandfathers have been doing. (FG 1)

Two factors are responsible for the motivation to keep farming as a tradition. These are ‘born to be a farmer’ and ‘farming belongs to the community’. This goes to argue that smallholder farmers are motivated to keep the tradition of farming because they are born to be farmers and they belong to a farming community. This motivation is cultivated through the socialization process in that children accompany their parents to the farm and made to believe that they will eventually become farmers.

**Born to Be a Farmer**

Analysis of the interviews shows that smallholder farmers are motivated to keep the farming tradition because they are born and trained as framers. Smallholder farmers believe they have very good work-related experience because they have acquired the requisite training right from infancy. The following are some of the responses from the smallholder farmers in support of this theme.

*I was born into farming. So that is why I am a farmer and if you do not have any knowledge for doing something else, you have to concentrate, more on what you have experience in, that is why I am a farmer. (LF 4)*

*We were trained in the farming, so as a teacher when you are trained to be a teacher you have to concentrate on that and if we do not concentrate on the farming, we are intentionally inviting poverty into the house and we do not want that. (FG 1)*

The above expressions from the farmers show that the idea of ‘born to be a farmer’ encourages them to do what they know how to do best. In order words, smallholder farmers have very little intention to abandon their natural occupation to farm and venture into other forms of work as their main occupation. They are therefore passionate about
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farming and are satisfied with their work as farmers. The narrative below indicates the
farmers’ passion for farming.

We have a passion for it (farming) because we cannot do any other work apart
from farming so I am proud to be a farmer. This is what we are trained to do...Yes,
we have a passion for it because we have not acquired any skills aside from the
farming business. So, we are proud to be farmers. The only time we feel
discouraged is when we do not get good yield because we begin to think of how
to feed our family since we do not have any hope. (FG 1)

All the above expressions go to suggest that, smallholder farmers in northern Ghana are
farming because they believe farming comes to them naturally and they have the requisite
experience to do so. Even though society socializes them to accept farming as their
number one occupation, they are passionate.

Farming Belongs to the Community

The responses from the participants revealed that smallholder farmers are motivated to
keep the farming tradition because they perceive it to belong to the community.

In my community, the majority of people in the community are farmers, and they
see farming as a business nowadays. Especially with the intervention of
ADVANCE, people have seen that farming is a business and not only to be self-
sufficient but also to get income. (LF 2)

In this community, everybody is a farmer, about 90% of us. Right from childhood
because even if you are going to school, Saturdays, Sundays you have to help your
father in the farm. (LF 1)

Majority of the community members are farmers as indicated by the expressions above.
These farmers perceive farming as a rural occupation that society must perpetuate. The
strong reverence for established and renowned farmers in the community fuel this
perception. The following expression provides evidence in this regard.

...much respected, the richest man in our district here is even a farmer and a big-
time farmer. He has buildings around in the capital here, tamale. He has stories
buildings here through farming. Through farming, he was able to work with some
Thus far, the two factors underpinning the motivation for farming to keep a cultural heritage are “born to be a farmer” and “farming belongs to the rural community”. Smallholder farmers are more likely to continue farming so long as they dwell in the community and observe the lives of successful farmers.

In sum, smallholder farmers in northern Ghana explain that their farming motivation emanates from three main reasons. First, to ensure household survival. Second, to generate income and lastly, to keep a cultural heritage. This suggests that the motives for farming among smallholder farmers in northern Ghana are more social than economic.

### 4.2.3 Salient Beliefs about Improved Agricultural Innovations

The second objective of the current study was to explore the key beliefs of smallholders’ farmers about the three improved agricultural innovations (row planting, improved seeds and fertilizer). According to the Theory of Planned Behavior (Ajzen, 1991), beliefs influence an individual’s attitude, subjective norms and perceived behavioural control which in turn influence his/her intentions and behaviour. These beliefs are behavioural, normative and control beliefs, which represent the main themes under this section. The study generated several beliefs about improved agricultural innovations from the interview responses that correspond to the salient beliefs proposed in the TPB.
Behavioral beliefs in this context refer to the possible outcomes of adopting improved agricultural innovations. The study identified seven (7) behavioral beliefs about the improved innovations. These include, *increase yield, attractive produce, time-consuming, labour intensive, increase farm budgets, makes farmers lazy and affects crop quality.*

**Increase Crop Yield**

Majority of the smallholder farmers are of the view that adopting row planting, improved seeds and fertilizer enhances soil fertility and boosts their crop production. The farmers form this belief based on the quantitative output of the three agricultural technologies relative to using traditional planting methods. These are some of the responses from the interviews and focus group discussions to support this belief.

*One advantage is the yield. Because previously, when we were not planting in rows, the most yield we could make was 6 bags but currently due to the row planting, improve seeds and fertilizer, we are able to make about 10 to 12 bags from an acre.* (LF 1)

*I was doing 3 acres and that time I could only get 15 bags from those 3 acres but right now I am doing two acres and I can 20 to 22 bags from that 2 acres. So that is one benefit from the row planting.* (FG 1)

*The time we were not planting with improved seeds and role planting, we were just using 1 bag of fertilizer to deceive (that’s the term farmers use) 1-acre of land and we expect to get more yield. However, we do not get the expected yield but now we use 3 bags of fertilizer on 1-acre of land and we get more yield as compared to previous times.* (FG 2)

Increase in yields helps farmers to satisfy their desire to produce enough for household consumption. It also provides surplus food that they can sell for income. Thus, when the farmers improve their yield it makes them happy because they are able to achieve two of their major motivations for farming.
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Another advantage is that when you plant, it germinates, and you the farmer gets to the farm and you see the plants you know that if everything went well you could feed your family and even get some to sell. But the grains you see that when it germinates, either they will be standing or they will be falling and some parts of it will be dying. That why they now get in using improved seeds and fertilizer. (FG 2)

The improved seeds too will help you get good yields because if you use the gains for a number of years, more than five years you will still be using that same thing, the yield will be going down. Like the first year you used this type of seed, you get 10 bags, the following year it will reduce that is how it will go down until the time that you will not even get 5 bags per acre. But buying improved seeds you get more yield than you expected because last year we were introduced to pioneer seeds and we were told that at least one could get 25 bags from an acre. (FG 1)

The overwhelming yield evidence of adopting row planting, improved seeds and fertilizers create a positive attitude towards these innovations. The smallholder farmers observed these yield improvements either from demonstration farms established by agricultural extension officers or through their own experiments on their respective farms. For instance,

From the demonstrations, we did quarter an acre and we had four bags so that shows that if one does an acre and does things well like you do row planting, use improved seeds and apply fertilizer, even if you will not get the 25, you will get at least 18 bags. (FG 1)

At times, you will start planting and see that you have been beaten by time and you decide to plant some portions with planting anyhow. At the time of harvesting, you find that the row planting you get more yield than that other part that you just plant anyhow. (FG 2)

The above narratives go to affirm the belief that row planting, improved seed and fertilizer application are very advantageous to smallholder farmers because it helps to enhance their capacity to feed their families and generate additional income. For example, one of the male smallholder farmers indicated:

...there is now an abundance of food in the house but previously when we were not using role planting, we could not feed on the maize we get from the farm for about 4 months. Now we are able to feed on it until we get another grain. (FG 1)
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Thus, the smallholder farmers perceive improved agricultural innovations namely; row planting, improved seeds and fertilizer applications as yield-increasing technologies. The study found this belief to resonate with the majority of the farmers and tend to influence their attitude towards the three agricultural innovations under investigation.

Attractive Farm and Produce

The smallholder farmers believe that using the three improved agricultural innovations makes their farms and products look attractive. The farms are less crowded with row planting. In addition, the seeds and fertilizers allow for good crop germination.

When you plant anyhow, it could be over-crowded or over-spacing and getting yields the starting point will be getting good plants on the field. If you do not get the germination right, I think you will not get a good yield. The row planting will help you get the standard crops population a farmer will need on a piece of an acre or piece of land at a particular time...when you plant both the grains and the seeds when it germinates you see very different and the seeds are very good because you will see that the germination some of the plants will germinate and die the seeds that you bought and plant, the plants you will just see all, germination rate ok and they will not die again. (FG 1)

...the beauty of the field. Because when you plant anyhow, and you get to the farm, you do not see rows and you don’t see the beauty of the crops. But the planting in rows, you see the beauty of it....During the germination period, you could notice that germination from the improved seeds are very stronger than those from our own grains because plants that germinate from our grains either than the improved seeds do die within some short time. (FG 2)

The above comments by the smallholder farmers reveal that adopting the three innovation makes the crops stronger and keeps them alive compared to using other traditional farming practices. According to the farmers, improved agricultural innovations also contribute to the aesthetic features of their farms. They have also observed that the more attractive the farm produce the more its market value increase. Besides, the buyers prefer to buy grains produced using improved varieties than those produced from farmer-saved seeds. The following expressions are in evidence of this observation.
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The way you plant your seeds in lines (row planting) is very nice and with that, if you have your pictures and you WhatsApp it to anyone, maybe agencies/companies that are maybe buying those products, they may have an interest. It attracts investors to come...In addition, in terms of purchase, people prefer buying the varieties of the improved seeds than those from our own grains. (FG1)

Accessibility to the market is not difficult for us because we have improved our technology people are in need of our produce. They do not have a doubt with that. Because even if they see the product physically they know that, they are good and healthy. (LF 4)

Thus far, the above responses from the smallholder farmers suggest that the attractiveness of the farm and its produce owing to the adoption of row planting, improved seeds and fertilizers are important to them. The belief that these improved agricultural technologies ensure attractive farm produce, positively influence smallholder farmers’ attitude toward adopting these improved agricultural innovations.

Time Consuming and Labour Intensive

The smallholder farmers said they are less likely to adopt improved agricultural innovations because they believe it is time-consuming and demands more labour on the farm. The farmers often depend on their household membership to assist them.

...The role planting we need more hands and if you are single or two persons in your house you will use more days to do the planting leaving other things. So that is the disadvantage. (FG 2)

...you know the row planting is time-consuming. So the number of days you use to do the planting if he knows that the child is going to pay school fees or chop money she would rather use that to go the market to get something to give to the child. (LF 3)

Apart from the time and labour demand of the three innovations, smallholder farmers also said they consume energy. This suggests that it is tiring trying to apply especially row planting and fertilizers. This according to the farmers seriously challenge their efforts to adopt the innovations because it restricts them from expanding their farmlands.
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It requires a lot of energy in applying the fertilizers making the work very difficult. We do not have machines which could make the work easier......It consumes a lot of energy. You have to pull the rope, do the dibbling and the planting. If there could have been something to plough the field for you like making the rows for you, your responsibility will just be to come and do the planting. That will have been very good. (FG 2)

It takes a lot of energy especially with the row planting because you need to have some people to pull the rope and others will be dibbling. And getting more hands you need more money to plant an acre. I think that is the disadvantage we have seen with the row planting. (FG 1)

In view of the labour intensity, most of the smallholder farmers resort to the assistance of their school-going children. According to them, when school is in session it frustrates their efforts because they do not have money to hire the services of labourers to assist them on their farms.

...when the time comes for planting and there are school days, it very difficult to do the planting. It will even let someone loose the planting period because you don’t have children to go and do the planting. So we are still advocating that if we could get planters and other things to help us. (LF 1)

...when it rains and school is still in progress you will not get children to go and do the planting. So that is one disadvantage for the row planting...It needs more people and if you don’t have more people in your house or you don’t have the money to hire labour to help you it’s another problem. (FG 1)

The foregoing responses from the farmers suggest that adopting improved agricultural innovations “is time-consuming” and “it needs more people” on the farm. This belief primarily relates to the adoption of row planting compared to fertilizer application and use of improved seeds. This difficulty creates a negative attitude towards the three innovations and influences the rate of innovation adoption.

Increases Farm Budget

Related to the disadvantage of time consumption and the labour intensity is an increase in farm budget. Smallholder farmers say adopting all three innovations particularly
improved seeds and fertilizers adds to the cost of farming. This arises in the form of hiring more labour and buying sufficient quantity of fertilizer for the field as well as the cost of high-grade seeds. What creates this difficulty is that most of the farmers are not used to making huge financial investments on their farms. Thus, the additional cost associated with row planting tends to discourage adoption of the innovation. On the need for more fertilizers, the following are of the remarks made by some of the smallholder farmers.

Also, row planting requires a lot of fertilizer. Therefore, our inability to provide the fertilizer sometimes diminish our interest in the row planting technology. (FG 1)

Two disadvantages. One is the row planting needs a lot of fertilizer. When you plant anyhow it doesn’t need much fertilizer as compared to planting in rows. Someone would like to plant in a row but getting the fertilizer would scare him from doing that. (FG 2)

According to the farmers, the cost of improved seeds remains a major disadvantage or challenge for adoption. They often opt for the farmer saved seeds due to their inability to meet the cost required of the seeds. For example:

Just last year I did some cost analysis and found out that buying seeds for an acre, will be higher than selling one bag of maize in the market. So I thinking that the cost is a major disadvantage. (FG 1)

The comment of the above smallholder farmer suggests that they find a seed variety costing as much as a bag or sack of maize in the market to be expensive and are not willing to invest. The cost of these innovations, when perceived to be high, prevents smallholder farmers from adoption irrespective of the positive observations they have made about the innovations. For instance, an innovation such as improved seeds may increase yield and produce attractive produce but if farmers perceive the cost to be high, they will not adopt. The farmers explained:

...a farmer will notice that this variety of seeds is doing well but the cost will let him not use it because he cannot go and buy. So one disadvantage is the cost of the seeds...The major disadvantage is the cost because as farmers there are times...
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that you will not have the money and that will be the time for planting so you will not have the choice to use your grains. So the cost of the seeds is a big challenge. (FG 1)

Some of the seeds are costly so it’s capital intensive. So these are the two things have seen to be...if you buy the seeds, those who will help you do the dibbling and the planting is easier, it doesn’t take a lot of time you only need to get you money to go and buy...One disadvantage is the cost involved in buying the seed. At times, we even forget about buying the seeds or saving money to buy the seed because we are used to taking our grains to the farm and the cost is one factor. (FG 2)

In conclusion, it appears that smallholder farmers may have a negative attitude towards row planting, improved seeds and fertilizer application because of the likelihood to inflate their budget. The farmers indicated that to adopt row planting, you need more fertilizer and you have to use improved seeds as well to achieve the complementary benefits of the three innovations. However, with their poor financial position, they are unable to adopt these innovations. This is how one of the farmers summarized the belief that these innovations require an increase in their farming budget.

...the cost, the cost, because at the time of planting farmers we have many things to buy. You have to buy the seed, the fertilizer and chemicals/weedicides to do your spraying and if you put all these things together it will be so much burden on the farmer. So if they (seed dealer) could bring the cost down or government should start distributing seeds to farmers that will be nice. (SHF 8)

Makes Farmers Lazy

Some of the farmers indicated that adopting improved innovations also make farmers lose their sense of urgency. The participants said that the farmers tend to procrastinate and postpone work on the farm believing that all is well once modern innovations are applied. For some smallholder farmers, the negative work behaviour of other farmers because of applying modern innovations discourage them from its adoption particularly the spraying of agrochemicals including the application of fertilizers. Some of the participants captured this belief as follows:
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...and through that (agricultural innovations) people get reluctant and after spraying their farms maybe for some weeks they don’t go to their farm. Because they know the weeds will go off and not realising that if you don’t visit your farm anything can happen to your crops. so people feel lazy, because of improved technologies but not much...he goes and spray his farm and then come home and sit for 2/3 weeks and have not been to the farm because he knows there will not be grass to disturb the crops so is like a disadvantage. (FG 1)

Even though this belief about the improved agricultural innovations may be minor and erroneous, it could be influential in forming a negative attitude about the innovations among smallholder farmers.

Affect Crop Quality

Farmers believe that improved agricultural innovations especially the use of fertilizers and other agrochemicals impacts negatively on crop quality. The farmers believe the chemicals when sprayed on the farms get to the food and cause diseases. This suggests that applying chemical innovations is not acceptable to some smallholder farmers. Two (2) of the experienced smallholder farmers made the observations below.

...The chemicals can affect the food we eat. That is why we can see that we have so many diseases. (LF 3)

...you know, everything there is the good side and the bad side...these days people all over are spraying chemicals. When you want to talk, they say improved technology. Our forefathers will say they were not used to chemicals but these days people are spraying chemicals all over and when you spray it on your crops definitely it gets to the food you are eating, that is a disadvantage to me. (LF 1)

The belief that improved agricultural innovations affect crop quality is a minority position but seems to be the reality of some smallholder farmers. Their decision to adopt or not to adopt particularly fertilizers and some genetically engineered seeds could influence their attitude towards the innovations.
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In conclusion, the study found seven (7) behavioural beliefs that smallholder farmers hold about row planting, improved seeds and fertilizer application. Two (2) of the beliefs are positive whiles the remaining five (5) are negative. The positive beliefs about the improved agricultural innovations are *greater yield increase* and *attractive farm and crops*. The negative beliefs include *time-consuming, labour intensive, additional farm budget, decrease crop quality* and *encourages laziness*.

### 4.2.3.2 Normative Beliefs

Normative beliefs are significant others who encourages or discourages farmers from adopting improved agricultural innovations. The farmers are often motivated to comply with the desires of these salient referents. In this study, five (5) key referents were identified, namely, lead farmer, fellow farmers, ADVANCE, Nucleus farmer and family members.

**Lead Farmer and Fellow Farmers**

According to the smallholder farmers, they are encouraged and discouraged by their own colleague farmers and the lead farmer. The lead farmer is the focal person in the farming community and provides land for demonstrations by agricultural extension officers to teach other farmers about modern methods of farming. The lead farmer is required to ensure that his/her fellow farmers comply with modern agricultural techniques. Some of the lead farmers remark about the discouraging comments made by other farmers when their colleagues are making efforts to adopt improved agricultural innovations. The lead farmers commented:

...there are some people (farmers) like that, whenever they are doing the planting, other farmers passing by will say that they are lazy. “These maize crops you won’t just plant and you are just carrying all these ropes around, you are lazy”. In this case, I have to come in and encourage them to continue. (LF 3)
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The Farmers also encourage themselves. Sometimes they complain about their colleague farmers to me. They will say, “go and tell this person, the way I have seen his farm, he is not been working at the farm. So tell him, I have told him and he says I should go away it’s not my farm so you call him and tell him”. So there I will go to his house or I will wait for him to meet him at the field to see things for myself yourself. (LF 1)

Farmers, too there are other people who discourage them from using the ropes because anytime they are doing the planting other farmers will be passing by and saying that ‘look at the man, one acre you want to use 2 days to do the planting, you are lazy’. So that is the kind of things that they have been telling them but I have to make sure they continue with the good agronomic practices. (LF 2)

The above comments show that farmers consult the lead farmers when they feel discouraged or they experience doubt about farming technology. The lead farmers could be a source of discouragement when they are ill-informed about technology. Thus, the lead farmers are more likely to encourage the adoption of row planting, improved seeds and fertilizers when they have a positive attitude towards these innovations. On the other hand, the lead farmers are more likely to discourage the adoption of row planting, improved seeds, fertilizers when they have a negative attitude towards these innovations. Besides, the farmers themselves without the intervention of the lead farmer encourages or discourages each other. One lead farmer described some farmers as making great efforts to assist each other to adopt row planting.

I know two or three out-growers who are also doing great work. They help their other friend to do the row planting. They normally come together to encourage others to come so that they will do together. Like if they do 1 acre here is for this farmer. The next day they move to another farmer’s farm. So that’s how they are doing it. (LF 4)

According to some farmers, they are indirectly encouraged to use the innovations by observing their fellow farmers’ adoption behaviours and outcomes in respect of row planting, improved seeds and fertilizer applications.

...seeing a colleague farmer harvests his crops and getting yields we will also go for that improved seeds...When I see experienced farmers harvesting their crop
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and getting a good yield from row planting and improved seeds would move me to use improved seeds and plant rows. (FG 2)

...what also encourages me is that when I see a colleague farmer plant improved seeds and use fertilizer and the plants are nice, the way it has germinated is a factor that makes me want to use fertilizer and improved seeds. (LF 3)

The above expressions suggest that encouragements from lead farmers and farmers themselves influence the adoption of the three improved innovations.

ADVANCE and Agricultural Organizations

Another normative belief identified in the study is agricultural development organizations. These institutions either are in the community or send officers to the farmers to educate them on effective farming practices. Thus, agricultural development organizations provide technical and even logistical support to the farmers to improve their farming activities. Among the key institutions identified by the farmers to influence innovation adoptions are ADVANCE project and MoFA. This is how the farmers described these institutions.

... We have ADVANCE. They have been doing a lot to improve our farming. They have officers that go around to advise people to plant in rows, use improved seeds and apply fertilizers. We have MoFA they come. We have technical officers (TOs) from MoFA. Even in the dry season, they come to teach how to do your budgeting, plan, everything and in the farming season, they come and even goes to people’s farm to visit. (LF 3)

We know about ADVANCE who come to train us on good agronomic practices on several occasions. And for the demonstration farms that they do, we have field days so we know that doing this is good and doing this is bad and other things. (FG 2)

I know of ADVANCE project that encourages us or educates us to use the row planting. They encourage us and even on the planting day they will come and support us on the farm. (FG 1)
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The above comments show that mainly ADVANCE and MoFA visit the farmers to provide support for planning, budgeting and planting effectively. However, other organisations occasionally visit farms to encourage farmers to adopt agricultural innovations. One of the farmers described the intervention of other organizations as:

We also have other organizations who come here to train (one group of farmers). So they trained us on the row planting and the use of improved seeds. They also encourage us to do the right thing. (LF 4)

The study observed that the influence of ADVANCE is more profound as they are visible on the ground and offer regular technical assistance. They also assign supervisory duties to the lead farmers to ensure that the smallholder farmers apply the knowledge and skill acquired from the technical workshops and training they provide to them. It came out in the interview that there is a perceived pressure among the farmers to comply with the directives of ADVANCE. A lead farmer describes ADVANCE officials as insisting on doing the right thing.

...very much especially ADVANCE, always they will call you and ask you, at your demonstration farm have you done this with your farmers. If you tell lies, they may be at the farm and they are asking you. If you tell lies they will say, we are on your farm but we have not seen that work. So try to do it. Though they do not pressure us very much they always are on us physically to do things in the right way (LF 3)

Another lead farmer also remarked:

Even if you see them, coming to your community sometimes, I will be in town and I see them or they call me and see they are coming to the community. I will say I am not there and they say whom will they meet and I will call one of them of the farmers and say they should go and meet him he will organize them for them to talk to them. (LF 2)

From the above expressions, it is evident that ADVANCE, MoFA and other agricultural development organizations influence smallholder farmers’ decision to adopt improved innovations which are row planting, improved seeds and fertilizer.
Psychological determinants and innovation adoption

Nucleus Farmer and Other Opinion Leaders

The study also found nucleus farmers and other opinion leaders as normative beliefs who have the potential to influence innovation adoption among smallholder farmers. The nucleus farmer is a commercial farmer in the community or region who provides farming services such as ploughing, providing seeds and fertilizers among others to the farmers on cash or barter terms. According to the farmers, the nucleus farmers organize meetings to advise them on the adoption of row planting, improved seeds and fertilizers and agrochemicals and they are capable of increasing the yields significantly.

