Market In Their Palms?

Exploring Smallholder Farmers' Use Of Mobile Phone Farming Applications And Their Effect On The Farmers' Farming, Marketing And Well-Being

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A Case Study of Selected Counties in Kenya

A Thesis Presented In Partial Fulfilment Of The Requirements For The Degree of Master of Philosophy in Development Studies at Massey University, Palmerston North, New Zealand

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ABSTRACT

The role of technology in development has been discussed in wide and varied literature. Over the course of history, technology has facilitated the process of development by helping individuals transcend some of the problems they face in their daily life. In recent times, the revolution in information and communication technology has come to play a crucial role in development and poverty reduction. This study explored the use of such technology, in