Our nucleus farmer is even doing more to encourage us to plant in rows, use improved seeds and agrochemicals. They organise meetings and tell us what to do. In the dry season, how to prepare our land, budgeting and planning and during the planting they organize us, teach us and show us videos and pictures on how to plant. Sometimes if you refuse to go by those good agronomic practices, he will not plough your farm for you or give you inputs that you need. (LF 1)

As indicated by the above farmer, nucleus farmers can refuse to supply farming inputs or provide services to noncompliant farmers who fail to adopt prescribed agricultural practices. According to the farmers, some opinion leaders also encourage farmers to adopt modern innovations. These persons are not involved directly or openly but do so on the quiet. The farmers indicated:

There is the community development chairman, he’s been encouraging us to use the technology and I don’t know any opinion leader who will be discouraging us. If someone is not doing it, he will be doing it on the quiet. (SHF 7)

The study found nucleus farmers and opinion leaders in the farming community to be influential in the farmers’ decision to use the three improved agricultural innovations. This suggests that their attitude towards innovation is critical. They will encourage or discourage the adoption of these innovations depending on their positive or negative attitude.
Psychological determinants and innovation adoption

Family Members

The study observed that female farmers are especially influenced by their husbands to adopt or not to adopt row planting, improved seeds and fertilizer. Their husbands also provide the extra labour needed to implement certain innovations such as row planting.

Some of the female participants explain:

*I have someone who encourages me to do row planting. That is my husband. He helps to do the row planting because it involves manpower. (FG 2)*

One of the female farmers related a personal experience:

*I quite remember a particular time when my husband could not make it to the farm and my child was the one to support me. I thought of it that we were going to suffer so I decided that we should just plant it but my husband was not happy about that and he told me that next time I shouldn’t do that again. (FG 2)*

The above experience narrated suggests that husbands in various households are displeased when their wives resort to farming practices that will not yield positive results. Thus, family members especially husbands are influential in the innovation adoption decisions of female farmers. The tone of their comments also indicates a willing spirit on the part of female farmers to listen to the advice of their husbands regarding the adoption of improved agricultural innovations.

4.2.3.3 Control Beliefs

Control beliefs in this context are the beliefs about the presence of factors that may facilitate or impede the performance of the behaviour. The study identified five (5) control beliefs about agricultural innovations include *lack of money to invest, availability of subsidies, sufficient knowledge and skills* as well as *inputs and logistics support*. The sections below present details of these beliefs with relevant supporting interview quotes.
Psychological determinants and innovation adoption

Availability of Subsidies

The study found that smallholder farmers believe subsidies from government and agricultural development organizations encourage them to adopt improved innovations. They expect subsidies in the form of a reduction in the cost of fertilizer and improved seeds. Alternatively, they expect the government and other agencies to supply free fertilizers and seeds to them. Some of them also expect financial handouts to help recruit labourers on their farms. The farmers passionately expressed this belief as:

...Inability to provide adequate fertilizers since those technologies require a lot of fertilizer. Sometimes the fertilizers are not there. So if ADVANCE or MoFA does not support us and reduce the price we can’t use it...the cost of the seeds, the cost range from GHC 80 to 250 per acre depending on the seed variety you want to use. So if ADVANCE could get the improved seeds and start giving to the smallholder farmers that will also help in improving the yield. (FG 1)

Financial support from maybe the government or from my nucleus farmer, who will support me to hire some people to help me plant it, that will also be an encouragement to do it...the availability of seeds, because at the time most farmers like these pioneer seeds getting it in town is difficult. For the last two years, this year I don’t know but if it more closely to the farmer it will be an encouragement for me to use it. And the cost, if it is brought down. (FG 2)

All the above comments from the farmers indicate that without subsidies in the form of financial support and reduced cost of farming inputs, the farmers are unable to adopt the improved agricultural innovations. Thus, smallholder farmers are likely to adopt improved seeds and apply the right quantities of fertilizer when the cost is perceived to be moderate or they are supplied free of charge. On the other hand, they are less likely to adopt innovations when there are no subsidies from government or development agencies.
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Lack of Money to Invest

The study found that a typical farming budget requires investment in land clearing, labour, improved seeds, fertilizers and other agrochemicals. The smallholders indicated that they lack the financial resource to invest sufficiently in all these areas. Some of the farmers after calculating the total cost of farming cut down cost by substituting for other innovations or taking them out of their budget completely. The following responses show how the lack of money affects investment in improved agricultural innovations.

.... we are also appealing to ADVANCE because they have been teaching us how to do row planting, how to apply fertilizer and get improved seeds. But if they could support us financially, we think we will carry...all these technologies we will use it. Because we are not very wealthy enough to carry it on...so ADVANCE to add something, a top up with some resources on the technology that they are teaching us...To access seeds and fertilizer and also these chemicals people find it difficult to maybe get money to get those things. (FG 1)

...at the time of planting you need a lot of things to do. You buy chemicals, you plough, you get people to help you and the food to use on the farm. So you will just take all these things into consideration and go for the lesser cost seeds. (FG 2)

The preceding comments suggest that with little or no money, smallholder farmers are less able to adopt row planting, improved seeds and fertilizers. However, farmers can adopt these improved innovations when they have enough financial resources to invest in their farms. To improve their financial positions some farmers, sign contracts with a commercial farmer who offer farming services to them on credit and pay after harvest.

...for the accessibility of inputs for some of the farmers who cannot afford is to maybe sign a contract with some of these companies ADVANCE is linking us to, AGRICARE and HAFNAS. You can sign a contract with them to assist with the supply of seeds and fertilizer to farmers. It not very difficult getting the contracts, sometimes they will even bring it to your community to ask if you are in need. So many companies come to sign a contract with us but we see it not to be fair because the returns are too much, unlike AGRICARE and co. So, so many of them in the dry season they come, organize meetings, call people, talk to people, “we want to do this, we want to supply these number of bags of fertilizer, so after that maybe each bag of fertilizer you pay one and a half bag of cocoa
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"sack"...which people don’t get. so we do sign contracts with other companies and buyers because some of them will support you to produce and they will buy. You will pay them back and they will buy the remaining produce if you wish to sell to them. (LF 3)

The above comment shows that the credit companies provide not only credit facilities but also technical support like training and workshops on best agricultural practices. However, some farmers perceive the credit arrangement to be unfair and exploitative and therefore refuse to sign them. Thus, the lack of money and fair credit facilities to invest in farming seems to affect farmers’ effort to adopt improved agricultural innovations.

**Sufficient Skills and Knowledge**

The farmers indicated that with sufficient knowledge and skills they will be able to adopt row planting and apply fertilizers effectively. The farmers are equipped with farming knowledge and skills through meetings, on-farm trials and workshops organized by agricultural extension officers. The farmers related that awareness and education about innovation are very important.

Also, people not attending meetings, absent from meetings including training is also a problem. When you absent from meetings you do not get the skills or the knowledge about the technology. (FG 1)

Knowledge and awareness of the technology are also good because if you do not know the spacing you cannot do it. So, awareness and education too will be a factor that will make it easy for one to do it. (FG 2)

The findings suggest that sufficient knowledge and skills facilitate farmers’ utilization of innovations. Thus, when farmers have adequate knowledge and skills about row planting, improved seeds and fertilizer application they are more confident about their ability to adopt the innovations. On the other hand, when farmers have little or no knowledge and skills about these improved agricultural innovations, they are less confident in their ability to adopt them.
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**Inputs and Logistics Support**

The farmers mentioned the lack of tractor services and other logistics such as ropes to undertake row planting to impede their adoption behaviour. These inputs and logistics are in short supply and therefore stifles effort to adopt innovations that require their usage. Comments from the farmers suggest that the unavailability of required inputs and logistics is frustrating because it delays planting and prevents innovation adoption. The farmers described their frustrations as:

...the tractors to do the ploughing are not enough here. So, the time you want to plough...they will plough it for you late and at that time you will not want to use more days to do the planting. so you just go and do the anyhow planting...Because we don’t have the ropes, this year I’m compelled to use the traditional way of planting because I was waiting for the one with the rope but I have found out that if care is not taken I might not be able to plant at the right time. (FG 1)

We need other inputs, but it is difficult to get them. Tractors for ploughing are not enough so you do not get them early when you want to plough your field. So you don’t have the time to plant in rows...it has benefits but there is one problem associated with it, like pulling the rope needs a lot of energy and he is talking or if there could be NGOs and government could make planters accessible to these smallholder farmers that they would have been happy. (FG 2)

It is evident from the above narrations that availability of inputs and logistics ensures that smallholder farmers can confidently adopt improved agricultural innovations such as row planting and the application of agrochemicals.

The study argues that farmers’ behavioural, normative and control beliefs about improved agricultural innovations influence their adoption behaviour. These beliefs tend to influence attitudes, subjective norms and perceived behavioural controls of farmers, which in turn affects their intentions and actual adoption behaviour. Thus, the stronger the belief the more likely it will affect adoption or non-adoption of improved agricultural innovations (row planting, improved seeds and the application of fertilizers etc).
4.2.4 Summary of Findings

In summary, study one found the contextual meaning of improved agricultural innovations among farmers in Northern Ghana. It also identified the main motives for farming and three salient beliefs that smallholder farmers have about improved agricultural innovations. The study established that smallholder farmers have more social motives for farming than economic motives. Tables 1 and Table 2 below provide a summary of findings for study one.
### Table 1: Summary of Findings Indicating Meaning of Improved Agricultural Innovations and Farming Motives of Smallholder Farmers

<table>
<thead>
<tr>
<th>NO</th>
<th>MAIN THEMES</th>
<th>SUBTHEMES</th>
<th>ILLUSTRATIVE INTERVIEW QUOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Improved agricultural innovations</td>
<td>Modern; Complementary</td>
<td>...when you use the row planting and you apply the right quantity of fertilizer to the field you get more yields as compared to the traditional way of planting.</td>
</tr>
<tr>
<td>2</td>
<td>Farming Motivations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Household survival</td>
<td>Feed the family; Cater for other household needs</td>
<td>...my main motivation for farming is to feed my family first before anything else...</td>
</tr>
<tr>
<td></td>
<td>b. Generate excess income</td>
<td>Business venture; Needs of non-farmers</td>
<td>...also, farming is the leading occupation now, so that even motivate us to engage in farming. You can build a beautiful house from farming and buy cars.</td>
</tr>
<tr>
<td></td>
<td>c. Keep a traditional heritage</td>
<td>Born to farm; Belongs to the community</td>
<td>...also, we were born and trained in farming work to become farmers in the future. So, it’s like we are continuing a tradition.</td>
</tr>
</tbody>
</table>

*Source: Field survey (2017)*
Table 2: Summary of Findings of Smallholder Farmers’ Salient Beliefs about the Improved Agricultural Innovations

<table>
<thead>
<tr>
<th>NO</th>
<th>MAIN THEMES</th>
<th>SUBTHEMES</th>
<th>ILLUSTRATIVE INTERVIEW QUOTES</th>
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<tbody>
<tr>
<td>1.</td>
<td>Beliefs about improved innovations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Behavioural beliefs</td>
<td>Increase yields; Attractive farm; Attractive produce; Time wasting; Increase labour cost and farm budget; Decrease soil fertility and food quality</td>
<td>The time we were not planting with improved seeds and role planting, we were just using 1 bag of fertilizer to deceive 1-acre of land and we expect to get more yield. However, we do not get the expected yield but now we use 3 bags of fertilizer on 1-acre of land and we get more yield as compared to previous times</td>
</tr>
<tr>
<td></td>
<td>b. Normative beliefs</td>
<td>Lead farmers; Nucleus farmers; Fellow farmers; Family members; ADVANCE/ MoFA)</td>
<td>...there are some people (farmers) like that, whenever they are doing the planting, other farmers passing by will say that they are lazy. “These maize crops you won’t just plant and you are just carrying all these ropes around, you are lazy”. In this case, I (lead farmer) have to come in and encourage them to continue</td>
</tr>
<tr>
<td></td>
<td>c. Control beliefs</td>
<td>Lack of money to invest; Availability of subsidies; Sufficient skills; Sufficient knowledge; Qualified technical assistance and inputs</td>
<td>...the cost of the seeds, the cost range from GHC 80 to 250 per acre depending on the seed variety you want to use. So if ADVANCE (external organization) could get the improved seeds and start giving to the smallholder farmers, which will also help in improving the yield</td>
</tr>
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</table>

Source: Field survey (2017)


4.3 Discussion of Findings

As mentioned earlier, study one sought to achieve two main objectives namely, to identify the farming motivations of smallholder farmers in Northern Ghana and to explore the key beliefs that smallholder farmers have about the three improved agricultural innovations. This section discusses the qualitative findings in relation to the study objectives. The first section discusses the three farming motivations, which include ‘farming to ensure household survival’, ‘farming to generate income’ and ‘farming to keep a cultural heritage’. The second section present findings on salient beliefs about improved agricultural innovations (behavioural, normative and control beliefs).

4.3.1 Farming Motivations of Smallholder Farmers

The qualitative study was instrumental in identifying the major farming motivations for smallholder farmers in Northern Ghana. The study identified three main motivations: household survival, income generation and maintaining cultural heritage. The findings are consistent with several studies that have investigated farmers’ objectives for farming or towards the adoption of innovations (Greiner et al., 2009; Grover, 2013; Hammond et al., 2017; Koutsoukos & Lakovidou, 2013; Naspetti, Bteich, Pugliese & Salame, 2016; Nordhagen et al., 2017; Pannell et al., 2006). All these studies have found various farming motives ranging from economic, lifestyle, social, environmental and traditional. Besides, most of these studies suggest economic motives to drive farming intentions and behaviour. However, the findings of the present study suggest other non-economic motives strongly influence farming among farmers in the study context. This is consistent with Karami and Keshavarz (2010) who observed that the farming occupation is rarely profitability driven.
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The first motivation for farming which is to ensure household food security was a regnant comment among the smallholder farmers. This motive for farming is unsurprising because researchers often describe smallholder farmers as subsistence farmers (Grovers, 2013). These farmers mainly farm for household consumption and survival. In this study, most of the farmers felt a sense of responsibility towards their households and were mindful of farming practices or innovations that can help them obtain enough food to feed their families. This motivation to feed the family and support other family needs is important because it makes the farmers amenable to improved agricultural innovations that can increase yield and ensure more food at home.

Several factors could influence the motivation to ensure household survival. A study by Bogale (2012) in Ethiopia found household food insecurity to be associated with several factors including farm size, household size, irrigation access, fertilizer use and improved seeds. Besides, Mango, Zamasiya, Makate, Nyikahadzoi and Siziba (2014) found personal and household factors to affect household food security among smallholder farmers in Zimbabwe. These include the age of household head, education of household head and household labour size. Furthermore, Owusu, Abdulai and Abdul-rahman (2011) maintains, that participation in non-farm occupations is critical to ensuring household security and poverty reduction in rural farming communities.

Simply having an objective to farm for food does not assure household survival. Thus, smallholder farmers may be greatly motivated to engage in farming to ensure food security but may not realize this motive if they lack the capacity to address factors militating against their efforts, especially in respect of adopting improved agricultural innovations. It appears worthwhile to encourage smallholder farmers to adopt three
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improved agricultural innovations (e.g. row planting, improved seeds and fertilizer application) given their desire to ensure food security at the household level. However, this could remain a challenge without seeking effective ways to address factors associated with food insecurity.

The second farming motivation found among smallholder farmers in Northern Ghana is to generate excess income. Smallholder farmers in our study indicated that they view farming as an occupation, which provides viable means to generate income because there is a huge demand for their crops by non-farmers. A possible explanation for this motivation is that most of the smallholder farmers are full-timers who desire to generate excess income to enhance their standard of living. The study observed that the motivation to generate excess income from farming is not a primary one but important (Naspetti et al., 2016; Pannell et al., 2006). Growth in incomes generated by smallholder farmers is instrumental to rural economic and social development, reinvestment and growth of farm businesses and sustainable food supply at the regional and national level (Naspetti et al., 2016).

The motivation to generate excess income has a relationship with farm output and active market participation. The more smallholder farmers increase their crop productions, the more likely they are to sell part of their output in the market for a profit (Kan, Kimhi & Lerman, 2006). However, several factors blight the motivation to profit from farming to improve and develop farms as well as create wealth (Pannell et al., 2006). These factors include land and machinery ownership (Mathijs & Noev, 2004), household resources (land, capital and labour) (Balint & Wobst, 2006), and the farmers’ readiness to participate in the market (Lerman, 2005). The motive to be profitable through farming is
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very useful in the sense that it could positively influence the farmers to look for capital or money to invest in improved agricultural innovations, which have the potential to increase farm output significantly. When smallholder farmers are unable to increase their capacity to adopt yield-increasing innovations, they are likely to diversify their time and limited resources into other farm and non-farm related activities in order to achieve their motive of income generation.

The last farming motivation from this study is to keep a cultural heritage. This motivation is reinforced by the belief that farmers are “born to farm” and “farming belongs to the community”. As a cultural heritage, smallholder farmers feel very much connected to farming than the desire to raise excess income from farming. According to Grovers (2013), the motivation to keep farming as a traditional inheritance is necessary for passing on farming knowledge and maintaining interest in farming among current and future generations. Grovers (2013) rightly argues, “since one of the main means of obtaining agricultural know-how is still through generational family farms, the idea of farming as an inheritance is as much practical as it is philosophical” (p. 101). This suggests that making farming relevant in the community requires using effective ways of socialization, which would make farming occupation attractive to children and youths in farming households and grow more farmers in the community. Besides, the idea that smallholder farmers believe they were born to farm makes farming appealing to them and encourages them to do so, even with little or no farming experience.

The natural acceptance of farming as a community occupation and the desire to keep the tradition and pass it on to the next generation is perhaps one reason why smallholder farmers produce with the objective of household consumptions. By so doing, agriculture
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becomes more relevant and attractive to children in farming families and ensures that the farming tradition passes on to the next generation of farmers. The study found that the motivation to farm as an inheritance is profound in that it enhances the general life satisfaction of smallholder farmers. In this regard, it logically follows that smallholder farmers would adopt agricultural innovations that will ensure adequate food supply in the household. However, the study observed that farmers were not determined to produce crops for commercial purposes since it would demand considerable financial investments.

From the findings, there appears to be some relative importance attached to each of the farming motives held by smallholder farmers. Specifically, smallholder farmers accord more importance to social motivations compared to economic motives. The study argues that smallholder farmers are more likely to adopt improved agricultural innovations if they have greater economic motivation. However, when smallholder farmers have greater social motivation, they are less likely to adopt improved agricultural innovations. This is because the yield required to meet social expectations is less compared to the production expectation to make economic gains from farming. Since, most of the farmers lack the financial resources to invest significantly in their farms to produce more, meeting their social obligations would be enough for them. Thus, there could be a relationship between farming motivations and innovation adoption among smallholder farmers.

**4.3.2 Salient Beliefs about the Improved Agricultural Innovations**

Beliefs about people’s environment influence their behaviour (Jamsari et al., 2012). In other words, smallholder farmers’ beliefs, expectations and perceptions about improved innovations guide their innovation adoption behaviour. Therefore, cognition plays a major role in innovation adoption. According to the Theory of Planned Behaviour (TPB,
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Ajzen, 2011), individual beliefs influence attitude, subjective norm and perceived behavioural control, which in turn creates intentions and eventually leads to actual behaviour. The beliefs are behavioural, normative and control beliefs. Eliciting these beliefs from the smallholder farmers helps to understand and explain the three main psychological constructs that essentially predicts intention and behaviour in relation to the adoption of improved agricultural innovations (Ajzen, 2015).

The study used thematic analysis to analyse the data from the elicitation study based on the recommendations of Fishbein and Ajzen (2010) and Francis et al. (2004). The researcher organized the data from twenty-two (22) participating farmers according to keywords, phrases and similarities and coded them to reflect the three set of beliefs proposed by the TPB. In all, the study identified twenty (20) salient beliefs with behavioural beliefs accounting for eight (8) and normative and control beliefs comprising six (6) each.

In terms of behavioural beliefs, the study elicited three (3) positive beliefs about improved agricultural innovations. The positive beliefs are, increase yields, create beautiful farms and produce attractive crops. These positive beliefs help to create a favourable attitude towards agricultural innovations. Nevertheless, the study identified five (5) negative beliefs: time-consuming, labour intensive, increase farm budgets, makes farmers lazy and reduce crop quality. These beliefs negatively affect farmers’ attitude towards innovations. The findings of the study suggest that smallholder farmers in Northern Ghana have more negative than positive beliefs particularly about row planting, improved seeds and fertilizer application. Whereas some of the beliefs found supported earlier studies, others did not support previous research. For instance, two of the negative

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beliefs about improved agricultural innovations (reduce crop quality and make farmers lazy) did not confirm the results of Borges and Lansink (2016) and Lalani et al. (2016).

Furthermore, the study identified six (6) salient referents that may be influential in the decision to adopt or not to adopt improved agricultural innovations by smallholder farmers. These significant others who constitute the normative beliefs are, lead farmers, nucleus farmers, opinions leaders, fellow farmers, family members (spouses), extension officers from government and non-governmental agricultural organizations (e.g MoFA and ADVANCE-project). This finding suggests that important referents encourage the diffusion of agricultural innovations within the farming communities. However, these referents should themselves have a favourable attitude towards improved agricultural innovations in order to encourage its adoption.

With respect to control beliefs, the study found six (6) factors that impede or facilitate the adoption of improved agricultural innovations, specifically, row planting, improved seeds and fertilizer application. These factors include lack of money to invest, sufficient knowledge, sufficient skills, subsidies, inputs and logistics support. The presence or absence of these factors has the potential to increase or decrease the adoption confidence of smallholder farmers. Thus, the findings suggest that when smallholder farmers perceive they have the necessary ability to overcome the control factors associated with the innovations, they are more likely to adopt them.

The study found several reasons why smallholder farmers adopt improved agricultural innovations (row planting, improved seeds and fertilizer). A major reason for innovation adoption among farmers in Northern Ghana is to increase crop yield. This is consistent
with the results of Lalani et al. (2016) who reported that yield increase is a leading cognitive driver in the adoption of conservation agriculture. The farming motives of the farmers could well explain the belief in the yield increasing capacity of the innovations. The study found that one of the profound motivations for farming is to ensure household survival by producing food for household consumption. To be able to achieve this objective, the farmers attempt to adopt innovations they believe could produce relatively more yield per acre. However, the farmers fail to adopt improved innovations because they perceive them to be time-consuming, labour intensive and increase their farm budget. This does not support earlier findings of Lalani et al. (2016) but supports the results of Borges and Lansink (2015) who reported that Brazilian cattle farmers are less likely to adopt improved natural grassland because it requires hiring more employees and buying machines.

Smallholder farmers perceived extension officers from government and non-governmental organizations (NGOs) (e.g. MoFA and ADVANCE project) as the main referents influencing their decision to adopt improved agricultural innovations. This finding is also consistent with earlier studies by Borges and Lansink (2015) and Lalani et al. (2016) who found NGOs and government extension officers as heavily regarded by farmers. A possible explanation for the reverence for ADVANCE within the region is that officers of the project are visible in the community and they provide regular and timely technical support to the farmers compared to officers from other agricultural institutions including government agencies. Another interesting finding is the identification of spouses, lead and nucleus farmers as other important referents. The study found husbands to be influential perhaps due to the patriarchal culture in Northern Ghana. Women are less empowered, in that men or their husbands dominate their views about
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issues. This suggests that husbands in farming households could strongly encourage or
discourage female farmers’ from adopting improved agricultural innovations.

The study found a lack of money as a factor that reduces farmers’ capacity and confidence
to adopt improved innovations. Borges and Lansink (2015) also found this factor to reduce
farmers’ intention to adopt improved natural grassland. A possible explanation
could be that most of the farmers live in poverty and find it extremely difficult to raise
enough funds to invest in their farms. The farmers also identified some facilitating
factors: availability of subsidies, inputs and technical assistance as well as sufficient
knowledge and skills. Thus, smallholder farmers perceive the availability of these factors
to inhibit or facilitate their ability to adopt improved innovations (Fielding, Terry,
Masser, Bordia & Hogg, 2005).

4.4 Summary and Conclusion

Briefly, the qualitative study uncovered two main issues: farming motivations of
smallholder farmers and their salient beliefs about improved agricultural innovations
(such as row planting, improved seeds and fertilizer application). The study found three
farming objectives of smallholder farmers in Northern Ghana. According to the farmers,
they farm to ensure household survival, generate excess income and to safeguard a
traditional heritage. The narratives of the smallholder farmers suggest that the motivation
to ensure household survival is profound relative to the “income generation” and
“keeping a traditional heritage” motivations. Most farmers, at least for those in this study,
prefer to farm much more for social reasons than economic.
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The finding that smallholder farmers are motivated by a range of factors, which varies from farmer to farmer, is important to agricultural policy-making and development. Agricultural intervention programs with non-profit incentives could potentially appeal to a certain group of smallholder farmers who focus on securing food for their households. Logically, non-economic motivation could limit smallholder farmers’ effort to adopt improved agricultural innovations. In order words, farmers are likely to adopt row planting, improved seeds and fertilizers if they have a strong motive to generate excess income. To the extent that smallholder farmers rarely cited income generation as a motivating factor for farming, suggest that these farmers lack knowledge about the business aspect of farming. Therefore, smallholder farmers may need business and profit-oriented workshops that would expose them to the various business models of farming and encourage them to adopt improved agricultural innovations. This would increase their yield significantly and allow them to sell for profit whiles achieving their objective of household survival.

In line with the Theory of Planned Behaviour (Ajzen, 1991), the study identified three groups of salient beliefs about agricultural innovations and found twenty (20) beliefs in all. First, the study identified eight (8) behavioural beliefs: increase yield, create beautiful farms, produce attractive crops, time-consuming, labour intensive, increase farm budgets, make farmers lazy and affect crop quality.

Farmers’ positive attitude towards improved agricultural innovations (such as row planting, improved seeds and fertilizer) could be enhanced by emphasizing the benefits and addressing the spurious perceptions about the innovations. Second, the study generated six (6) key referents, which drives subjective norms: lead farmer, nucleus...
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farmers, opinions leaders, fellow farmers, family members (spouses) and extension officers from government and non-governmental organizations (such as MoFA and ADVANCE project). These important others served as strategic agents for the diffusion of agricultural innovations within the farming community. Lastly, the study identified six (6) control factors: lack of money, sufficient knowledge, sufficient skills, subsidies, inputs and logistics support. The study observed that the presence of financial constraints made it difficult for farmers to adopt agricultural innovations. However, the presence of subsidies, sufficient knowledge and skills as well as inputs and logistics made it easier for farmers to adopt agricultural innovations. The shared numbers of behavioural beliefs suggest that this set of beliefs could greatly influence smallholder farmers’ innovation adoption behaviour.

The researcher used the beliefs elicited in the qualitative study to design belief-based measures and administered them to a larger population of smallholder farmers. This was to ascertain the relative effect of the beliefs on attitude, subjective norms, perceived behavioural control and adoption intention. The next chapter present details of the results in Study 2 (quantitative).
CHAPTER FIVE

STUDY 2 (QUANTITATIVE)

5.0 Introduction

This chapter consists of four major sections. First, it presents the specific methods adopted for quantitative data collection and data analysis. Second, the chapter presents the findings of study 2 based on the stated hypotheses. The third section discusses the findings in relation to literature and ends with a conclusion.

5.1 Methods

This section presents specific methods used in the conduct of study 2. It discusses issues such as design, sample size, inclusion/exclusion criteria, data collection, instruments and analytic technique.

5.1.1 Design of Study 2

Study 2 adopts a survey design. Survey research is a quantitative research design, which provides a numeric description of opinions, attitudes or behaviour of a population through the study of a sample from that population (Creswell, 2013). It includes a longitudinal and a cross-sectional design. In a longitudinal design, the researcher collects data over a period whereas in a cross-sectional study the researcher collects data at one point in time (Fowler, 2013). The purpose of survey research is to generalize opinions, trends and attitudes of a sample to a population (Fowler, 2013).

This study used the cross-sectional design to collect data at a single point in time, where the researcher compares multiple variables at the same time (Davies & Smith, 2005). This
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study considers the cross-sectional design because it seeks to generalize the effect of psychological constructs such as beliefs, attitudes, subjective norms and perceived behavioural control on the intention to adopt improved agricultural innovations to the population of smallholder farmers in Northern Ghana. This design is also appropriate because of its economy and rapid turnaround time in collecting as well as identifying characteristics of a large population (Creswell, 2013; Fowler, 2013). The study suitably examined participants’ beliefs and attitudes and adoption intention using the cross-sectional survey.

5.1.2 Sample Size

A sample refers to a constituent of a larger population, studied to estimate an unknown behaviour of the population and make conclusions about that population (Zikmund, Babin, Carr & Griffin, 2013). A representative sample makes it possible to research the opinions, experiences, attitudes and behavioural patterns of the whole population (Kerlinger & Lee, 2000). Thus, a careful sampling process ensures confidence in the findings of the population under investigation.

Following recommendations for minimum sample size in survey research by Fields (2013) and Green (1991), the study contacted 260 smallholder farmers out of a target of 300, representing 87% overall response rate. The response rate was significant because Babbie (2007) recommends a response rate of 60% to be appropriate. Besides, given the power of 0.80 at 0.05 level of significance, a sample size of 260 was adequate to detect at least a moderate effect in the population of smallholder farmers in Northern Ghana (Cohen, 1992). Furthermore, the study tested the conceptual framework using correlation, standard multiple regression and path analysis. The sample size of 300 was estimated
using the g*power (Faul, Erdfelder, Lang & Buchner, 2007), a statistical software used in social and behavioural research to calculate appropriate sample size considering the expected effect size (0.80) level of significance (0.05), number of variables (9 study variables) and the analytical technique (multiple regression). Some notable scholars have recommended a sample size of at least 100 for testing comprehensive models with multiple constructs (e.g. Bagozzi & Yin, 2012; Kline, 2010). Thus, a sample sized of 260 used in this study was adequate for the data analysis.

5.1.3 Exclusion and Inclusion Criteria

The following are the main factors that were considered for eligibility to participate in the study.

- Participation in the quantitative phase of the study was open to all smallholder farmers registered on the ADVANCE- Ghana project. The rationale was to ensure that all those contacted were smallholder farmers since the researcher by himself could not authenticate the status of the farmers. As at the time of data collection, the project had registered over 6000 smallholder farmers in the Gushegu district.

- The study included all smallholder farmers with at least 2 years of cumulative farming experience. The participants were into maize, rice and soybeans production.

- The study excluded smallholder farmers in the district who grow other crops such as groundnuts, yams etc.

- Even though youths below the age of 18 cultivate their own farms, the study only considered adult farmers, both male and female.
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5.1.4 Survey Instrument Development and Procedure

The types of survey instruments gathered for this study was informed by the Theory of Planned Behaviour (Ajzen, 2002) and the recommendations of Francis et al. (2004) after the initial elicitation study (Study 1). As indicated earlier, new belief-based measures which served as indirect measures for the TPB constructs were developed from the salient beliefs generated in study 1. The reason for developing these new measures was because of the researcher’s best knowledge no such study has been conducted within the study context as at the time of data collection. Similar studies have developed scales to measure salient beliefs and used them in a different context (e.g. Borges et al., 2016; Lalani et al., 2016). However, the researcher recognizes that using these scales in the context of the current study would detract from the meaningful interpretation of the findings. Thus, it was imperative to design belief-based scales which are culturally relevant and meaningful to the participants.

The final survey instrument included 40 major questions, which measured demographic variables, the theory of planned behaviour variables (intention, attitude, subjective norms and perceived behavioural control), beliefs (using newly constructed belief-based measures) and two additional variables (risk attitude and psychological wellbeing) (see Appendix A for details). Thus, the final questionnaire is into three parts. The first part solicits demographic information. The second section collects responses on the direct and indirect measures (beliefs) of the theory of planned behaviour components. The final section of the survey collects information on two additional variables, namely psychological wellbeing and risk attitude.
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The researcher originally constructed the questionnaire in English and later translated it into Dagbani. The researcher used back-translation to compare the Dagbani and English version for accuracy (Alselaimi, 2010). Both the Dagbani and English version of the final survey was similar in structure in terms of the order of items. The survey’s translation into Dagbani was by a technical officer from Innovations for Poverty Action (IPA), an International NGO working with rural communities in the Northern Region of Ghana. A professor of the researcher recommended the officer. He is a graduate and a native of the region. He has been translating surveys for the organization for more than three (3) years. A language expert at the Ghana Institute of Languages back-translated the Dagbani version of the survey to check for similarity in the original version. The language expert made changes where necessary. The researcher reframed some of the items and deleted those that are difficult to understand.

The first section of the questionnaire asked participants about some relevant demographic characteristics. Some of the personal information were age, gender, size of the farm, type of crop produced, and years of farming experience, average bags of crops harvest as well as membership in farmer organizations. The second section of the questionnaire asked questions based on the components of the theory of planned behaviour. There were two measures, namely direct and indirect TPB measures.

5.1.4.1 Direct TPB Measures

The direct TPB measures are the intention, attitude, subjective norm and perceived behavioural control about improved agricultural innovations. Borges et al. (2014) used these measures in a similar study. The study modified the measures to suit the context of the current study.
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1. **Attitude towards Improved Agricultural Innovations**

An attitude in this study refers to the positive or negative evaluation of improved agricultural innovations. The study used a 4-item semantic differential scale with seven-point bipolar adjectives to measure attitude (Ajzen, 2006). The adjective pairs include ‘bad-good’, ‘disadvantageous-advantageous’, ‘unnecessary-necessary’, ‘unimportant-important’. The 7-point semantic differential scale ranged from (1) ‘bad’ to (7) ‘good’. For example,

“Using improved agricultural innovations in at least part of my farm for the next planting season is”:

<table>
<thead>
<tr>
<th>Bad</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Good</th>
</tr>
</thead>
</table>

The Cronbach Alpha for the scale was 0.88.

2. **Subjective Norm**

Subjective norm refers to perceptions of social pressure to adopt or not to adopt improved agricultural innovations. The study modified a 3-item subjective norm scale used by Borges et al. (2014) and based on Ajzen’s (2006) recommendations. The study measured these items on a 7-point scale. An example of the items is:

“Most people who are important to me think that I should use improved agricultural innovations in at least part of my farm for the next planting season”.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

The reliability coefficient for the subjective norm scale was 0.81.

3. **Perceived Behavioural Control (PBC)**

Perceived behavioural control (PBC) refers to the extent to which a farmer feels capable to adopt improved agricultural innovations. The study used a 5-item scale
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to assess perceived behavioural control. The study measured these items with a
7-point scale. An example of the items is:
“If I want to use improved agricultural innovations in at least part of my farm for
the next planting season, I have sufficient knowledge”.

Definitely not 1 2 3 4 5 6 7 Definitely yes
The scale has a reliability coefficient of 0.82

4. Intention to Adopt Improved Agricultural Innovations

Intention refers to the plan made to adopt improved agricultural innovations. The
study used a 4- item scale to assess intention to adopt improved agricultural
innovations. The study measured these items with a 7-point scale. An example of
the items is:
“How strong is your intention to use improved agricultural innovations in at least
part of your farm for this planting season?”

Very Weak 1 2 3 4 5 6 7 Very Strong
The Cronbach alpha reliability of the scale was 0.92

5.1.4.2 Indirect TPB Measures

Following the thematic analysis of Study 1, eight behavioural beliefs, six normative
beliefs and six control beliefs were identified. In all, the study discovered twenty beliefs
of smallholder farmers about improved agricultural innovations. Table 3 below provides
a summary of these beliefs. Besides, additional information is in the final survey
questionnaire (See Appendix A for details).
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Table 3: Salient Beliefs about Improved Agricultural Innovations

<table>
<thead>
<tr>
<th>Behavioural Beliefs</th>
<th>Normative Beliefs</th>
<th>Control Beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>(outcomes)</td>
<td>(Referents)</td>
<td>(Factors)</td>
</tr>
<tr>
<td>Increase Yields</td>
<td>Lead farmers</td>
<td>Lack of money</td>
</tr>
<tr>
<td>Attractive farm</td>
<td>Nucleus farmers</td>
<td>Availability of subsidies</td>
</tr>
<tr>
<td>Attractive produce</td>
<td>Fellow farmers</td>
<td>Sufficient knowledge</td>
</tr>
<tr>
<td>Time wasting</td>
<td>Family members</td>
<td>Sufficient skills</td>
</tr>
<tr>
<td>Increase in labour cost</td>
<td>Extension officers</td>
<td>Technical assistance</td>
</tr>
<tr>
<td>Increase farm budget</td>
<td>Opinion leaders</td>
<td>Availability of inputs</td>
</tr>
<tr>
<td>Decrease soil fertility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease food quality</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey (2017)

The researcher framed questions for the belief items presented in Table 3 Smallholder farmers had to respond to two questions, which they answered using a 7-point scale anchored in the extreme points. The study derived belief-based measures using the Expectancy-Value model. In this model, the behaviour is a function of expected outcomes and the value one has for those outcomes (Ajzen & Fishbein, 2008). For instance, the multiplicative composite of behavioural beliefs and their evaluations form an indirect measure of attitude (Wauters et al., 2010). The following is a detailed procedure for developing each belief-based measure.

1. Behavioural Beliefs (Outcomes):

   A behavioural belief refers to the subjective probability that performing a certain behaviour will result in a positive or negative outcome (Ajzen, 2006). Behavioural beliefs are the indirect measures of attitude towards a given behaviour (intention
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to adopt the innovations). To assess behavioural beliefs, the researcher asked the participants two questions about each of the outcomes presented in Table 3. First, “How likely is it that if you use improved agricultural innovations in at least part of your farm for this planting season you would (outcomes), (unlikely – likely)”. Second, “How important is it that if you use improved agricultural innovations in at least part of your farm for this planting season you would (outcomes), (unimportant – important)”. For each of the outcomes in Table 3, the two questions produced behavioural belief and outcome evaluation variables.

Using the expected-value model for each outcome, the researcher calculated the product of the behavioural belief and the belief evaluation variables. This resulted in eight behavioural beliefs, which the researcher aggregated to produce a composite belief-based measure which could be used to indirectly measure attitude towards improved agricultural innovations.

2. Normative Beliefs (Referents)

Normative beliefs are the perceived pressure from significant others to adopt or not to adopt improved agricultural innovations as well as the motivation to comply with the pressure from significant others. Normative beliefs serve as indirect measures of the subjective norm. To determine normative beliefs, the researcher asked the participants two questions about each of the important referents presented in Table 3. First, “How likely is it that each of the person/group (referents) would think that you should use improved agricultural innovations in at least part of your farm for the next planting season, (unlikely – likely)”. Next, “How much do you care about what each of the person/group
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(referents) thinks you should do on your farm, for example, to use improved agricultural innovations in at least part of your farm for the next planting season, (not at all – very much)”. For each referent in Table 3 above, these two questions produced a normative belief and a motivation to comply with variables.

The study calculated the product of the normative belief and motivation to comply with for each referent, which resulted in six normative beliefs. The aggregate of the six normative beliefs produced a composite belief-based measure which could be used to indirectly assess subjective norm.

3. Control Beliefs

Control belief is an individual’s perception of factors that can impede or facilitate the performance of a given behaviour. In the context of this study, control beliefs are the factors prevent or encourage the adoption of improved agricultural innovations. Control beliefs are antecedents or indirect measures of perceived behavioural control. To measure the control beliefs for this study, the researcher asked two questions about each of the factors presented in Table 3 above. First, “How likely is it that each of the (factors) would be present to facilitate or to prevent you to use improved agricultural innovations in at least part of your farm for the next planting season, (unlikely – likely)”. Second, “How strong are each of the (factors) to facilitate or to prevent you to use improved agricultural innovations in at least part of your farm for the next planting season, (very weak – very strong)”. For each factor in Table 3 above, these two questions produce a control belief and power to control variables.
Using the expected-value model for each factor, the researcher computed the product of the control belief and power to control variables, which resulted in six control beliefs. The aggregate of the six control beliefs created a composite belief-based measure which could be used to indirectly assess perceived behavioural control.

### 5.1.4.3 Measures for Additional Variables

The study included two additional variables alongside the main psychological predictors of the TPB. The two variables are psychological wellbeing and risk attitude. The third section of the questionnaire contains these two variables.

1. **Psychological Wellbeing**

To measure psychological wellbeing, the study used the 10-item brief psychological wellbeing scale developed by Su, Tay and Diener, (2013). The scale measures interest and engagement in daily life activities, meaning and purpose in life and a sense of mastery and accomplishment. The scale includes items such as “My life has a clear sense of purpose”, “My life is going well”, “What I do in life is valuable and worthwhile”, “I am achieving most of my goals” and “There are people who appreciate me as a person”. Participants were asked to indicate the extent to which they agree or disagree with the items using a 7-point scale ranging from (1) ‘strongly disagree’ to (7) ‘strongly agree’. In terms of interpretation, a score above 4.0 or neutral that is 5, 6, 7 were described as good, high and extremely high psychological well-being respectively. The scale has an impressive internal consistency with an alpha coefficient of 0.90.
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2. Risk Attitude

The study measured risk attitude using the 12-item risk orientation questionnaire (ROQ) which assesses individual attitude towards risky decisions (Rohrmann, 2002). The questionnaire is used to measure two risk behaviours namely, risk propensity and risk aversion. Examples of items in the questionnaire are, “Even when I know that my chances are limited, I try my luck”, and “I tend to imagine the unfavourable outcomes of my actions”. Participants were asked to respond to the degree to which they agree or disagree to the risk propensity and aversion items using a 7-point scale ranging from (1) ‘strongly disagree’ to (7) ‘strongly agree’. The two subscales of the questionnaire have acceptable Cronbach’s Alpha coefficients that are 0.62 for risk propensity and 0.67 for risk aversion. In this study, the researcher intended to average all the 12 items of the questionnaire to create an overall measure of risk attitude, by reverse scoring all the risk aversion items. So, a high score on the questionnaire represent risk-taking propensity while low scores represent risk avoidance. The researcher modified the questionnaire to assess the risk attitude of smallholder farmers in the study context.

5.1.4.4 Pilot study

The researcher conducted a pilot study on a small sample of 30 farmers prior to the main study. This was to determine the factor structures of the newly developed belief-based measures and reliabilities of all the survey instruments and to make informed changes if necessary (Aron & Aron, 1999).
5.1.4.4.1 Validation of Newly Developed Belief-Based Measures

To validate the newly developed belief-based measures (behavioural, normative and control beliefs), the researcher conducted a principal component analysis using varimax rotation to estimate the factor structure of the measures. In the analysis, all the belief-based scales located at least two factors with eigenvalues greater than one. The researcher examined the rotated factor solutions and the results showed that more items loaded on one factor, with very few items on the other factors. As a result, the analysis was re-run to load items on a single factor and a reasonable solution was obtained. The researcher set the cut off for item loading at 0.30 following the recommendation of Spector (1992). According to him, the minimum cut-off points for principal component analysis of 0.30 is acceptable.

The analysis revealed satisfactory loadings for 4 out of 8 behavioural beliefs on a single factor. This belief-based factor was named as *behavioural beliefs* to reflect the beliefs about outcomes associated with the application of improved agricultural innovations. Similarly, 5 out of 6 normative-belief items loaded well on a single factor. This normative-belief factor was named as *normative beliefs* to represent the important others whose opinion matter to smallholder farmers. In addition, 4 out of 6 control belief items loaded adequately on a single factor. The researcher named this factor as *control beliefs* to indicate beliefs about factors that encourage adoption of the improved innovations. The naming of the factors followed the approach by Dixon and Azibo (1998) who used principal component analysis to extract factors and named factors based on the similarities between the items. Table 4, 5, and 6 below present details of the items and factor loadings on the behavioural beliefs, normative beliefs and control beliefs scales respectively.
Psychological determinants and innovation adoption

Table 4: Item Loadings on Behavioural Beliefs Measure for Smallholder Farmers in Northern Ghana

<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM CONTENT</th>
<th>LOADINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Factor 1: Behavioural Beliefs</strong></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>How likely is it that if you use improved agricultural innovations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in at least part of your farm for the next planting season you would:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Increase Yields</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>b. Produce attractive crops and healthy crops</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>c. Hire more labour</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>d. Increase farm budget</td>
<td>0.68</td>
</tr>
<tr>
<td>24</td>
<td>How important is it that if you use improved agricultural innovations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in at least part of your farm for the next planting season you would?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Increase Yields</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>b. Produce attractive and healthy crops</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>c. Hire more labour</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>d. Increase farm budget</td>
<td>0.72</td>
</tr>
</tbody>
</table>

*Source: Field survey (2017)*
### Psychological determinants and innovation adoption

#### Table 5: Item Loadings on Normative Beliefs Measure for Smallholder Farmers in Northern Ghana

<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM CONTENT</th>
<th>LOADINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td><strong>Factor 1: Normative Beliefs</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>How likely is it that each of the following person/group would think that you</td>
<td></td>
</tr>
<tr>
<td></td>
<td>should use improved agricultural innovations in at least part of your farm for</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the next planting season?</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>Lead farmer</td>
<td>0.87</td>
</tr>
<tr>
<td>f.</td>
<td>Nucleus farmer</td>
<td>0.81</td>
</tr>
<tr>
<td>g.</td>
<td>Family member</td>
<td>0.87</td>
</tr>
<tr>
<td>h.</td>
<td>Other farmers</td>
<td>0.84</td>
</tr>
<tr>
<td>i.</td>
<td>Extension officers (MoFA &amp; ADVANCE)</td>
<td>0.31</td>
</tr>
<tr>
<td>27</td>
<td>How much do you care what the following person/group think you should do on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>your farm, for example, to use improved agricultural innovations in at least</td>
<td></td>
</tr>
<tr>
<td></td>
<td>part of your farm for the next planting season?</td>
<td></td>
</tr>
<tr>
<td>e.</td>
<td>Lead farmer</td>
<td>0.86</td>
</tr>
<tr>
<td>f.</td>
<td>Nucleus farmer</td>
<td>0.81</td>
</tr>
<tr>
<td>g.</td>
<td>Family members</td>
<td>0.86</td>
</tr>
<tr>
<td>h.</td>
<td>Other farmers</td>
<td>0.80</td>
</tr>
<tr>
<td>i.</td>
<td>Extension officers (MoFA &amp; ADVANCE)</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*Source: Field survey (2017)*
Table 6: Item Loadings on Control Beliefs Measure for Smallholder Farmers in Northern Ghana

<table>
<thead>
<tr>
<th>NO</th>
<th>ITEM CONTENT</th>
<th>LOADINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Factor 1: Control Beliefs</strong></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>How likely is it that each of the following factors would be present to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>facilitate or to prevent you to use improved agricultural innovations in</td>
<td></td>
</tr>
<tr>
<td></td>
<td>at least part of your farm for the next planting season?</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Availability of government subsidies</td>
<td>0.52</td>
</tr>
<tr>
<td>b.</td>
<td>Sufficient skills</td>
<td>0.73</td>
</tr>
<tr>
<td>c.</td>
<td>Sufficient knowledge</td>
<td>0.71</td>
</tr>
<tr>
<td>d.</td>
<td>Availability of technical support</td>
<td>0.66</td>
</tr>
<tr>
<td>e.</td>
<td>Availability of inputs</td>
<td>0.71</td>
</tr>
<tr>
<td>32.</td>
<td>How strong are the following factors to facilitate or to prevent you to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>use improved agricultural innovations in at least part of your farm for the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>next planting season?</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Availability of government subsidies</td>
<td>0.59</td>
</tr>
<tr>
<td>b.</td>
<td>Sufficient skills</td>
<td>0.82</td>
</tr>
<tr>
<td>c.</td>
<td>Sufficient knowledge</td>
<td>0.73</td>
</tr>
<tr>
<td>d.</td>
<td>Availability of technical support</td>
<td>0.69</td>
</tr>
<tr>
<td>e.</td>
<td>Availability of inputs</td>
<td>0.72</td>
</tr>
</tbody>
</table>

*Source: Field survey (2017)*
5.1.4.4.2 Pilot Reliabilities of Survey Measurements

Majority of the instruments recorded impressive reliabilities above 0.70. However, three of the scales namely perceived behavioural control, behavioural beliefs and risk attitude reported reliability coefficients of 0.60, 0.66 and 0.63 respectively. For risk attitude scale, the researcher dropped two items out of the total twelve because they were not contributing positively to the internal consistency of the instrument. Nevertheless, the remaining instruments had all their items retained since the reliabilities were acceptable. Table 7 below presents details of the reliabilities for all the measurement instruments.

Table 7: Summary Pilot Results on the Reliabilities of the Measurement Instruments

<table>
<thead>
<tr>
<th>SCALE</th>
<th>CRONBACH ALPHA</th>
<th>NO OF ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT</td>
<td>0.87</td>
<td>4</td>
</tr>
<tr>
<td>ATT</td>
<td>0.91</td>
<td>4</td>
</tr>
<tr>
<td>SBN</td>
<td>0.88</td>
<td>3</td>
</tr>
<tr>
<td>PBC</td>
<td>0.60</td>
<td>5</td>
</tr>
<tr>
<td>BBs</td>
<td>0.66</td>
<td>8</td>
</tr>
<tr>
<td>NBs</td>
<td>0.87</td>
<td>10</td>
</tr>
<tr>
<td>CBs</td>
<td>0.62</td>
<td>10</td>
</tr>
<tr>
<td>RSATT</td>
<td>0.63</td>
<td>8</td>
</tr>
<tr>
<td>PSYCWB</td>
<td>0.86</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Pilot report of survey instruments (2017)

Note. ATT= Attitude towards Improved Agricultural Innovations; SBN= Subjective Norm; PBC=Perceived Behavioural Control; BBs= Behavioural Beliefs; NBs= Normative Beliefs; CBs= Control Beliefs; INT=Intention to adopt improved agricultural innovations; RSATT= Risk Attitude; PSYCWB= Psychological Wellbeing.
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5.1.5 Data Collection Procedure

The final questionnaire used for data collection in this quantitative study consisted of nine scales. The researcher administered 300 questionnaires to the farmers. However, the researcher retrieved 260 completed questionnaires. The data collection exercise lasted for a total period of 12 weeks. The researcher collected data with the help of three research assistants who were graduates, natives of the region and experienced in conducting surveys among farmers. Officials from the ADVANCE project facilitated field entry by introducing the researcher to the lead farmers in the five villages. The lead farmers, in turn, introduced the researcher and explained the purpose of the study to the smallholder farmers. The researcher and his assistants collected data methodically that is moved from one village to the other after surveying smallholder farmers available and willing to participate in the study. The research assistants conducted the survey using the translated Dagbani version of the questionnaire. Moreover, they allowed the participants enough time to respond to the questions. On average, it took about 20 minutes to complete each questionnaire.

5.1.6 Quantitative Data Analysis

Quantitative data were analysed using descriptive and inferential statistics. The researcher used descriptive analysis to capture the demographic and farming characteristics of the respondents. To proceed with the inferential statistics, the researcher calculated Cronbach alpha coefficients for all the newly developed and modified instruments to determine their reliabilities. In addition, the researcher used correlation and standard multiple regression to test the hypothesized model. Specifically, correlation analysis examined the relationship between all the study variables and multiple regression tested the predictive strength of the study variables.
The researcher used the Sobel test for mediation to test for the significance of the mediation relationships.

5.2 Results of the Study

This section presents information about the data preparation processes for quantitative analysis using multiple regression techniques. The section begins with descriptive results of smallholder farmers’ personal, farming and information acquisition data. It also includes results for normality and correlation results of all the study variables. Next, the researcher tested the research hypotheses to determine significant relationships between the study variables.

5.2.1 Descriptive Statistics of Smallholder Farmers’ Background Factors

This section provides results on personal, farming and information acquisition characteristics of respondents. This section has three parts. all three subsections provide details of these background factors.

5.2.1.1 Personal Characteristics of Smallholder Farmers

Smallholder farmers’ age, gender, educational level, farming experience and household membership represents their personal characteristics. Table 8 below presents results on personal factors.
Table 8: Summary Descriptive Statistics on Farmers’ Personal Characteristics

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CATEGORIES</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td>38</td>
<td>12.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience (yrs)</td>
<td></td>
<td>13</td>
<td>9.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household mem.</td>
<td></td>
<td>11</td>
<td>7.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>162</td>
<td>62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>98</td>
<td>38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>No Formal Edu</td>
<td>210</td>
<td>80.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary/JSS</td>
<td>33</td>
<td>12.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sec/Voc./Tech.</td>
<td>13</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Degree</td>
<td>4</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey (2017)

From table 8 above, most of the smallholder farmers surveyed were males. Specifically, 62% of the respondents were males while 38% were female. The youngest farmer in the study was 20 and the oldest was 65. The study found the average age of the smallholder farmers to be 38. The educational level of the farmers ranged from “no formal education” to “diploma or degree”. Eighty-one (81) per cent of the respondents have no formal education, followed by those with basic education, secondary/technical, or vocational education and those with a diploma or bachelor’s degree. The experienced farmer had farming experience of 46 years and the least experienced has 3 years. On average, respondents had over 12 years of farming experience. The household size
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ranged from zero to 38 with a mean of 11 persons per household, which is about the
same as the district average household size of 10 persons in the 2010 census (GSS,
2014).

5.2.1.2 Farming Characteristics of the Smallholder Farmers
In addition to personal information, the study assessed the farming characteristics of
the farmers. These factors include farm size, type of crops and innovation mainly
adopted as well as access to credit and subsidies. Table 9 below provides results on the
farming data of the smallholder farmers.
Table 9: Summary of Descriptive Statistics on Farmers’ Farming Characteristics

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CATEGORIES</th>
<th>FREQUENCY</th>
<th>PERCENTAGE (%)</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Size</td>
<td>Maize</td>
<td>4.62</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rice</td>
<td>1.04</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soybeans</td>
<td>2.67</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crops</td>
<td>Maize (only)</td>
<td>21</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rice (only)</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soybeans (only)</td>
<td>8</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Any two</td>
<td>163</td>
<td>63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All three</td>
<td>68</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovations</td>
<td>No innovation</td>
<td>11</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Row planting</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improved seeds</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agrochemicals</td>
<td>220</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Any two innovations</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All three innovations</td>
<td>16</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidies</td>
<td>Yes</td>
<td>142</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>118</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credit</td>
<td>No</td>
<td>183</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cash</td>
<td>52</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>In-kind</td>
<td>13</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Both cash and in-kind</td>
<td>12</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey (2017)
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From table 9 above, the type of crops produced ranged from maize, rice and soybeans. More than half of the smallholder farmers 62.7% produced a combination of two crops. That is, they mostly cultivated maize with rice or maize with soybeans. Nearly 30% of the smallholder farmers cultivated all three crops. About 8% and 3% of the smallholder farmers did only maize and soybeans respectively. In terms of farm size, the average maize, rice and soybeans farms were 4 acres, 1 acre and 3 acres respectively. This means that a farmer who produced all three crops is likely to do a total acreage of 7 acres or more.

In addition, the type of innovation used ranged from “no innovation” to “all three innovations”. A very good majority of the smallholder farmers (84.7 %) often applies fertilizer to their farms but do not adopt row planting and improved seeds. About 6.2 % of the farmers adopted all three innovations and 4.2 % applied no innovation at all. Very few farmers adopted row planting (2.3 %) and improved seeds (1.2) only. Besides, close to half of the smallholder farmers (45.4%), do not receive government subsidies at least once per year and most of the participating farmers (70.4%) do not have access to credits. For the farmers who can access credit, 20% of them received in cash and 5% received in kind.

5.2.1.3 Information Acquisition Sources of the Smallholder Farmers

Acquisition of information refers to sources where farmers mostly acquire knowledge and skills about best agricultural practices. These sources include farmer-based associations, workshops, technical visits and association with commercial farmers. Table 10 below provides results on the information acquisition sources of the smallholder farmers.
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Table 10: Summary Statistics of Farmers’ Information Acquisition Sources

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>CATEGORIES</th>
<th>FREQUENCY</th>
<th>PERCENTAGE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Assistance</td>
<td>No</td>
<td>25</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td>Government</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>NGO’s</td>
<td>169</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Some of the above</td>
<td>59</td>
<td>22.7</td>
</tr>
<tr>
<td>Farming Workshops</td>
<td>Yes</td>
<td>207</td>
<td>79.6</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>53</td>
<td>20.4</td>
</tr>
<tr>
<td>Association Membership</td>
<td>Yes</td>
<td>185</td>
<td>71.2</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>75</td>
<td>28.8</td>
</tr>
<tr>
<td>Link to Nucleus Farmer</td>
<td>Yes</td>
<td>143</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>117</td>
<td>45</td>
</tr>
</tbody>
</table>

Source: Field survey (2017)

From table 10 above, more than half of the respondents (65%) receive technical assistance from NGO’s or other agricultural development organizations. Nearly 10% of the farmers did not receive any technical assistance in their farming activities. However, close to 80% of the farmers indicated that they participate in farming workshops and on-farm demonstrations or trial activities. In terms of social network and getting information about improved agricultural innovations, most of the
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respondents (71.2%) belong to farmer associations with half of them (55 %) linked to a nucleus (commercial) farmer.

5.2.3 Reliability and Normality Test for Study Variables

Normality is the degree to which sample data are consistent with a normal distribution (Field, 2013). Normality of data is preferred for the use of parametric tests and requires the inspection of the skewness and kurtosis values of the study variables. The study conducted normality and reliability checks for all the psychological constructs in the study. Table 11 below presents the results of the analysis.

Table 11: Summary of Normality and Reliability

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>MEAN</th>
<th>SD</th>
<th>SKEWNESS</th>
<th>KURTOSIS</th>
<th>ALPHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATT</td>
<td>28.38</td>
<td>2.66</td>
<td>-3.90</td>
<td>22.65</td>
<td>0.84</td>
</tr>
<tr>
<td>SBN</td>
<td>18.65</td>
<td>2.51</td>
<td>-1.89</td>
<td>4.01</td>
<td>0.78</td>
</tr>
<tr>
<td>PBC</td>
<td>25.70</td>
<td>5.71</td>
<td>-0.04</td>
<td>-0.70</td>
<td>0.71</td>
</tr>
<tr>
<td>BBs</td>
<td>160.87</td>
<td>27.95</td>
<td>-0.93</td>
<td>1.31</td>
<td>0.80</td>
</tr>
<tr>
<td>NBs</td>
<td>190.03</td>
<td>57.66</td>
<td>-1.09</td>
<td>0.04</td>
<td>0.92</td>
</tr>
<tr>
<td>CBs</td>
<td>219.28</td>
<td>31.90</td>
<td>-1.33</td>
<td>2.62</td>
<td>0.88</td>
</tr>
<tr>
<td>INT</td>
<td>23.61</td>
<td>4.21</td>
<td>-1.39</td>
<td>2.92</td>
<td>0.90</td>
</tr>
<tr>
<td>RSATT</td>
<td>50.30</td>
<td>7.61</td>
<td>-0.44</td>
<td>-1.00</td>
<td>0.66</td>
</tr>
<tr>
<td>PSYCWBB</td>
<td>48.34</td>
<td>5.72</td>
<td>-1.19</td>
<td>1.15</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Source: Field survey (2017) n=260

Note. ATT= Attitude towards Improved Agricultural Innovations; SBN= Subjective Norm; PBC=Perceived Behavioural Control; BBs= Behavioural Beliefs; NBs= Normative Beliefs; CBs= Control Beliefs; INT=Intention to adopt RSATT= Risk Attitude; PSYCWBB= Psychological Wellbeing.
Psychological determinants and innovation adoption

From table 11 above, the skewness and kurtosis scores of the variables indicate that most of them are within the acceptable range of +2 to -2 and +3 to -3 respectively (Doane & Seward, 2011; Tabachnick & Fidell, 2007). This suggests that the data distribution for most of the study variables do not severely deviate from normal and meet the requirement for the use of parametric tests. The variables with normal distribution scores are the subjective norm, perceived behavioural control, adoption expectation beliefs, adoption referent beliefs, and adoption facilitator beliefs as well as intention to adopt innovations, risk attitude and psychological wellbeing. The only variable that had skewness and kurtosis values beyond the preferred range of normality was the attitude. However, it was included in the final analysis based on the recommendation of Field (2013). According to him, studies using a sample size of 200 or more could take for granted the importance of the skewness and kurtosis values. Thus, the psychological constructs used in the study do not severely violate the normality assumption. In the case of any violation, as pointed out earlier, the study took it for granted due to the sample size of 260 participants and expected not to cause any serious threat in the final analysis (Hair, Black, Babin, & Anderson, 2010).

Table 11 above also reveals the reliability coefficients for the measurement instruments used in the data collection. The reliabilities of the scales ranged from moderate (0.66) to high (0.92) (Wells & Wollack, 2003). Among the scales that recorded very high reliabilities are an intention to adopt, adoption referent beliefs, adoption expectation beliefs, adoption facilitator beliefs, attitude, subjective norm, psychological well-being and perceived behavioural control. Risk attitude was the only measurement instruments that recorded moderate reliability (0.66).
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5.2.4 Correlation Matrix of Psychological Constructs in the Study

As part of the preliminary analysis, the study correlated all the psychological constructs with each other using the Persons r correlation to check for multicollinearity. Multicollinearity is a condition in which two variables strongly correlates and may be doing the same thing (Hair et al., 2010; Field, 2013). Table 12 below presents the results of the correlation matrix.
Table 12: Correlation Matrix of Psychological Constructs in the Study

<table>
<thead>
<tr>
<th>NO</th>
<th>VARIABLES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ATT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SBN</td>
<td>0.25**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PBC</td>
<td>0.17**</td>
<td>0.37**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BBs</td>
<td>0.42**</td>
<td>0.28**</td>
<td>0.40**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>NBs</td>
<td>0.34**</td>
<td>0.53**</td>
<td>0.27**</td>
<td>0.25**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CBs</td>
<td>0.12</td>
<td>0.33**</td>
<td>0.15**</td>
<td>0.29**</td>
<td>0.28**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>INT</td>
<td>0.27**</td>
<td>0.30**</td>
<td>0.18**</td>
<td>0.21**</td>
<td>0.49**</td>
<td>0.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>PSYCWB</td>
<td>0.18**</td>
<td>0.32**</td>
<td>0.15**</td>
<td>0.23**</td>
<td>0.49**</td>
<td>0.23**</td>
<td>0.36**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>RSATT</td>
<td>0.00</td>
<td>0.12*</td>
<td>-0.08</td>
<td>-0.13*</td>
<td>0.45**</td>
<td>0.11</td>
<td>0.31**</td>
<td>0.45**</td>
<td></td>
</tr>
</tbody>
</table>

Note: n=260, * p < 0.05; ** p < 0.01

Note. ATT= Attitude towards Improved Agricultural Innovations; SBN= Subjective Norm; PBC=Perceived Behavioural Control; BBs= Behavioural Beliefs; NBs= Normative Beliefs; CBs= Control Beliefs; INT=Intention to adopt improved agricultural innovations; RSATT= Risk Attitude; PSYCWB= Psychological Wellbeing.
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From Table 12 above, the results show that most of the psychological constructs used in the study significantly correlate positively with each other. The correlation coefficients varied from weak ($r=0.04$) to moderate ($r=0.53$). The size of the correlations suggests no issue with multicollinearity. Of interest is the correlation between the indirect measures of the TPB constructs and their corresponding direct measures. For instance, attitude correlated significantly and positively with the measure of the behavioural belief ($r=0.42$). Likewise, subjective norm and the normative beliefs measure correlated well ($r=0.53$). Perceived behavioural control (PBC) and the control beliefs measure ($r=0.15$) also correlated significantly. Subjective norm correlated with all the study variables. Besides, the intention to adopt improved agricultural innovations correlated with the entire study variables except for the control beliefs measure. Overall, the correlations among the study variables were significant. Thus, the study used all the variables in the final analysis.

5.2.5 Hypothesis Testing

The study tested five main hypotheses to determine the relationships between the adoption intention, attitudes, subjective norm, perceived behavioural control and the three salient beliefs. The following sections present the results from the analysis of these hypotheses.

5.2.3.1 Hypothesis 1: Attitude, Subjective Norm, Perceived Behavioural Control and Intention to adopt Improved Agricultural Innovations.

In consultation with extant literature, the study hypothesized that attitude, subjective norms and perceived behavioural control will predict intention to adopt improved agricultural innovations. Specifically, it states that:
Psychological determinants and innovation adoption

**H1a.** Attitude towards the improved agricultural innovations will significantly predict adoption intention.

**H1b.** Subjective norm will significantly predict intention to adopt improved agricultural innovations.

**H1c.** Perceived behavioural control will significantly predict intention to adopt improved agricultural innovations.

The above hypothesis was tested using multiple regression techniques in SPSS. In this case, the intention to adopt the three improved innovations was regressed on attitude, subjective norm and perceived behavioural control. The table below presents a summary of the results.

Table 13: Summary Coefficients of Attitude, Subjective Norms, Perceived Behavioural Control and Intention to Adopt Innovations.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>T</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Constant</td>
<td>6.93</td>
<td>2.77</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Attitude</td>
<td>0.32</td>
<td>0.10</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Subjective norms</td>
<td>0.38</td>
<td>0.11</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>Perceived behavioural control</td>
<td>0.05</td>
<td>0.05</td>
<td>0.06</td>
</tr>
</tbody>
</table>

a. Dependent variable: Intention to adopt agricultural innovations
b. $F = 13.03, R^2 = 0.12, \,* p<0.05, \,**p<0.01$
Psychological determinants and innovation adoption

The results in Table 13 above shows that subjective norms (β = 0.23, \( p < .01 \)) has the highest influence on intention to adopt improved agricultural innovations, followed by attitude (β = 0.20, \( p < .01 \)). Perceived behavioural control (β = 0.06, \( p > .05 \)) did not show a significant effect on intention to adopt improved agricultural innovations. The model \( R^2 \) was 0.12, indicating that attitude, subjective norm and perceived behavioural control combine to explain 12% of the variations in intention to adopt improved agricultural innovations in the next planting season.

The results largely support the research hypotheses that attitude, subjective norm and perceived behavioural control will predict intention to adopt improved agricultural innovations (specifically, row planting, improved seeds and fertilizer). Except that, perceived behavioural control did not significantly predict intention to adopt agricultural innovations. Therefore, the results supported hypotheses 1a and 1b but rejected hypothesis 1c.

5.2.3.2 Hypothesis 2: Behavioural Belief, Normative Belief, Control Belief and Intention to Adopt Improved Agricultural Innovations.

The second hypothesis examined the effect of adoption expectation, referent and facilitator beliefs on the intention to adopt improved agricultural innovations. The hypothesis specifically stated that:

- **H2a.** Behavioural beliefs will directly predict intention to adopt improved agricultural innovations.
- **H2b.** Normative beliefs will directly predict intention to adopt improved agricultural innovations.
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H2c. Control beliefs will directly predict intention to adopt improved agricultural innovations.

The study tested all three sub-hypotheses with the multiple regression techniques in SPSS. The analysis regressed intention to adopt improved agricultural innovations on behavioural beliefs, normative beliefs and control beliefs. Table 14 below provides a summary of the multiple regression results.

Table 14: Summary Coefficients of Behavioural Beliefs, Normative Beliefs, Control Beliefs and Intention to Adopt Improved Agricultural Innovations.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>T</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Constant</td>
<td>16.08</td>
<td>1.85</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Behavioural Beliefs</td>
<td>0.02</td>
<td>0.01</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Normative Beliefs</td>
<td>0.04</td>
<td>0.04</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Control Beliefs</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.06</td>
</tr>
</tbody>
</table>

a. Dependent variable: Intention to adopt improved agricultural innovations
b. $F = 28.58$, $R^2 = 0.25$, *p<.05, **p<0.01

From table 14 above, normative beliefs ($\beta = 0.48$, $p < .01$) which is an indirect measure of subjective norm strongly influenced the intention to adopt improved agricultural innovations. However, behavioural beliefs ($\beta = 0.11$, $p > .05$) and Control beliefs ($\beta = -0.06$, $p > .05$) which are indirect measures of attitude and perceived behavioural control respectively did not significantly predict intention to adopt agricultural innovations. The
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model $R^2$ was 0.25 which indicates that behavioural beliefs, normative beliefs and control beliefs combined, explain 25% of the variations in intention to adopt improved agricultural innovations in the coming planting season.

The results partially support the research hypotheses in that normative beliefs predict intention to adopt improved agricultural innovations. However, behavioural beliefs and control beliefs did not significantly predict the intention to adopt innovations. This suggests that the results support hypothesis 2b and rejects hypotheses 2a and 2b.

5.2.3.3 Hypothesis 3: Mediation of Attitude, Subjective Norm and Perceived Behavioural Control in the Relationship between Behavioural, Normative, Control Beliefs and Intention to Adopt Improved Agricultural Innovations Respectively.

The third hypothesis examined the mediation role of attitude, subjective norm and perceived behavioural control in the relationship between behavioural, normative and control beliefs and intention to adopt improved agricultural innovations. The study specifically stated the hypotheses as:

**H3a.** Attitude will significantly mediate the relationship between behavioural belief and intention to adopt improved agricultural innovations.

**H3b.** Subjective norm will significantly mediate the relationship between normative belief and intention to adopt improved agricultural innovations.

**H3c.** Perceived behavioural control will significantly mediate the relationship between control belief and the intention to adopt improved agricultural innovations.
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The third hypothesis is mediation. Mediation is a hypothesized causal effect in which one variable (independent) affects a second variable (mediator) which in turn affects a third variable (dependent) (Baron & Kenny, 1986). This suggests that the mediator variable mediates the relationship between the independent and the dependent variables. To conduct the mediation analysis, the study followed the four-step approach proposed by Baron and Kenny (1986). Using this approach, the study conducted a series of regression analysis and inspected the significance of the coefficients at each stage to determine the mediation effect. The four-stage mediation analysis approach is as follows:

1. Conduct a simple regression analysis with the independent variable predicting the dependent variable.
2. Conduct a simple regression analysis with the independent variable predicting the mediator.
3. Conduct a simple regression analysis with the mediator predicting the dependent variable.
4. Conduct a multiple regression analysis with the independent variable and mediator predicting the dependent variable.

Table 15 below presents a summary of the mediation results after going through the four-step approach. The study completed the analysis by running the Sobel test to establish the significance of the mediation effects.
Psychological determinants and innovation adoption

Table 15: Summary of the Mediation Results

<table>
<thead>
<tr>
<th>Relationships</th>
<th>Unstandardized Coefficients</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IV &amp; Mediator</td>
<td>Mediator &amp; DV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>B</td>
</tr>
<tr>
<td>BB – ATT – INT</td>
<td>0.42</td>
<td>0.01</td>
<td>0.27</td>
</tr>
<tr>
<td>NB - SN - INT</td>
<td>0.53</td>
<td>0.00</td>
<td>0.30</td>
</tr>
<tr>
<td>CB – PBC – INT</td>
<td>0.15</td>
<td>0.01</td>
<td>0.18</td>
</tr>
</tbody>
</table>

**p<0.01

Note. ATT= Attitude towards Improved Agricultural Innovations; SN= Subjective Norm; PBC=Perceived Behavioural Control; BB= Behavioural Beliefs; NB= Normative Beliefs; CB= Control Beliefs; INT=Intention to adopt improved agricultural innovations

Table 15 above shows that the Sobel test statistic was significant for the three separate mediation analysis. Specifically, the results from the analysis indicate that attitude (t = 2.82, p < 0.01) serves as a significant mediator between behavioural beliefs and intention to adopt improved agricultural innovations. Likewise, subjective norm (t = 2.98, p < 0.01) mediates the relationship between normative beliefs and intention to adopt the innovations. Furthermore, perceived behavioural control (t = 3.83, p < 0.01) significantly mediates the relationship between control beliefs and intention to adopt improved agricultural innovations. The analysis suggests a full mediation for attitude and perceived behavioural control as well as a partial mediation for the subjective norm.

The results from the analysis fully support the research hypotheses that attitude will mediate the relationship between behavioural beliefs and intention to adopt improved agricultural innovations. Subjective norm will mediate the relationship between normative beliefs and intention to adopt improved agricultural innovations. Moreover,
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perceived behaviour control will mediate the relationship between control beliefs and
intention to adopt improved agricultural innovations. Therefore, the results of the study
support hypotheses 3a, 3b and 3c.

5.2.3.4 Hypothesis 4: Farmer Characteristics and Beliefs about Improved
Agricultural Innovations.

The fifth hypothesis of the study examined the effect of six farmer background
c characteristics on the three salient beliefs about improved agricultural innovations. The
six farmer background characteristics are age, gender, farming experience, household
size, farm size and annual average bags of crops produced. The hypothesis states:

H4a. The six farmer background factors will significantly affect behavioural
belief about improved agricultural innovations.

H4b. The six farmer background factors will significantly affect normative belief
about improved agricultural innovations.

H4c. The six farmer background factors will significantly affect control belief
about improved agricultural innovations.

The study used the multiple regression method in SPSS to assess this hypothesis. The
table 16 below shows the summary of the multiple regression results.
Table 16: Summary Coefficients of the Effect of Six Farmer Characteristics on Behavioural Beliefs

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Constant</td>
<td>160.43</td>
<td>6.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>0.06</td>
<td>0.19</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Farming experience</td>
<td>-0.14</td>
<td>0.24</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>Household members</td>
<td>0.02</td>
<td>0.25</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>-5.88</td>
<td>4.21</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>Farm size</td>
<td>0.58</td>
<td>0.55</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Annual Ave. bags of crops</td>
<td>-0.05</td>
<td>0.10</td>
<td>-0.05</td>
</tr>
</tbody>
</table>

Table 16 above shows that the six farmer characteristics tested did not have any significant effect on behavioural beliefs. The model $R^2$ was 0.55, which is not significant. The results fully reject the hypothesis that farmer background characteristics will significantly affect behavioural beliefs about row planting, improved seeds and fertilizer. Thus, the results of the analysis reject hypothesis 4a.
Table 17: Summary Coefficients of the Effect of Six Farmer Characteristics on Normative Beliefs

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Constant</td>
<td>183.66</td>
<td>12.80</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>-0.71</td>
<td>0.37</td>
<td>-0.16</td>
</tr>
<tr>
<td></td>
<td>Farming experience</td>
<td>0.66</td>
<td>0.48</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Household size</td>
<td>1.38</td>
<td>0.51</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>-7.20</td>
<td>8.43</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td>Farm size</td>
<td>2.72</td>
<td>1.10</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Annual Ave. bags of crops</td>
<td>-0.34</td>
<td>0.20</td>
<td>-0.16</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Normative Beliefs
b. $F = 3.30$, $R^2 = 0.07$, * $p<.05$, ** $p<0.01$

The results provided in Table 17 above shows that four farmer background characteristics namely, age, farming experience, gender and annual average bags of crops produced did not significantly affect normative beliefs about improved agricultural innovations. However, two variables: household size ($\beta = 0.19$, $p < .05$) and farm size ($\beta = 0.24$, $p < .05$) significantly affected normative beliefs of smallholder farmers about improved agricultural innovations. The model $R^2$ was 0.07, which indicates that all the six variables combined; explain 7% of the variations in normative beliefs about improved agricultural innovations.
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The results suggest that smallholder farmers from large households and those with large farms are more likely to comply with the views of salient referents on the adoption of improved agricultural innovations. The results partially support hypothesis 4b that all the six farmer background characteristics will significantly affect normative beliefs about improved innovations.

Table 18: Summary Coefficients of the Effect of Six Farmer Characteristics on Control Beliefs

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>t</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Constant</td>
<td>204.70</td>
<td>7.21</td>
<td>28.39</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>0.38</td>
<td>0.21</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Farming experience</td>
<td>-0.27</td>
<td>0.27</td>
<td>-0.08</td>
</tr>
<tr>
<td></td>
<td>Household members</td>
<td>-0.42</td>
<td>0.29</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>10.47</td>
<td>4.75</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Farm size</td>
<td>0.61</td>
<td>0.62</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Annual Ave. bags of crops produced</td>
<td>-0.13</td>
<td>0.11</td>
<td>-0.11</td>
</tr>
</tbody>
</table>

a.  Dependent Variable: Control Beliefs
b.  F = 1.69, R² = 0.04, * p<.05, **p<0.01

Table 18 above indicates that all the six farmer background characteristics except gender did not significantly affect control beliefs. Gender (β = 0.16, p < .05) significantly affected control beliefs which suggest that men compared to women smallholder farmers are more likely to believe in the presence of factors which could impede or facilitates the
adoption of improved agricultural innovations. The model $R^2$ was 0.04, which was not statistically significant. The results largely reject the hypothesis that farmer background characteristics will significantly affect control beliefs about improved agricultural innovations. Therefore, the results of the analysis largely reject hypothesis 4c.

5.2.3.5 Hypothesis 5: Psychological Wellbeing, Risk Attitude and Beliefs about Improved Agricultural Innovations.

This hypothesis examined the effect of psychological wellbeing and risk attitude on the salient beliefs about row planting, improved seeds and fertilizer. The hypothesis states that:

**H5a.** Psychological well-being and risk attitude will significantly affect the behavioural belief about improved agricultural innovations.

**H5b.** Psychological well-being and risk attitude will significantly affect the normative belief about improved agricultural innovations.

**H5c.** Psychological well-being and risk attitude will significantly affect the control belief about improved agricultural innovations.

The study used the multiple regression method in SPSS to assess this hypothesis. Table 19 below shows the summary of the multiple regression results.
It is evident from Table 19 above that psychological wellbeing ($\beta = 0.36, p < .01$) and risk attitude ($\beta = -3.61, p < .05$) significantly influence behavioural beliefs. Whereas psychological wellbeing affects behavioural beliefs positively, risk attitude had a negative effect. The $R^2$ model was 0.10, which means that psychological well-being and risk attitude combined, explain 10% of the variance in behavioural beliefs.

The results suggest that the better the psychological wellbeing of the smallholder farmers, the more likely they will form positive beliefs about the outcomes of improved agricultural innovations. On the other hand, the greater the risk attitude of the smallholder farmers, the more likely they will have negative beliefs about improved agricultural innovations. Therefore, the results of the analysis support the hypothesis 5a that psychological well-being and risk attitude will have a significant effect on behavioural beliefs about improved agricultural innovations.
On the normative belief, results presented in Table 20 above shows that psychological wellbeing ($\beta = 0.34, p < .01$) and risk attitude ($\beta = 0.30, p < .01$) have significant effect on normative beliefs. The results also show that psychological wellbeing has the greatest effect compared to risk attitude. The model $R^2$ was 0.31, which means that psychological well-being and risk attitude combined, explain 31% of the variance in the normative belief about the innovations.

The results suggest that smallholder farmers with better psychological well-being are more likely to have positive views about their salient referents in connection to innovation adoption. Again, smallholder farmers with high-risk attitude are more likely to positively view the opinions of salient referents on issues innovation adoption. Thus, the results of the analysis support hypothesis 5b that psychological well-being and risk attitude will have a significant effect on a normative belief about improved agricultural innovations.
Table 21: Summary Coefficients of Psychological Wellbeing, Risk Attitude and Control Beliefs

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficient</th>
<th>T</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 Constant</td>
<td>141.60</td>
<td>20.53</td>
<td>6.899</td>
<td>0.00</td>
</tr>
<tr>
<td>Psychological wellbeing</td>
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<td>0.38</td>
<td>0.21</td>
<td>2.986</td>
</tr>
<tr>
<td>Risk attitude</td>
<td>0.15</td>
<td>0.29</td>
<td>0.04</td>
<td>0.525</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Control Beliefs
b. $F = 7.27$, $R^2 = 0.05$, **$p<.01$, *$p<.05$

From table 21 above, only psychological well-being ($\beta = 0.21, p < .01$) significantly influence the control belief about improved innovations. The model $R^2$ was 0.05, which suggest that the combined effect of psychological wellbeing and risk attitude explain 5% of the variance in control beliefs about agricultural innovations. The results suggest that smallholder farmers with better psychological well-being are more likely to believe in the presence of inhibiting or facilitating factors identified and are also confident in their ability to overcome the issues in order to successfully adopt improved agricultural innovations. Therefore, the study partially supports hypothesis 5c which states that psychological well-being and risk attitude will significantly affect control beliefs about improved agricultural innovations.

5.2.4 Summary of study two Findings

In this quantitative study, five (5) main hypotheses with fifteen (15) sub-hypotheses were tested to determine the relationship between farmer characteristics, salient beliefs,
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attitude, subjective norm, perceived behavioural control and intention to adopt improved agricultural innovations (specifically, row planting, improved seeds and fertilizer).

First, the study established that attitude and subjective norm significantly predicts intention to adopt agricultural innovations. However, perceived behavioural control did not predict adoption intention. Hence, two (H1a and H1b) out of the three sub-hypotheses under hypothesis 1 were supported while the remaining hypothesis (H1c) was rejected. In all, subjective norm predicted intention better than the attitude towards improved agricultural innovations.

Secondly, the study found out that normative beliefs which served as an indirect measure for subjective norms significantly predicted adoption intention. On the other hand, behavioural beliefs and control beliefs, which represent indirect measures for attitude and perceived behavioural control respectively, did not predict the intention to adopt agricultural innovations. Thus, the results supported only one of the sub-hypotheses (H2a) under hypothesis two. The results rejected the other two sub-hypotheses (H2a and H2c).

Thirdly, the study found that attitude fully mediated the relationship between behavioural belief and adoption intentions. Besides, the study established that subjective norm partially mediated the relationship between normative belief and adoption intentions. Similarly, the study found a full mediation for perceived behavioural control in the relationship between control belief and adoption intentions. Therefore, the results supported all three sub-hypotheses of hypothesis three.
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Furthermore, the study tested six farmer background characteristics to determine their effects on all three salient beliefs. These farmer characteristics include age, gender, farming experience, farm size, annual average bags produced and household size. The results found that none of the farmer background factors had a significant effect on behavioural beliefs. However, farm size and household size had a significant influence on normative beliefs, whiles gender significantly influence the control beliefs about improved agricultural innovations. Therefore, the results from the analysis largely rejected hypothesis four in that the results wholly rejected hypothesis 4a and partly supported hypotheses 4b and 4c.

Finally, in terms of hypothesis five, the study found psychological wellbeing and risk attitude to influence behavioural and normative beliefs significantly. However, with control belief, the study did not find a significant effect of risk attitude but for psychological wellbeing. As a result, the results from the analysis fully supported hypotheses 5a and 5b but partly supported hypothesis 5c.

5.3 Discussion of Study 2 Results

The primary objective of this study was to identify the main psychological factors that influence the intention to adopt improved agricultural innovations among smallholder farmers in Northern Ghana. The study used the TPB as the main theoretical framework to explain the adoption intention of smallholder farmers. The study formulated and tested five main hypotheses using the multiple regression method in SPSS. In this section, the discussion focuses on the findings associated with the relationships between the TPB variables, farmer characteristics, psychological wellbeing and risk attitude. The study discusses the main findings with reference to literature and theory.
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First, the study hypothesized that attitude, subjective norm and perceived behavioural control will significantly predict intention to adopt improved agricultural innovations (row planting, improved seeds and fertilizer). The results from the analysis showed that attitude and subjective norm significantly predicted adoption intention but not perceived behavioural control. This suggests that the results largely supported the first hypothesis. Besides, the predictive power of subjective norm over attitude means that Ghanaian smallholder farmers’ intention to adopt agricultural innovations is influenced more by perceived social pressure than attitude. The study seems to suggest that among smallholder farmers in Northern Ghana, at least for those used in this study, the opinions of salient referents around them about their farming activities is important. Their favourable or unfavourable intention to adopt agricultural innovations is a function of the strength of the perceived social pressure from significant others.

The finding that subjective norm, followed by attitude significantly predict intention to adopt improved innovations is consistent with the results of some previous studies (e.g. Ambrosius et al., 2015; Borges & Lansink, 2016; Hansson et al., 2012; Hunecke et al., 2017; Gebrezgabher et al., 2015; Lalani et al., 2016). While some of the studies cited above found subjective norm to predict intention better than attitude, others also found the attitude to predict intention to adopt agricultural innovations better than the subjective norm. In the case of Hansson et al. (2012), they found both attitude and subjective norm to predict farmer decisions regarding innovation adoption significantly. Besides, Borges and Lansink (2016) conducted a study among Brazilian cattle farmers to identify the psychological determinants that influence the intention to adopt improved natural grassland. The study found subjective norm as the main predictor of farmers’ intentions to adopt improved natural grassland compare to perceived behavioural control and
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attitude. The findings of these studies suggest mixed results of the impact of subjective norm on farmers’ intention to adopt agricultural innovations. Differences in cultural settings could be the reason for the mixed results (Ivancevich, Konopaske, & Matteson, 2005).

The greater influence of subjective norm on adoption intention suggests that perceived social pressure and the opinion of salient referents play a significant role in the decision to adopt agricultural innovations among smallholder farmers in Northern Ghana. This is in line with the views of Martinez-Gracia et al. (2013), who studied small-scale dairy farmers in central Mexico and observed that farmers may appreciate the views of significant others in society because they want to demonstrate a commitment to shared cultural values and attract social approval. Smallholder farmers in Northern Ghana tend to value the opinion of others to ensure that their behaviour concurs with the social norms. This also seems to provide a sense of security against any uncertainty about the adoption of improved agricultural innovations. This suggests that the behaviour of smallholder farmers in Northern Ghana is not exclusive of their cultural and social values; rather they frequently check their behaviour with an important reference group (Burton, 2004). As Borges et al. (2014) rightly pointed out, smallholder farmers are more likely to be motivated to adopt agricultural innovations by the social pressure to do so even if they have an unfavourable attitude towards the innovations.

Apart from the main impact of subjective norm, the study also found the attitude to influence smallholder farmers’ intention to adopt agricultural innovations (row planting, improved seeds and fertilizer). This means that a positive attitude towards improved agricultural innovations strengthened the farmers’ intention to adopt these innovations at
least on some part of their farms. Ghanaian smallholder farmers live in rural communities, which are collectivistic in nature. These farmers have a community orientation where the opinions of others override individual viewpoints. Therefore, differences in cultural orientation could explain the relatively less impact of attitude on the adoption intention of Ghanaian smallholder farmers. For instance, Garforth et al. (2006) studied English farmers who belong to an individualistic culture and found the attitude to be more impactful in their intention to adopt innovations to improve oestrus detection in dairy herds. On the other hand, Ramayah, Lee and Lim (2012) in a study of recycling behaviour in Malaysia, a collectivistic culture, found a stronger effect of the subjective norm.

However, the results showed no significant influence of perceived behavioural control on smallholder farmers’ intention to adopt the three innovations. This suggests that the perception of smallholder farmers’ in Northern Ghana about their ability to adopt agricultural innovations does not influence their intention. This does not resonate with the findings of previous studies (Borges & Lansink, 2016; de Leeuw et al., 2015; Greaves, Zibarras, & Stride, 2013; Han, Hsu & Sheu, 2010; Ramayah et al., 2012) who validated the entire TPB model, in that all the three constructs (attitude, subjective norm and perceived behavioural control) were significant. Thus, the study failed to establish the influential role of perceived behavioural control on behavioural intention as espoused by the TPB. Nevertheless, the result is consistent with previous studies that used the TPB and at least one of the constructs was not significant. (Knussen, Yule, MacKenzie & Wells, 2004; Tonglet, Phillips & Read, 2004; Yazdanpanah, Hayati, Hochrainer-Stigler & Zamani, 2014). Interestingly, the results validate the theory of reason action (TRA) (Fishbein & Ajzen, 2011), an antecedent of the TPB. This means that in explaining smallholder farmers’ intention to adopt improved innovations using the three
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psychological constructs, the TRA offers a more parsimonious explanation compared to the TPB.

In the second hypothesis of the study, it was expected that the indirect measures of the three TPB variables (ie. behavioural beliefs, normative beliefs and control beliefs) will directly predict intentions to adopt improved agricultural innovations. According to Borges et al. (2016), “from a measurement perspective, the multiplicative composite beliefs based on expectancy-value models are causal indicators of their respective constructs” (p.199). This suggests that behavioural, normative and control belief measures could serve as indirect measures of attitude, subjective norm and perceived behavioural control constructs of the TPB. The effect of these salient beliefs provides a more specific means of improving the adoption intention for improved agricultural innovations.

The study found normative beliefs to predict intention to adopt improved agricultural innovations. However, behavioural beliefs and control beliefs did not directly influence the intention to adopt innovations. This means that the specific referents identified by the smallholder farmers influence their intentions and decisions. These referents include lead farmers, nucleus farmers, colleague farmers, family members and the extension officers from government and ADVANCE project. The study found that the most important referent to be the nucleus/commercial farmer, especially within the study setting. Smallholder farmers, including lead farmers in Northern Ghana, look up to the nucleus farmer for agricultural inputs and services in most cases on credit. In this case, nucleus farmers tend to have a power relationship with the smallholder farmers. Thus,
smallholder farmers are prone to comply with the opinions of the nucleus farmer on the adoption of agricultural innovations.

The findings of the study are inconsistent with previous studies on the role of normative beliefs in influencing the intention to adopt improved agricultural innovations. For example, Rehman et al. (2007) investigated the factors that influence the uptake of new technology on dairy farms in southwest England using the TPB as a theoretical framework. The study found other farmers and advisors as the important referents who influence the intention of farmers to comply with a prescribed practice for estruses detection in cows. Similarly, Bruijnis, Hogeveen, Garforth and Stassen (2013) in a study among Dutch farmers, found advisors to influence intention to improve the foot health of dairy cows while colleague farmers, family members and friends did not. Again, Martinez-Garcia et al. (2013) found family members, particularly fathers, to influence farmers’ intention to adopt improved natural grassland. Likewise, Borges et al. (2016) found that family and cattle traders are the salient referents who influence farmers’ intention to use improved natural grassland.

A possible explanation for the mixed results on normative beliefs and their influence on farmers’ intention to adopt innovations could be differences in cultures, innovations and decisions (Borges et al., 2014). In this study, the key normative belief is the nucleus farmers who can serve as a medium to influence smallholder farmers’ adoption intention about improved agricultural innovations. For example, extension activities to promote the adoption of agricultural innovations could focus not only on disseminating information about improved agricultural innovations to farmers but also to the nucleus farmers. This intervention would be more effective in creating a stronger adoption
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intention because if nucleus farmers are knowledgeable and informed about the innovations, they are more likely to press on the smallholder farmers to adopt.

The study also postulated that the TPB constructs (attitude, subjective norm and perceived behavioural control) will respectively mediate the relationship between behavioural belief, normative belief, control belief and intention to adopt the three innovations. The study found that all the TBP constructs significantly mediated the relationship between their corresponding beliefs and intentions. This suggests that behavioural belief indirectly influence adoption intentions through attitude towards innovation. Similarly, normative belief indirectly influences adoption intention through the subjective norm. Likewise, control belief indirectly influences adoption intentions through perceived behavioural control. Thus, there was a full mediation for behavioural and control beliefs. However, normative belief had a partial mediation, in that it can directly influence the intention to adopt improved agricultural innovations without the mediating effect of the subjective norm.

In the behavioural belief-attitude model, the study found outcome beliefs such as “increase farm yields” “produce attractive yields” and “hire more labour” to influence smallholder farmers’ evaluation (attitude) of the adoption of improved agricultural innovations. The most significant outcome belief was to “increase farm production (see Appendix). This is not surprising considering that the motivation for these smallholder farmers in Northern Ghana is to ensure household food security. In this regard, intervention strategies that accentuate these three outcomes to the smallholder farmers through extension activities or the nucleus farmer (as this study as shown) will go a long way to increase attitude and intention to adopt improved agricultural innovations (Borges
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The study found two positive outcome beliefs and one negative belief influential in farmers’ attitude toward agricultural innovations. Therefore, extension programs intended to disseminate information about these agricultural innovations could emphasize that these innovations may help smallholder farmers to increase food at home, which is health and quality. The intervention could also demystify the negative view about the innovations by indicating how worthwhile it is to expend a little energy in the adoption of these innovations.

In the normative belief-subjective norm model, the study identified “lead farmers”, “fellow farmers” and “extension officers (ADVANCE or MoFA)” as the beliefs representing the important referents that influence smallholder farmers’ subjective norm to adopt agricultural innovations. This finding suggests the important role of “lead farmers” and “fellow farmers” in influencing intention to adopt agricultural innovations, which could be due to their close interaction with smallholder farmers at a personal and community level. The explanation for the importance of “extension officers (ADVANCE or MoFA)” is that smallholder farmers view them as an important source of technical and scientific information. In the case of officers from the ADVANCE project, they have built demonstration farms in various farming communities to proof to the farmers the benefits of adopting improved agricultural innovations. In addition, they take a personal interest in the farmers’ activities and visit their farms regularly to assist them. Thus, at the grassroots level, smallholder farmers feel persuaded to observe the views of “lead and fellow farmers” as well as extension officers from “ADVANCE or MoFA”. To this end, extension programs can effectively use these three significant others at the rural and grassroots level, to disseminate information about agricultural innovations among smallholder farmers, particularly within the study setting.
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Moreover, in the control belief-perceived behavioural control model, the results revealed that all the six factors identified combined, influence smallholder farmers’ perception about their own capability (perceived behavioural control) to adopt agricultural innovations. The five factors are lack of money to invest, sufficient knowledge, sufficient skills, availability of subsidies and the availability of qualified technical assistance. The study found that these factors on their own have an insignificant effect on perceived behavioural control but had a combined interactive influence on farmers’ perception of their ability to successfully adopt the innovations. A possible explanation for this result is that the participants involved in this study were beneficiaries of the ADVANCE project who appears to receive equal support on these factors to be able to adopt the innovations. Therefore, they were unable to assess their perceived capability to adopt innovations.

Possibly, if the study had used a different group of smallholder farmers who are not beneficiaries of the ADVANCE project, the individual effect of these beliefs could have been significant. Nevertheless, the results have important implications for extension services and interventions. Extension officers through the significant referents found in this study must practically demonstrate the applications and benefits of improved agricultural innovations to smallholder farmers at periodic intervals. The study expects this intervention to enhance smallholder farmers’ adoption intention because if extension officers demonstrate on the field how to apply these innovations, smallholder farmers will be more likely to perceive that they have sufficient knowledge and skills to adopt them.

Most studies on agricultural innovation adoption have often included farmer background factors to determine their influence on adoption decisions and behaviours (Corner-
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Thomas et al., 2015; Gebrezgabher et al., 2015; Ainembabazi & Mugisha, 2014; Gillespie et al., 2014; Ogada et al., 2014; Muzari et al., 2012). Besides, the TPB model posits that any other variable outside the main constructs affects intention and actual behavioural through their influence on the salient beliefs (behavioural, normative and control beliefs) (Ajzen, 2011). In line with this viewpoint, the study hypothesized that six farmer characteristics will influence the behavioural, normative and control beliefs. The six farmer background factors are age, gender, farming experience, farm size, household size and average annual bags of crops produced.

The study found among all the six background factors that gender, household and farm size have a significant influence on at least one of the beliefs. Household and farm size significantly affected normative belief whereas gender significantly influenced control belief. However, none of the background factors affected behavioural belief. This means that the six background factors do not influence smallholder farmers’ beliefs about the positive outcomes of improved agricultural innovations. Moreover, smallholder farmers with relatively bigger farms and households were more likely to believe the opinions of important referents about the adoption of agricultural innovations. Besides, female smallholder farmers were less likely to believe they have control over the main factors needed to adopt improved agricultural innovations successfully.

This finding partially supports the results from previous studies. For example, Martinez-Garcia et al. (2013) found farm size to influence intention but not for age, experience and household size. Similarly, Borges and Lansink (2015) found the household size and farming experience to influence the intention of farmers to adopt improved natural grassland. However, they did not find age and farm size to be significant. Furthermore,
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Lalani et al. (2016) studied smallholder farmers’ motivation to adopt conservation agriculture (CA) in Mozambique and found significant influence for age but not for gender on motivation to use CA. Other studies have found no influence of background factors on adoption intentions and decisions (Bruijnis et al., 2013; Fielding et al., 2005).

The finding that smallholder farmers with bigger farms and or households tend to believe the views of important referents on agricultural innovations is because of their motivation to increase yield to feed the family. They, therefore, seek to benefit from the knowledge and expertise of other successful farmers or extension officers. Moreover, a possible explanation for why female smallholder farmers are less likely to believe they have control over the barriers to innovation adoption is because male farmers have more access to farming inputs and opportunities. Compared to the females, male smallholder farmers in Northern Ghana appears to be the major recipients of subsidies from the government and other agriculture-oriented organizations because of the masculinity culture in the region. These opportunities and cultural privileges make the male smallholder farmers believe they can overcome impeding factors to the adoption of improved agricultural innovations.

Finally, the study advanced that risk attitude and psychological well-being will significantly influence behavioural, normative and control beliefs. The results of the study revealed that risk attitude had a significant influence on behavioural and control beliefs but did not affect normative belief. This means that smallholder farmers with high-risk attitude are more likely to believe that adopting the three innovations lead to favourable outcomes. For instance, they believe that adopting improved agricultural innovations allow them to increase their yields, produce attractive and healthy crops.
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Again, the study found that smallholder farmers with low-risk attitude were significantly more likely to believe that control factors would affect their self-efficacy to adopt improved innovations than those with high-risk attitude. In other words, they think that without money, subsidies, sufficient knowledge and skills and technical assistance they are incapable of successful adoption of improved agricultural innovations.

The results also discovered that psychological wellbeing influenced all the three beliefs (behavioural, normative and control beliefs) significantly. This suggests that smallholder farmers with better psychological well-being were more likely to believe that adopting improved agricultural innovations would lead to a positive outcome such as increasing crop yields and producing attractive crops. Similarly, smallholder farmers with better psychological well-being were more likely to believe the opinion of important referents about the adoption of agricultural innovations. In addition, the finding suggests that smallholder farmers with better psychological well-being were more likely to believe that they can overcome the factors that could affect their ability to adopt innovations.

The finding on the effect of risk attitude on the salient beliefs about the three innovations is consistent with other studies by previous researchers. For example, Greiner et al. (2009) investigated the motivations and risk perceptions associated with the adoption of conservation practices by farmers in Australia. They found among others that respondents who perceive themselves, as risk-takers were more likely to adopt the new grazing practices. Likewise, Borges and Lansink (2015) analysed the intention of Brazilian cattle farmers to adopt improved natural grassland. The results of their study revealed that unwilling farmers, unlike willing farmers considered themselves as risk-averse and were less likely to use improved natural grassland. Other studies have also found high-risk
attitude individuals to be more likely to adopt new technologies despite the risk-reducing nature of these innovations (Cole & Matsumiya, 2007; Liu, 2013). However, the study contradicts the results of Gillespe et al. (2014) who found more risk-averse producers to be more likely to adopt innovations such as intensive breeding and artificial insemination, which have the potential to increase their profit margins. These mixed findings may be due to differences in technologies and the outcome of adoption.

On the other hand, virtually no studies within the agricultural innovation adoption literature have considered the effect of psychological well-being on adoption intention and behaviour. This highlights the importance of the present finding. The study is consistent with other findings in a different context. For example, Ong and Lin (2016) investigated the effect of wellbeing on continuance intention and loyalty to use social network sites. The results of their study indicated that psychological wellbeing has a greater influence on continuance intention to use social network sites. Within organizational behaviour literature, the current finding is consistent with the claims of Podsakoff, MacKenzie, Paine and Bachrach (2000) as well as Wright and Cropanzano (2000). They asserted that employee psychological well-being affects organizational citizenship behaviour and job performance. The argument is that, when employees are happy, it increases their efforts and performance in the workplace (Fisher, 2010).

In this study, farmers with low-risk attitude were more likely to believe that the presence of control factors would affect their adoption capacity. They were also more likely to think that adoption of innovations would not lead to favourable outcomes. This is because low-risk attitude farmers may perceive investment in agricultural innovations, particularly the purchase of improved seeds and fertilizer to be risky and fear they might
lose out in the end. The cost of perceived uncertainty about the three innovations may have overshadowed the expected potential outcomes, hence the adoption apprehension for low-risk attitude smallholder farmers (Ross, Santos, & Capon, 2010; Yu & Nin-Pratt, 2014).

The current finding where psychological wellbeing positively influences the three salient beliefs about agricultural innovations is due to the eudaimonic approach used to defined well-being. The eudaimonic view of psychological well-being suggests that “a happy life entails doing what is right and virtuous, pursuing important goals, growing, as well as developing and using one’s ability and talents, regardless of one’s feelings at any point in time” (Ong & Lin, 2016, p. 1044). In this regard, smallholder farmers in Northern Ghana, particularly within the study area are more likely to hold positive beliefs about improved agricultural innovations to the extent that adopting these innovations lead to achieving important goals in life. In the earlier qualitative study, it became evident that smallholder farmers are motivated to farm because they want to ensure food security, generate income and keep farming as a tradition. Their happiness or quality of life satisfaction is contingent on their ability to pursue and achieve these goals. Hence, their positive belief that adopting agricultural innovations is the right thing to do since it boosts their sense of hope and optimism.

This result has important implications for policy and agricultural interventions. Agricultural programmes aimed at encouraging technology adoption to improve domestic and national crop productions should target smallholder farmers with high-risk orientation and better psychological wellbeing since they are likely to hold positive beliefs about innovations and are more likely to adopt them. Besides,
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strategies should seek to provide accurate information to reduce the uncertainty associated with the innovations in order to make risk-averse farmers more willing to adopt them. The findings are summarized in the observed model below.
Figure 3: An Observed model of predictors of intention to adopt improved agricultural innovations; continuous arrows represent correlation and discontinuous arrows represent relationships where beliefs generate indirect measures.
5.4 Summary and Conclusion

In all, the quantitative study supported some of the research hypotheses and rejected some of them. First, the study affirmed that subjective norm and attitude are the main predictors of intention to adopt improved agricultural innovations. The study also affirmed that normative beliefs (an indirect measure of the subjective norm) directly influence adoption intention. Furthermore, the study found behavioural belief, normative belief and control belief to indirectly influence adoption intention through the TBP variables of attitude, subjective norm and perceived behavioural control.

In addition, the study found gender, farm size and household size to influence the control and normative beliefs respectively. In addition, risk attitude of smallholder farmers strongly influences their behavioural and control beliefs whereas psychological wellbeing significantly affected all the three salient beliefs. On the other hand, the study rejected the hypothesis that perceived behavioural control of smallholder farmers predicts intention to adopt improved innovations. The study also rejected the proposition that adoption expectation beliefs and adoption facilitator beliefs directly predict adoption intention.

Besides, the study rejected the assertion that farming experience, age, annual average bags of crops produced, gender, farm size and household size significantly influence behavioural belief. This means that farmers attitude towards improved agricultural innovations (i.e. row planting, improved seeds and fertilizer use) can be improved regardless of these farmer background characteristics. The study found that age, farming experience and annual bags produced did not affect any of the salient beliefs. In addition, farm size and household size did affect control belief and gender did not affect normative
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belief. Finally, the study affirmed that risk attitude and psychological well-being have a significant influence on the three salient beliefs about the innovations, with psychological wellbeing proving influential on all three beliefs.

The findings from the quantitative study make a significant contribution to extant literature from a different context, particularly the strength of normative beliefs, subjective norms, risk attitude and psychological wellbeing in influencing intention to adopt improved agricultural innovations.
CHAPTER SIX

GENERAL DISCUSSION

6.0 Introduction

This chapter discusses how the objectives of the study were achieved using the mixed-methods approach and indicate the relationship between the qualitative and quantitative study approaches. The chapter begins with an overview and summary of the two studies. Next, the study presents the limitations of the study and points to areas where future research could address to improve our understanding of smallholder farmers’ innovation adoption intentions and behaviour. The study further discusses the Implications of the study in relation to theory and research. By so doing, the study demonstrates how the main theoretical framework, the TPB helped to explain smallholder farmers adopt intention regarding improved agricultural innovations. As part of the discussion on implications, the study also looks at how the findings can inform effective agricultural policy formulations and intervention implementations. It also highlights avenues within the area of farmers’ innovation adoption where psychological research and practice in Ghana could be supportive. Finally, the study highlights the significant contributions to science and concludes on the entire dissertation.

6.1 Overview of Study and Summary of Findings

The main purpose of the study was in two folds. First, the study sought to explore the farming motivations of smallholder farmers and to identify their beliefs about row planting, improved seeds and fertilizer application. Second, the study intended to investigate the psychological factors that influence smallholder farmers’ intention to
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adopt the three agricultural innovations. The study setting was in the Gushegu district in the Northern region of Ghana and the main theoretical model was TPB.

To ascertain the above objectives, a two-part study was designed using the mixed methods approach. Specifically, the study adopted the exploratory sequential mixed methods design. With this design, the study first explored the farming motivations and beliefs of smallholder farmers about improved agricultural innovations. Then the study used the salient beliefs identified from the initial study to construct belief-based measures and used in a larger quantitative study together with other measures. Twenty-two smallholder farmers participated in the qualitative study where 18 of them formed two separate focus groups and the remaining four engaged in one-on-one personal interviews. The quantitative study contacted 260 participants from the Gushegu district in their various homes to complete a questionnaire. In all, the study used 282 participants (22 for the qualitative and 260 for the quantitative studies). The study used the thematic analysis approach to analyse the qualitative data whereas the quantitative information was analysed using descriptive and inferential statistics.

Two research questions guided study one, namely what the farming motivations of smallholder farmers in Northern Ghana are and what are the salient beliefs of smallholder farmers about improved agricultural innovations (row planting, improved seeds and fertilizer application). Thematic analysis revealed that the farming motives of smallholder farmers in Northern Ghana are to ensure household survival, generate excess income and maintain cultural heritage. The need to feed the family and to keep a tradition came up strongly as the main motives compare to the need to generate income. Thus, the farmers had more social motives for farming than economic. The study argues that social motives
could hinder continuance adoption of agricultural innovations. The study further discovered twenty salient beliefs of smallholder farmers about improved agricultural innovations. The study found seven behavioural beliefs namely, ‘increase yield’, ‘attractive farm and products’, ‘time-consuming’, ‘labour intensive’, ‘increase farm budgets’, ‘makes farmers lazy’ and ‘reduce crop quality’. Similarly, seven normative beliefs were discovered: ‘lead farmer’, ‘nucleus farmers’, ‘opinions leaders’, ‘fellow farmers’, ‘family members (spouses)’, ‘MoFA’ and ‘other non-governmental agricultural development organizations (ADVANCE project)]. In addition, the study found six control beliefs, that is ‘lack of money’, ‘sufficient knowledge’, ‘sufficient skills’, ‘subsidies’, ‘inputs’ and ‘logistic support’. The study indicated that these beliefs were influential in determining the adoption intentions of the smallholder farmers in respect of row planting, improved seeds and fertilizer application.

In the second quantitative study, five main hypotheses were tested. First, the study confirmed that attitude and subjective norm are significant predictors of intention to adopt improved agricultural innovations (row planting, improved seeds and fertilizer application). However, perceived behavioural control was not significant in predicting the intention to adopt the three innovations. Secondly, the study found normative beliefs to directly influence intention to adopt improved agricultural innovations whereas behavioural beliefs and control beliefs do not. Thirdly, attitude mediated the relationship between behavioural belief and intention; subjective norm mediated the relationship between normative belief and intention; perceived behavioural control mediated the relationship between control belief and intention to adopt improved agricultural innovations. The study also found that gender, farm size and household size affected control and normative beliefs respectively. However, other background factors such as
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Age, farming experience and annual bags of crops produced did not affect any of the three salient beliefs. Finally, psychological wellbeing significantly affected all three beliefs but risk attitude influence only the behavioural and control beliefs. Thus, the study found that intention to adopt the three innovations originates from attitude, subjective norm and perceived behavioural control, which in turn are driven by behavioural, normative and control beliefs about the innovations.

Study 1 and 2 complement each other in two main ways. First, Study 1 focused on eliciting salient beliefs about the improved agricultural innovations using a smaller sample size. The study identified 20 beliefs (behavioural, normative and control beliefs) that are salient to farmers in northern Ghana. The beliefs generated in Study 1 forms part of the reality of the smallholder farmers interviewed. In Study 2, the researcher examined these beliefs among a larger sample of farmers. This study helped to determine the extent to which the beliefs reflects the reality of many of the smallholder farmers in northern Ghana. For instance, out of the seven behavioural beliefs identified in Study 1, four turn out to be reliable in Study 2. This suggests that the three beliefs rejected are not consistent with the general beliefs of smallholder farmers in the study area. Likewise, Study 2 confirmed five out of the six (6) control beliefs about the improved agricultural innovations. On the other hand, Study 2 affirmed all seven normative beliefs about the innovations identified in Study 1.

In sum, Study 1 identified beliefs about improved innovations whereas Study 2 examined their reliability and effect on other psychological variables (attitude, subjective norm and perceived behavioural control). This mixed methods approach is consistent with
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recommendations of Creswell (2013) and other empirical studies (Borges et al., 2014; Lalani et al., 2016).

Another point of complementarity between Study 1 and 2 is with respect to the construction of belief-based measures. The researcher used the beliefs identified in Study 1, having confirmed their reliabilities to construct belief-based measures namely, adoption expectation, adoption referents and adoption facilitator instruments. These measures were validated using principal component analysis and the study examined their effect on adoption intention. These psychological scales are specific to farmers in northern Ghana and other researchers could use them in a similar study. In this study, the researcher could have imported belief-based measures from other cultures but that would have taken away the contextual relevance of the variables under study. By eliciting items from the study context, the two-fold study helped to construct locally relevant instruments that are meaningful, and the farmers can easily relate.

6.2 Limitation and Direction for Future Research

The study had a few theoretical and methodological limitations that could reduce confidence in the analyzed data and weaken the strength of the results and conclusions from the study. The limitations of the study could restrict the broader applicability of the findings. However, the study made interesting observations about the role of psychological variables in the adoption decisions of smallholder farmers in northern Ghana.

First, the study did not consider the role of past behaviour in predicting adoption intention. This was due to the focus on the TPB and its main constructs. Smallholder
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farmers’ prior adoption information on the three innovations could have helped to explain the phenomenon better. Some studies suggest that past behaviour predicts future behaviour much better than a measure of behavioural intention (Sheeran, 2002).

Secondly, the study could not fully determine the process by which smallholder farmers actually adopt the innovations under investigation. The TPB constructs of attitude, subjective norm and perceived behavioural control of the farmers are snap-shots of their intention in time (Beedell & Rehman, 2000; Borges, 2015, p.151, thesis). This means that the study was limited to assessing smallholder farmers’ intention to adopt the three improved agricultural innovations for the next planting season. It would have been good to conduct a follow-up study using the same farmers to determine whether their intentions translated into actual adoption behaviour. This could have provided further insight into the dynamics of innovation adoption, particularly to know whether the TPB constructs are stable over time.

Thirdly, the study used self-reported scales to measure all the psychological constructs. This means that the data could have suffered from participants’ acquiescence bias (Borges, 2015 thesis), in that the farmers might have agreed with statements in the questionnaire without considering their contents, perhaps to portray ‘a good farmer’ attitude. Besides, since the study used a translated questionnaire, it could not have been perfect in understanding, which could affect the genuineness of the participants’ responses.

The study did not test whether smallholder farmers differ in their levels of intention to adopt the three innovations. Like other studies (Borges et al., 2014; Lalani et al., 2016),

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It assumed that the farmers were homogeneous with respect to their intentions to adopt the innovations. However, this approach could not explain differences in intention levels and what factors could explain this difference.

Furthermore, the study explored the farming motivations of the smallholder farmers in Study 1 but Study 2 did not examine the effect of farming motives on farmers beliefs or adoption intention. Again, other studies have indicated that personality characteristics have some influence on innovation adoption (He & Veronesi, 2017), which the study should have tested. Although in the questionnaire administered to the participants there were measures on personality and farming motivation, these measures could not be included in the final analysis because of inconsistent responses from the farmers and low reliabilities of the measures. An examination of the influence of personality and farming motives could have contributed to this study.

Finally, the opinions and views of smallholder farmers in other regions of northern Ghana were not included. The study selected participants from a list of farmers provided by the ADVANCE project, many of whom are beneficiaries of the programs and activities implemented by the project in the region. It is possible that the views of other farmers who are not beneficiaries of the ADVANCE project could bring some insight into the findings of the study. Therefore, some caution is required in further generalizing the findings to all smallholder farmers in northern Ghana.

Based on the above limitations, the study proposes some directions for future research. Foremost, this study included other variables (e.g. farmer, farm and household characteristics) apart from the main psychological factors to deepen understanding of the
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phenomenon. However, other categories of variables exist that may influence smallholder farmers’ adoption decisions (Edward-Jones, 2006). To this end, the study recommends that future studies should include other variables such as the characteristics of the innovation and the wider social environment to observe their potential interaction with the variable in the TPB. The inclusion of these variables would create a complex research model but it will also help to elucidate our understanding of the factors that influence farmers’ adoption behaviour.

In addition, the study revealed that attitude and subjective norm are the two most important variables in the TPB that predicts intention to adopt the three innovations. This suggests that the Theory of Reasoned Action (TRA), the antecedent of the TPB could offer a suitable explanation for smallholder adoption decisions. Unlike the TPB, which does not explicitly consider the background factors of the decision maker, the TRA explicitly accept that these factors directly influence the TPB variable of attitude and subjective norm. Therefore, the study recommended that future studies on adoption behaviour in northern Ghana should use the TRA to validate its applicability within the study context.

Based on reports from the MoFA and other scientific findings as shown in the earlier chapters, the study assumed that row planting, improved seeds and fertilizer application improve crop production at the farm level and these three innovations are profitable. Nevertheless, the study did not measure the actual farm level increases in the three innovations and their profitability. The study, therefore, recommends that future research can investigate the actually observed yield increases and profitability at the farm level regarding row planting, improved seeds and fertilizer applications.
Furthermore, the study recommends that future studies can adopt a comparative approach to compare differences in intention levels among smallholder farmers who are beneficiaries of some support from government and non-governmental agencies with those without any form of support. Studies can also widen the scope to include smallholder farmers in the southern part of Ghana. This will produce deeper contextual insight, which would inform strategies for agricultural interventions.

Finally, the study was unable to test the effect of certain variables due to inconsistencies in participants’ responses and poor reliabilities of the scales. These variables include past behaviour, farming motives, personality characteristics, among others. Therefore future studies are encouraged to consider these variables as their inclusion could add to our understanding of the adoption decision process of smallholder farmers in northern Ghana.

6.3 Implications and Recommendations

The study used a mixed methods approach to achieve the research objectives. The qualitative study intended to identify the drivers of the TPB constructs that is attitude, subjective norm and perceived behavioural control. In all, the study identified 20 salient beliefs, grouped them into behavioural, normative, and control beliefs. Implications and recommendations of the study are discussed in three main aspects, namely for theory, research and practice.

For Research:

The qualitative study revealed that smallholder farmers in northern Ghana believe that adopting the improved agricultural innovations, (row planting, improved seeds and fertilizer) increases yields per acre, make the farm beautiful and produce attractive crops.
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However, they also think that improved agricultural innovations require more labour, increase farm budget, decrease soil fertility, and affect crop quality and waste time. Moreover, the smallholder farmers believe that the lead farmer, nucleus farmer, family members (husbands), extension officers from government and ADVANCE project as well as other fellow farmers are the significant others whose advice about improved agricultural innovations matter to them. Besides, the smallholder farmers indicated that the lack of money to invest in the farm prevents them from adopting improved agricultural innovations. However, the availability of subsidies, sufficient knowledge and skills to deal with the innovations, and the availability of technical support, inputs and logistics facilitate their ability to adopt the improved agricultural innovations (row planting, improved seeds, fertilizer application). All these beliefs were included in the follow-up quantitative study to determine their interaction and effect on the TPB constructs.

The quantitative study indicated that the behavioural, normative and control beliefs identified in the initial qualitative study had a significant influence on the smallholder farmers’ positive evaluation (attitude), perceived social pressure from significant referents (subjective norm) and believe in their personal capability (perceived behavioural control) to adopt the improved agricultural innovations. The study found that smallholder farmers evaluated the improved agricultural innovations more positively to the extent that they believe the innovations allow them to increase their yield, make their farms beautiful and produce attractive crops. These were the man behavioural beliefs that drive attitude. Three of the behavioural beliefs (decrease soil fertility, decrease crop quality and waste time) identified in the qualitative study were dropped for low reliability. Again, the smallholder farmers are likely to perceive a higher social pressure on them on
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them to adopt the improved agricultural innovations to the extent that they believe lead farmers, nucleus farmers, family members (husbands), other farmers, extension officers from MoFA and ADVANCE project supports them in their adoption efforts and value their opinions. All the normative beliefs showed good reliabilities, hence their inclusion in the qualitative analysis. Furthermore, the smallholder farmers are likely to perceive that they have a higher self-efficacy to adopt the improved agricultural innovations the more strongly the farmers believe that they have sufficient knowledge and skills to deal with the innovations and they have access to subsidies, inputs and qualified technical assistance. All the control beliefs (except lack of money) identified in the qualitative study proved reliable and were therefore included in the analysis.

Results from the analysis indicated that about 79% of the smallholder farmers have a positive intention to adopt the improved agricultural innovations on at least part of their farm in the next planting season. This result is perhaps inconsistent with the low adoption rate of these innovations in northern Ghana. One of the reasons for this inconsistency is that the study measured smallholder farmers’ intention to adopt the improved agricultural innovations for the next planting season. Moreover, the TPB model used in this study opines that intention is the most significant originator of behaviour. However, the theory recognises that without sufficient control over the performance of the behaviour, intentions are not actualised (Ajzen, 1991). To this end, smallholder farmers’ in northern Ghana may have stronger intentions to adopt the improved agricultural innovations, but their rate of adoption could still be low. Besides, Triandes (1980) provides a possible explanation for the apparent inconsistency in adoption intention and behaviour. According to him, habits control behaviours sometimes more than conscious intentions. Therefore, smallholder farmers’ in the study setting may have very strong intentions to
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adopt the improved agricultural innovations (row planting, improved seeds and fertilizer application) but do not adopt them because they prefer to do things the usual way.

Besides the beliefs and the TPB variables (attitude, subjective norm, and perceived behavioural control), other background factors such as gender, farm size, household size, risk attitude and psychological well-being proved to have a significant influence in the model. To this end, the findings of the qualitative and quantitative study have important implications for research.

Agricultural innovation adoption research is virtually non-existent in the Ghanaian psychological literature. The current study sought to demonstrate the behavioural pattern of innovation adoption among smallholder farmers in Northern Ghana. It found that cultural norms and beliefs are the main underpinnings of the intention to adopt improved agricultural innovations. This implies that research to understand the innovation adoption phenomenon needs to consider the role of culture (specifically social norms) and it demands on smallholder farmers. It is therefore recommended for future studies to investigate how psychological variables such as beliefs, attitude, perceived social pressure among others are involved in the adoption decision process.

Methodologically, the use of the mixed methods approach in this study contributed immensely towards the results of the study. The objective of the study had both qualitative and quantitative requirements and the use of the exploratory sequential design brought out the complementary benefits of both methods. The approach most importantly brought to the fore the farming motives of smallholder farmers and their beliefs about improved agricultural innovations (row planting, improved seeds and
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fertilizer application). The contextual meaning of the beliefs helped to appreciate the basis of the attitude, subjective norm and perceived behavioural control of the farmers. The farming motives shared by the participants using qualitative interviews is worth building on by future scholars. Other studies could adopt similar methodologies, one that is not only theory-driven but also exploratory and theory generating to give unique meaning to adoption decisions in the Ghanaian setting (Anim, 2015).

Furthermore, given that both male and female smallholder farmers were used as participants for the study, particularly in the qualitative study, it is important to mention some commonalities and/or divergencies in their responses. In their response regarding knowledge about improved agricultural innovations. It was observed that the male farmers had better knowledge compared to the females. This is explained by the male farmers’ frequent participation in farming workshops and demonstrations, unlike their female counterpart who tend to learn about improving agricultural innovations from the male farmers (mostly their husbands).

In terms of responses regarding farming motivations, there were also some divergence and commonalities. Like the male smallholder farmers, most of the female farmers agreed that ensuring household food security and keeping a traditional heritage are major motivations for farming. However, whiles most of the male farmers agreed that the need to generate extra income to improve their standard of living is also part of their motivation for farming, the female smallholder farmers didn’t seem to generally agree. This divergence in farming motivation could be explained by the social expectations of men in the Northern region and Ghana as a whole. Household heads are not only expected to ensure food security at home but also expected to improve the livelihoods of the
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household through the provision of decent accommodation and other modern means of life.

Furthermore, some divergence and commonalities were observed in responses to salient beliefs about improved agricultural innovations. Generally, both male and female smallholder farmers share similar salient beliefs. Except to indicate that while the females cited access to land as a major control belief, the male farmers pointed at the lack of money to invest as their main control belief.

It is therefore recommended that future studies should take into consideration the above-cited commonalities and divergence in opinion regarding knowledge about improving agricultural innovations, motivations for farming and salient beliefs about improved agricultural innovations. These future studies should attempt to investigate the extent to which divergence in views about agricultural innovations influences the decision to adopt improve agricultural innovations.

For Theory:

Theoretically, the study extends the applicability of the TPB and shows the theory’s importance in understanding beliefs (social cognitive factors) and social norms (socio-psychological factors) (Martinez-Garcia et al., 2013). Several agricultural studies have applied the TPB to understand the determinants of farmers’ decision to adopt innovations (Edward-Jones, 2006). This study has demonstrated the usefulness of the TPB in identifying the underlining factors of smallholder farmers’ innovation adoption behaviour within the Ghanaian context. This suggests that the TPB can provide a sound theoretical rationale for future adoption studies in Ghana.
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The study provides a vital insight with respect to the role of social referents in the adoption decision process of farmers in Northern Ghana. This confirms the findings of other studies (e.g., Borges & Lansink, 2016; Martinez-Garcia et al., 2013). The implication is that explanations on the adoption decisions of smallholder farmers should address the role of significant referents. It is important to research on the extent to which the findings of this study apply to other smallholder farmers in the country. This will provide strong evidence for a comprehensive program to promote innovation adoption among smallholder farmers in Ghana as a whole.

The study illuminates the predictive power of psychological well-being (a new variable in adoption studies) in influencing the beliefs of smallholder farmers and indirectly affecting the intention to adopt the improved agricultural innovations. To the extent that there was a strong relationship between psychological well-being, beliefs and the TPB constructs, adoption researchers could begin to explore the level of psychological well-being necessary for positive orientation towards the adoption of the improved agricultural innovations.

For Policy and Psychological Practice:

The study established a significant relationship among psychological variables such as beliefs, attitudes, perceived social pressure and adoption intention. This finding has significant implications for policy interventions intended to promote innovation adoption. The study argues that the presence of the right psychological conditions toward improved agricultural innovations would strengthen farmers’ intention to adopt the innovations and this will, in turn, lead to actual innovation adoption. When smallholder farmers adopt improved agricultural innovations on their farms, they are likely to become effective and
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efficient at their farming work. Farmer effectiveness refers to the extent to which farmers in this study achieve their objective to ensure household survival, generate excess income and maintain a traditional heritage. Based on this argument, the study recommends that policymakers should pay enough regard to the psychological components inherent in the adoption process when designing interventions to promote innovation adoption.

This recommendation is important to the extent that farmer effectiveness is likely to improve the quality of work life, that is, an enhancement in the physical, social and psychological wellbeing of smallholder households. The study further argues that enhancing the quality of work life is likely to produce desirable farming outcomes such as farmer satisfaction, commitment and social awareness. Farmer satisfaction is a condition in which a farmer is content with farming as an important source of livelihood. Farmer commitment, on the other hand, is a feeling of responsibility towards the farming occupation in which the farmer actively participates in shaping the farming context, practices and productivity. Thus, the level of farmer satisfaction and commitment plays a key role in the continuous process of innovation adoption among smallholder farmers. Given the right mental attitude, satisfaction and commitment, smallholder farmers are likely to consciously create social awareness about improved agricultural innovations, in that, they will make known the availability and benefits of the innovation to other smallholder farmers to encourage innovation adoption among the farming population. The Figure below expresses this argument.
Figure 4.0: An intervention model of innovation adoption and farmer outcomes

The figure above proposes the main antecedents and consequences of innovation adoption. The study suggests that promoting innovation adoption starts with a focus on the mindset, attitude, perceptions etc of farmers. When farmers have a positive psychological orientation about improved agricultural innovations, they are more likely to form a stronger intention to adopt then and vice versa. Figure 6.1 above suggest that a strong adoption intention will likely lead to innovation adoption and farmer effectiveness which will, in turn, improve the quality of work life, farmer satisfaction and commitment of smallholder farmers. Thus, the intervention model could guide policymakers and I-O Psychologists to design effective adoption promotion interventions.
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The results from study 1 revealed that smallholder farmers in Northern Ghana are motivated more by social reasons (e.g. farming to feed the family, keep a tradition) than economic reasons (farming generate income). To this end, agricultural policies and interventions from the government (MoFA) and other nongovernmental agencies seeking to promote innovation adoption could be effective by targeting the population of smallholder farmers who are economically motivated to farm and appeal to their economic interest. Besides, policymakers could make efforts to identify the population of potential adopters of agricultural innovations and equip them with entrepreneurial skills to encourage the adoption of improved innovations. For instance, extension agents can provide specific training modules such as how to prepare farm budgets and access working capital, farm management, how to negotiate with suppliers and buyers as well as how to access technical support to smallholders who are willing to expand their scale of production.

The researcher expects this intervention to be effective because it is more likely to encourage the adoption of appropriate agricultural innovations. Besides, the public recognition of successful farmers among farming communities can help to reduce the existing risk-aversion of other farmers to adopt innovations through identification with successful farmers.

Study 2 found that subjective norm strongly predicts intention to adopt improved agricultural innovations. This suggests that smallholder farmers adopt the innovations, not because of their positive evaluation (attitude) and their personal capacity (perceived behavioural control), but most importantly their perception of social pressure to adopt (subjective norm). To this end, policymakers and extension officers could look for
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effective ways to increase the social pressure upon the smallholder farmers. For instance, at the community level, successful farmers could be encouraged to share their experiences and knowledge about improved agricultural innovations with other farmers through participatory activities and informal meetings.

The study found lead farmers, nucleus farmers, husbands, fellow farmers and extension officers from the ADVANCE project and MoFA as significant adoption referents of the smallholder farmers. Extension agents could use these salient referents in a more participatory approach to transfer knowledge and skills about the improved agricultural innovations to the smallholder farmers. For example, rather than using the traditional top-down approach, adoption referent could be involved in training course development and implementation to provide practical training lessons to the farmers.

The study also showed that behavioural beliefs (adoption expectations) enhance smallholder farmers’ evaluation of improved agricultural innovations. Again, by raising smallholder farmers’ believe in their ability to deal with the improved agricultural innovation, they become more likely to adopt them. For example, informing smallholder farmers that the improved agricultural innovations allow them to increase yields per acre, cultivate beautiful farms and produce attractive and healthy crops increase their intention to adopt the innovations. Similarly, when smallholder farmers have sufficient knowledge about the innovations, sufficient skills to deal with the innovations, access to subsidies from the government, access to inputs and technical support, it increases their intention to adopt the improved agricultural innovations. Thus, agricultural intervention programs promoting innovation adoption could practically demonstrate the practical benefits of these innovations on the field to boost adoption confidence.
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Indeed, institutions like ADVANCE has a number of demonstration farms installed in the farming communities. However, these demonstration farms could be increased and made visible to diffuse the innovations rapidly. Besides, policy makers (MoFA) could make conscious efforts to increase the number of extension officers who would visit the farms before, during and after the planting season to address the challenges facing the smallholder farmers in their effort to adopt the innovations.

In the case of psychological practice, the study provides enough evidence to show that the process of innovation adoption is rich in psychological variables. For instance, psychological wellbeing, farming motivation, risk attitude are just a few of the variables that the study found to be instrumental in the adoption process. This has important implications for psychological practice in Ghana, particularly I-O Psychology. One of the cardinal features of I-O Psychology is the selection of workers who have work and organizational fit. This suggests that I-O psychology could begin to develop farmer specific measures to assess farm workers fitness for farming. For instance, the I-O Psychologist could develop psychological instruments to measure farming motivation, psychological well-being, personality characteristics and risk attitude in order to determine those farmers who are predisposed to adopting modern agricultural innovations. This would ensure that agricultural spending by the government targets specific individuals with the right adoption personality.

Furthermore, I-O Psychologist must expand their scope of training and services to include all workers within the agricultural enterprise. The fact that psychological well-being had a significant influence on the cognitive orientation of the smallholder farmers has a significant implication for psychological assessment and training. It would be appropriate
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for Psychologists to design training modules for agricultural extension officers to equip them with better facilitation and knowledge transfer skills to provide more hands-on training to the farmers. In addition, Psychologists could educate extension officers on the strong psychological content inherent in farmer’ decision making to ensure comprehensive extension services delivery. Agricultural policy makers could engage psychologist to screen farmers with mental health concerns and assist them to boost their psychological well-being and quality of work life.

The study observed that female smallholder farmers were less likely to feel capable of adopting improved agricultural innovations compared to their male counterparts due to some cultural limitations. However, policymakers could explore other ways of empowering females to be active in the entire value-chain of crop production. For instance, policymakers could design interventions to encourage regular informal meetings among women to share their experiences with agricultural issues. Moreover, Policymakers could design strategies to improve links between female smallholder farmers and input suppliers, produce buyers and microfinance credit. This may effectively empower them to use improved agricultural innovations.

6.4 Contributions to Science

The study contributes bountifully to the literature of innovation adoption by introducing psychological perspectives to the field from the Ghanaian context. Research on innovation adoption in Ghana has primarily focused on the role of socioeconomic factors in the process of adoption. These studies often assume that economic rationale underpins farmers’ innovation adoption. However, the current study submits effectively that psychological factors play a significant role in the complex process of adoption. The
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study is among the first to use the social psychological model to explain factors that influence the intention to adopt improved agricultural innovations in Ghana.

The current study has shown that the relative contribution of the TPB variables depends on the cultural setting. While in other cultures, farmers’ adoption intention emanates strongly from attitude (Garforth et al., 2006) in this study, the subjective norm is the most important predictor of intention to adopt improved agricultural innovations. This suggests that social pressure upon smallholder farmers in northern Ghana is very profound. This result is very important because it helps to resolve the conflicting results on the relative contribution of the TPB predictors of adoption intention.

In the study of farmers’ adoption behaviour using the TPB as a theoretical model, studies have failed to include other potential factors to observe their interaction with the TPB variables. These other potential factors include demographic information, farm characteristics and household variables of potential innovation adopters. This approach has limited understanding of the complex process of adoption. One of the significant contributions of the study to science is the integration of these background variables into the TPB model to explain the extent to which they interact with each other. The study found gender, farm size and household size to influence the control and normative beliefs of the smallholder farmers, which in turn increases the perceived social pressure on them and their self-efficacy to adopt improved agricultural innovations (particularly, row planting, improved seeds and fertilizer application). The study also observed that variables such as age and experience did not affect the TPB variables, meaning that smallholder farmers in northern Ghana could improve their rate of innovation adoption.
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regardless of their age and farming experience. This result helps to settle the confusion regarding the effect of these background factors.

Another important finding of the current study is the role of psychological well-being, a variable rarely investigated in adoption studies. However, in organizational behaviour literature, studies have found psychological well-being to be a significant predictor of employee performance (Podsakoff et al., 2000; Wright & Cropanzano, 2000). Based on this relationship, the study hypothesized that psychological well-being will significantly influence farmer’s beliefs, which will indirectly affect their evaluation (attitude), the perception of social pressure (subjective norm) and their capacity to adopt the improved agricultural innovations. By confirming this hypothesis, the study introduces another psychological variable, which other researchers could further investigate to establish its actual role in the innovation adoption process. This could inform policy and make psychological practice relevant in the Ghana agricultural sector.

The study serves as a midwife to the establishment of the field of agriculture psychology in Ghana. The data gathered from this study could serve as baseline data for future research reference. It would also encourage more research in other areas of agriculture where psychological research and practice is needful. This field of agricultural psychology may not only focus on adoption studies but could include occupational health and safety, extension psychology, psychological assessment and testing for farmers, quality of work life, farmers’ effectiveness, satisfaction and commitment.
6.5 Conclusion

The purpose of this study was to examine the psychological factors that influence smallholder farmers’ intention to adopt improved agricultural innovations (row planting, improved seeds and fertilizer application). The study used the exploratory sequential mixed methods design. Using a purposive sampling strategy, a semi-structured interview protocol; Study 1 interviewed 22 experienced smallholder farmers (13 males and 9 females) in a focused group discussion and one-on-one interview session format. The aim of Study 1 was to explore the farming motivations and beliefs of smallholder farmers about improved agricultural innovations. The follow-up Study 2 was cross-sectional, using 260 smallholder farmers (162 males and 98 females) from the Gushegu district in the northern region of Ghana. Analytical tools used in this study include the Pearson’s product moment correlation, multiple regression and the Sobel test of mediation. The study revealed very good correlations between the variables used in the whole study. Based on the findings from the study, the following conclusions were drawn.

1. Intention to adopt improved agricultural innovations (row planting, improved seeds and fertilizer application) is mainly predicted directly by smallholder farmers’ perception about social pressure to adopt the innovations (subjective norm), followed by their evaluation of the positive benefits of adopting the innovations (attitude). Smallholder farmers’ perception of their own capability (perceived behavioural control) to deal with the innovations did not directly affect adoption intention.

2. Social pressure, which was the profound predictor of intentions to adopt the improved agricultural innovations, correlated positively with attitude and perceived behavioural control. This means that the more smallholder farmers
perceive social pressure upon them to adopt improved agricultural innovations, the more positively they evaluate the benefits of the innovation and the more they feel confident in their ability to adopt them.

3. That smallholder farmers evaluate the improved agricultural innovations more positively; the more likely and more importantly, they believe that the innovations allow them to increase their yield per acre, to make their farms beautiful and to produce attractive and healthy crops.

4. In addition, there is a high social pressure on smallholder farmers to adopt improved agricultural innovation to the extent that they believe in the opinion of the lead farmer, nucleus farmer; colleague farmers, family members (husbands) and extension agents from ADVANCE and MoFA have their support to adopt the innovations.

5. Smallholder farmers are more likely to perceive a higher personal capability to adopt improved agricultural innovations, the more likely and more strongly, they believe that they have sufficient knowledge and skills about the innovations, and they have access to subsidies, technical support and inputs.

6. Smallholder farmers with high-risk attitude, better psychological well-being are more likely to believe that adopting improved agricultural innovations is important and more likely to increase yield, make farm beautiful and produce attractive as well as healthy crops.

7. Smallholder farmers with better psychological well-being, bigger households and farm sizes are intrinsically more likely to believe that there is social pressure upon
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them from family members, lead farmers, nucleus farmers, colleague farmers as well as agents from government and ADVANCE project to adopt the improved agricultural innovations.

8. Finally, it is concluded that smallholder farmers with better psychological well-being, high-risk attitude, are intrinsically more likely and strongly to believe that they have sufficient knowledge, skills and resources to adopt improved agricultural innovations (row planting, improved seeds and fertilizer application). However, female smallholder farmers are less likely to believe that they can adopt innovations compared to their male counterparts.
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We are conducting a survey on the reasons why smallholder farmers adopt improved agricultural innovations in their farms. Specifically, we are interested in your opinion about improved agricultural innovations. The results will help research institutions and policymakers to effective interventions for farmers to improve their crop productions in the region.

Please read each question carefully and answer it to the best of your ability. There are no correct or incorrect responses; we are merely interested in your point of view. All responses to this survey are completely confidential.

Many thanks for your participation in this study.

Richmond Acquah-Coleman

PhD - University of Ghana, Legon.

SECTION A: SOCIOECONOMIC INFORMATION

1. Gender [Pagabei Doo?]: Male □ Female □
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2. Age (years) [Yuma] ……………

3. Education [Ashikuruninizanisheli]: No Formal Edu. □ Primary/JSS □ SSS/Voc./Tech □ Dip/Degree □

4. Farming Experience (years) [Yuma ala kaabepukparlimini?] …………………

5. Farm size (number of acres) [Apuunyela acre di baala?] ……………………………

6. Crop produced [Bo kaa kora?]: Maize □ Rice □ Soybeans □ Any Two □ All Three □

7. How many bags of crops do you harvest on the average per year? [A puzurisagri la wulayununipulini?]:
   Maize……………… Rice……………… Soy beans………………

8. How many members of your family depend on the household income [A yiyaalinirbaalayelmugsira ka yiliŋo lagrimaana?] …………………

9. Do you use improved agricultural innovations? [A nyeləŋun diegipukparlimsopalaatumani?]: Yes □ No □

10. If yes, which of the following do you practice? [Sopalaŋo dinsanikaadiegi?]: Row Planting □ Improved Seeds □ Agrochemicals □ Fertilizers □ Some of the above □ All of the above □ Others ……………………………

11. Do you get technical assistance in your farming? [A nyeri sonŋim apukarlimni?]: Yes □ No □

12. If yes, what kind of assistance? [ŋuniSonŋim kaanyera?]:
   Governmental Assistance □ NGOs Assistance □ Private Assistance □ All of the above □
13. Do you participate in agricultural workshops and on-farm trials? [Achanipukparibanaṃsimelagnsi minibnbrazahnbu mini pukparuganbanaṃsimepuri: Yes ☐ No ☐

14. Membership in farmers’ group(s) or association(s) [A be pukparibalagngushelini?):
Yes ☐ No ☐

15. Are you linked to a nucleus farmer [A malidaabipukparaṇun sondaapukpariniema beelagri?]: Yes ☐ No ☐

16. Do you get access to governmental subsidies at least once per year [A nyeri sonṣimognnatisani din che ka:]
Yes ☐ No ☐

17. Do you get access to some credits at least once per year [Yuunipulini, a anyeripukparlimsamlidira]:
Yes ☐ No ☐

18. If yes, what type of credit: Cash ☐ In-kind ☐ [Di bali di ni ka a nyeri dira]
SECTION B: INNOVATION ADOPTION INFORMATION

Instructions
The following questions make use of rating scales with 7 places; you are expected to circle the number that best describes your opinion. Do not think too long about your answer to each question; your first thought is usually the best. Please answer the questions as honestly as possible; there are no right or wrong answers. We are only interested in your personal opinion. In making your ratings, please remember the following points:
* Be sure to answer all items – do not omit any.

Please answer each by circling the number that best describes your opinion. Some of the questions may appear to be similar, but they do address somewhat different issues.

19- I intend to use improved agricultural innovations in at least part of my farm for the next planting season. [ In mali nia ni in zang pkarilim sopali sigli sheli din kan na]

Definitely not 1 2 3 4 5 6 7 Definitely yes

20- How strong is your intention to use improved agricultural innovations in at least part of your farm for the next planting season? [ wula in ye a nia ni a zang pkarilim sopali a puuni sigli sheli din kan na] 

Very Weak 1 2 3 4 5 6 7 Very Strong

21- How likely is it that you will use improved agricultural innovations in at least part of your farm for the next planting season? [ din too ning ka a zang pkarilim sopali sigli sheli din kan na]

Unlikely 1 2 3 4 5 6 7 Likely

22- I plan to use improved agricultural innovations in at least part of my farm for the next planting season (I know where and how to do). [ In mali nia ni in zang pkarilim sopali sigli sheli din kanna .( in mila ni yen ning li shem ni ni yen ning sheli polo)

Strongly Disagree 1 2 3 4 5 6 7 Strongly Agree
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23- How likely is it that if you use improved agricultural innovations in at least part of your farm for the next planting season you would:

Unlikely: 1 2 3 4 5 6 7
Likely:
- Increase farm yields per acre
- Produce attractive farm produce
- Have to hire labour
- Have to increase farm budget
- Decrease soil fertility
- Decrease food quality
- Waste time

24- How important is it that if you use improved agricultural innovations in at least part of your farm for the next planting season you would:

Unlikely: 1 2 3 4 5 6 7
Likely:
- Increase farm yields per acre
- Produce attractive farm produce
- Have to hire labour
- Have to increase farm budget
Psychological determinants and innovation adoption

Decrease soil fertility ○ ○ ○ ○ ○ ○ ○ [Din gbarigi a puu maa kulim]
Decrease food quality ○ ○ ○ ○ ○ ○ ○ [Puzur ni boyi]
Waste time ○ ○ ○ ○ ○ ○ ○ [Din di saha]

25- Using improved agricultural innovations in at least part of my farm for the next planting season is:

[ Ayi ning pukparilim sopala a puu yagshali polo sigli din kanna nyela din?]

Bad

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
[Di bi vela] | Good |

Disadvantageous

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<thead>
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<th>1</th>
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<th>3</th>
<th>4</th>
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<th>7</th>
</tr>
</thead>
</table>
[Di malila nahangu] | Advantageous |

[di malila songsim]

Unnecessary

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<tr>
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<th>3</th>
<th>4</th>
<th>5</th>
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<th>7</th>
</tr>
</thead>
</table>
[di bi kpa] | Necessary |

Unimportant

<table>
<thead>
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<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
[di kpaya] | Important |

26- How likely is it that each of the following person/group would think that you should use improved agricultural innovations in at least part of your farm for the next planting season: [ Ka daa din too ning ka lagggu shaga ni nyen kalli gc tehi ni a ning kparilim sopala apuu yagshalli sigli din kanna?]

Unlikely

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
Lead farmers | Likely |
Pukkari toonima | NA |
Nucleus farmers | ( ) |
Pukpariba ban be kori pam pam | ( ) |
Family members mabilgu | ( ) |
Fellow farmers pukparitaba | ( ) |
Agricultural org. (ADVANCE, MOFA etc) | ( ) |
Agric tuma duri |  
Psychological determinants and innovation adoption

27- How much do you care what the following person/group think you should do on your farm, for example to use improved agricultural innovations in at least part of your farm for the next planting season: [a tiaha puni wula ka nya nivu sheb bei group sheli tiaha zang chang an yan ning shem a koli puuni.]

<table>
<thead>
<tr>
<th>Not at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Very much</th>
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<tbody>
<tr>
<td>NA</td>
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<tr>
<td>Pukpari toonima</td>
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<td>Nucleus farmers</td>
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<tr>
<td>Pukpariba</td>
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<tr>
<td>Family members</td>
<td>o</td>
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<tr>
<td>Fellow farmers</td>
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<td>Agric tuma yelinima</td>
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</tbody>
</table>

28- Most people who are important to me think that I should use improved agricultural innovations in at least part of my farm for the next planting season. [Ninvu sheb ba nya talahi tima tehiya ni nzang mi pupkarilim sopala nning a puuni sigli sheli di kanna]

| Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
|-------------------|---|---|---|---|---|---|---|-----------------
| Asagti            |   |   |   |   |   |   |   | Bei a bi sagti |

29- Most people whose opinion I value would approve that I use improved agricultural innovations in at least part of my farm for the next planting season. [Ni wumdi sheb yetoa sagti ni n ning mi pupkarilim sopala sigli din kanna]

<table>
<thead>
<tr>
<th>Improbable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Probable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Di ku too ning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>din too ning</td>
</tr>
</tbody>
</table>

30- Most farmers like me will use improved agricultural innovations in at least part of their farm for the next planting season.[pupkaribe pam kamaa mani ni ning pupkarilim sopala sigli sheli di kanna]

<table>
<thead>
<tr>
<th>Unlikely</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Psychological determinants and innovation adoption

31- How likely is it that each of the following factors would be present to facilitate or to prevent you to use improved agricultural innovations in at least part of your farm for the next planting season: [Ding too ning ka ni yen karim daliri sheli too che ka a bi sagti pukparilim sopala sigli sheli din kanna]

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of money to invest</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Availability of gov’t Subsidies</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Sufficient skills</td>
<td>[Gomlati songsim]</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sufficient knowledge</td>
<td>[Nuuni bangsim din sagi Nuni bangsim]</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Availability of technical Support</td>
<td>[Pukparlim yelli bora ni songsim]</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Availability of inputs</td>
<td>[Pukparlim nema too beni]</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

32- How strong are the following factors to facilitate or to prevent you to use improved agricultural innovations in at least part of your farm for the next planting season?[yen karim la yel shanga ka yel ma wula ka di ni too che ka abi sagti pukparilim sopala sigli sheli din kanna]

<table>
<thead>
<tr>
<th></th>
<th>Very Weak</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Very Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of money to invest</td>
<td>[Lagri kalinsi]</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Availability of gov’t Subsidies</td>
<td>[Gomlati songsim]</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Sufficient skills</td>
<td>[Nuuni bangsim din sagi Nuni bangsim]</td>
<td>○</td>
<td>○</td>
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<td>○</td>
<td></td>
</tr>
<tr>
<td>Sufficient knowledge</td>
<td>[Pukparlim yelli bora ni songsim]</td>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
</tbody>
</table>
## Psychological determinants and innovation adoption

### Availability of technical support
- Availability of technical support: 0 0 0 0 0 0 0
- Support

### Availability of inputs
- Availability of inputs: 0 0 0 0 0 0 0

### 33- If I want to use improved agricultural innovations in at least part of my farm for the next planting season, I have sufficient knowledge.
- Ni bori ni in zang pkarilim sopala nko sigli din kanna n-mali di bagsim
- Definitely not: 1 2 3 4 5 6 7
- Definitely yes

### 34- If I want to use improved agricultural innovations in at least part of my farm for the next planting season, I have sufficient resources.
- Ei bori ni in zang pkarilim sopala nko sigli din kanna nmali di pkarilim yiko
- Definitely not: 1 2 3 4 5 6 7
- Definitely yes

### 35- How confident are you that you could overcome barriers that prevent you to use improved agricultural innovations in at least part of your farm for the next planting season?
- A dihitabli ni an toi nyang din kam yen gua soli zang cheng a zang kparilim sopala nko silgli sheli din kanna
- Completely unconfident: 1 2 3 4 5 6 7
- Completely confident

### 36- Using improved agricultural innovations in at least part of my farm for the next planting season, is completely up to me.
- Nnyi sagti ni nzang pkarilim sopala nko sigli din kanna nyela nsuhor yurilim
- Disagree: 1 2 3 4 5 6 7
- Agree

### 37- For me to use improved agricultural innovations in at least part of my farm for the next planting season, is under my control.
- Mani ei zang pkarilim sopala nko sigli din kanna di be la nsulunsi ni
- Not at all: 1 2 3 4 5 6 7
- Completely

### 38- For how many years have you been using improved agricultural innovations in at least part of your farm?
SECTION C: ADDITIONAL INFORMATION

Instructions

The following questions make use of statements; you are expected to write the number that best describes your opinion. Do not think too long about your answer to each question; your first thought is the usually best. Please answer the questions as honestly as possible; there are no right or wrong answers. In writing your numbers, please remember the following points:

* Be sure to answer all items – do not omit any.

Yen karimla yetog shenga ka yel ma yetog shel din nmani a tiaha. Di zang saha wagla ni atiaha kanaa labsi bohagu kam zung. Tiaha shel din dang kana a hankalini din ye za sung dimsuglo labsim bohasi maa din yelmangly ni ye sheli

39- When you think about being a farmer and managing your operation, how important are the following aspects to you?[ Ayi teha zang kpa a pupkarilim ny) ni an lihiria koli zung wula nye ni yen karim yei shang ny) dariza]

Not at all important 1 2 3 4 5 6 7 Extremely important

Please assign a number from 1 to 7 to each item.

 .......... Belong to rural community [ A pahi lanngu shelini ei
 .......... Be appreciated by society [ nirbi toi pagra ei
 .......... Help to feed the family [ a toi sung di mabiligu dihibu ni]
 .......... Improve the family and personal standard of living [ a toi kpansiri mabiligu ni mabilgu maa behagu]
 .......... Put children through school/university[ ka zoi ka a zaha bei behi school ni]
 .......... Farm to make money [ a toi kori bori lari]
 .......... Continue family tradition [ ka bori ni akpansiri dang kalli]

40- Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. [ Dimsuglo sabmi kalini tabli an sagti boha sheli min anbi sagti sheli

Strongly disagree 1 2 3 4 5 6 7 Strongly Agree

I see myself as:

 .......... Extraverted, enthusiastic (n kperi yellani ni suhipelli)
Psychological determinants and innovation adoption

………. Critical, quarrelsome [ninmohi ,vubobo]

………. Dependable, self-disciplined[m malli songsim, ka zhi dede

………. Anxious, easily upset[ai ka suhujia , a suhuhi yigisiri yom]

………. Open to new experiences, complex[m bori bohambu , n yela to pam

………. Reserved, quiet[ n be kperi yellani, n fomi

………. Sympathetic, warm[zori nambou, bi pkere yela ni.]

………. Calm, emotionally stable[ Baalim, suhuziya ]

………. Conventional, uncreative[n dolli sokura, n bi tagri yalla]

41-Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement.[dimsunglo sabmi kalinli tabli an sagti boha sheli min abi sagti boha sheli]

Strongly disagree  1  2  3  4  5  6  7  Strongly Agree

Nsagti

I see myself as:[Nyre la nmg kan nye]

………. My life has a clear sense of purpose[ n mi ni bori sheli behagu ni]

………. I am optimistic about my future[ n mala tiaha suma zang che in behagu ni]

………. My life is going well [ N behagu chen venvela]

………. I feel good most of the time[ n mala suhu peli saha kam]

………. What I do in life is valuable and worthwhile[ Ni tumdi tuunshaga malli songsim behigu puuni]

………. I can succeed if I put my mind to it[ Ne toi bo nya dii ning ka n zang in zagsim ning di ni]

………. I am achieving most of my goals[ N nyere nyelli shegc behiguni]

………. In most activities I do, I feel energized[ N mal lainyinbom o tuma shei]

………. There are people who appreciate me as a person[ Ninvu sheb nin ting in ninsalsil]

………. I feel a sense of belonging in my community[ nmala suhudo ni bei fong sheli ma]

42-Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. [ Dimsunglo sabmi kalinli tabli ansagti boha sheli min anbi sagti boha sheli]

Strongly disagree  1  2  3  4  5  6  7  Strongly Agree

nsagti

I see myself as: [Nyre la nmangn kan nye]

………. I’m quite cautious when I make plans and when I act on them
Psychological determinants and innovation adoption

[ N maari la nmang ni ni bori ni ning bin shanga ni ni ningdili shem]

.......... I follow the motto, 'nothing ventured, nothing gained'

[ N doli la yelgu, anbi labi, aku pilih]

.......... I've not much sympathy for adventurous decisions

[ Nka nambo zobo zang cheng gbaari sheli din mali dabem ni]

.......... If a task seems interesting I'll choose to do it even if I'm not sure whether I'll manage it

[ Tuma ei mali suhu bohagu ni ningli hal n yi bi dihitabl ni ni toi ning li]

.......... I don't like to put something at stake, I would rather be on the safe side

[ Nje ning zang bin sheli zali soli, nborimi ni in tuma chen ven yela saha kam]

.......... Even when I know that my chances are limited I try my luck

[ Hal n yi mi ni di nyela soyadinbi galsi, nna ku yen mal la tahma]

.......... In my work, I only set small goals so that I can achieve them without difficulty

[ In tuma shei in peri tuuin bihi di yen che kan ntoi ning li alaha]

.......... I express my opinion even if most people have opposite views

[ Nyerila in suhu ni tima shem hal niribi yi bi sagt ni yere shel maa]

.......... My decisions are always made carefully and accurately

[ Nshawara gbarila venyela ni di tu ni di gbari shem]

.......... I would like to act in my boss's job some time so as to demonstrate my competence, despite of the risk

.......... of making mistakes

[ Nbori ni tum in pkem tuma saha sheli din yen wuhi ni ngba ni toi tumli hal yi mi ni ntoi sarigi]

.......... I tend to imagine the unfavourable outcomes of my actions

[ Ntoi bori ni tiahari ni ning di bin yere shang ka di dii bi ning in behaguni]

.......... Success makes me take higher risks

In tuma yi chen venyela n toi bori ni in ning tum tuuin shanga ni bi dihitabl ni ni nye nasara di ni]
Psychological determinants and innovation adoption

APPENDIX B

QUALITATIVE INTERVIEW GUIDE (semi-structured)

The researcher will give a brief description of the research topic and purpose to informants. The study seeks to interview smallholder farmers in a focus group discussion and one-on-one personal interviews. The researcher will be soliciting questions on the meaning of improved agricultural innovations. Questions will also include your reasons for farming and the beliefs you have about improved agricultural innovations, specifically row planting, improved seeds and fertilizer application. The researcher will also like to find out how your beliefs about these innovations affect their adoption and what may help to improve technology adoption among smallholder farmers. Do you have any questions? Participants are free to end the interview at any time if they so wish.

Farmer Background Questions

i. Farmer’s information
   a. What is your name?
   b. Where do you come from?
   c. What is your highest level of education?
   d. How long have you been working as a farmer?

ii. Farming information
   a. What is the size of your farm?
   b. What type of crop do you grow?
   c. Do you have hired labour on your farm?
   d. Do you receive any support from government or NGOs to support your farming activities?

iii. Acquisition of information on Row Planting Technology
   a. Do you know anything about row planting technology?
   b. Do you receive visits from Agricultural extension officers concerning row-planting technology? If yes, how often?
   c. Do you participate in on-farm trials or seminars on row planting? If yes, how often.
   d. Are you a member of any farmers’ group or association?
Psychological determinants and innovation adoption

What are the main farming motives of smallholder farmers in northern Ghana?

1. As a smallholder farmer, what are your reasons for farming?
   The interviewer will use the point below to probe further to ascertain specific farming motives.
   i. Economic motives
   ii. Sociocultural motives
   iii. Psychological motives
   iv. Environmental motives

2. What are the salient beliefs of smallholder farmers about improved agricultural innovations?
   What is your understanding of improved agricultural innovations?
   How often do you use these improved agricultural innovations you have mentioned?

   What are your behavioural beliefs (consequences of adoption) about adopting the improved agricultural innovations? Specifically:
   a. What do you see as advantages of using the improved agricultural innovations you have mentioned?
   b. What do you see as disadvantages of using the improved agricultural innovations you have mentioned?

   What are your normative beliefs (consequences of adoption) about adopting the improved agricultural innovations? Specifically:
   c. Please, mention the individual(s) who would approve or disapprove or think you should not adopt improved agricultural innovations?
   d. Please, mention the group(s) who would approve or disapprove or think you should not adopt improved agricultural innovations?
Psychological determinants and innovation adoption

What are your control beliefs (facilitating and inhibiting factors) about adopting the improved agricultural innovations? Specifically:

e. Please mention any personal factors or circumstances that would make it easier or enable you to use the improved innovations you mentioned.
f. Please mention any personal factors or circumstances that would make it difficult or prevent you from using the improved agricultural innovations you mentioned.

3. Do you have any other comments?

4. Ending Question
   - Let us summarize the main points of our discussions. (The researcher presents a review of the responses to the key questions). Is this summary complete? Are there any additions or changes you would like to make?
APPENDIX C

ETHICAL CLEARANCE CERTIFICATE

UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES (ECH)
P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No: ........................................

9th February, 2017

Mr. Richmond Acquah-Coleman
Department of Psychology
University of Ghana
Legon

Dear Mr. Acquah-Coleman,

ECH 069/16-17: PSYCHOSOCIAL DETERMINANTS OF FARMERS’ INTENTION TO ADOPT IMPROVED AGRICULTURAL PRACTICES: A STUDY AMONG SMALLHOLDER FARMERS IN NORTHERN GHANA

This is to advise you that the above reference study has been presented to the Ethics Committee for the Humanities for a full board review and the following actions taken subject to the conditions and explanation provided below:

Expiry Date: 7/02/18
On Agenda for: Initial Submission
Date of Submission: 12/12/16
ECH Action: Approved
Reporting: Bi-Annually

Please accept my congratulations.

Yours Sincerely,

Rev. Prof. J. O. Y. Mante
ECH Chair

CC: Dr. Maxwell Asumeng, Department of Psychology

Tel: +233-303933866
Email: ech@ug.edu.gh | ech@isser.edu.gh
Section A – BACKGROUND INFORMATION

Title of Study: PSYCHOSOCIAL DETERMINANTS OF FARMERS’ INTENTION TO ADOPT IMPROVED AGRICULTURAL PRACTICES: A STUDY AMONG SMALLHOLDER FARMERS IN NORTHERN GHANA

Principal Investigator: Richmond Acquah-Coleman

Section B – CONSENT TO PARTICIPATE IN RESEARCH

General Information about Research

The main aim of this study is to provide a better understanding of the psychological factors that influence smallholder farmers’ intention to adopt improved agricultural technologies, specifically row planting technology. The study will, with the consent of participants, involve a survey and personal/focus group interviews with smallholder farmers particularly in northern Ghana. The study will require approximately 40 minutes of your time. The interviews would be audio recorded so that responses can accurately be documented. This would enable the researcher to review the topics and responses later
Psychological determinants and innovation adoption

for purposes of analysis. Participation is possible if only you are willing to have the interview.

Benefits/Risk of the study

The study is beneficial because it will provide the sort of evidence development organizations, government, and other policy makers need to provide interventions and policies that aim at improving farming practices and crop production in Ghana. Moreover, the study will contribute towards the establishment of a research area in the field of agricultural psychology in Ghana and Africa as a whole. You will receive no compensation for participating in this study. The completed dissertation would be made available to the University of Ghana, development organizations such as USAID and Farmer Based Organizations (FBOs) in Northern Ghana. Copies of the dissertation could be accessed for references in future research and/or practical application of relevant solutions. There are no known risks/discomforts associated with your participation, and there are none foreseeable.

Confidentiality

Participation is strictly confidential and you would not be identified by your name or your house in the reporting of the study. All information provided in this study will be held in absolute confidence; the tapes would remain in the custody and control of the researcher (Mr. Richmond Acquah-Coleman) always and would not be given out for any purpose to anyone who is not working directly with the researcher. The researcher will not share information which could identify you with anyone or in a publication. The information would be destroyed when the entire research is over in August 2018.

Compensation

Participants will not be paid for participating in this research since it is purely voluntary. However, it is intended that participants will be refreshed with a bottle of mineral after the research.
Withdrawal from Study

Your participation is very important but strictly voluntary. If you decide to participate, you have the right not to answer any question(s) you feel uncomfortable with and you can withdraw your participation at any time if you do not want to continue.

Contact for Additional Information

If you have any further questions or concerns, please contact me at racquah-coleman@st.ug.gh.edu or by telephone on 0207391183/0541148812. You can also contact my principal supervisor, Dr, Maxwell Asumeng at maxasumeng@yahoo.com.

If you feel you have not been treated in accordance with the descriptions in this consent form, or your rights as a participant in this research project have been violated, you may contact the Administrator of the Research Ethics Committee of University of Ghana via ech@ug.edu.gh or 00233- 303-933-866.

Section C- VOLUNTEER AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

__________________________________________  _______________________
Name of Volunteer                                        Signature or initials of volunteer          Date

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

__________________________________________
Name of witness
Psychological determinants and innovation adoption

Signature of witness    Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Richmond Acquah-Coleman (Researcher)

Researcher’s Signature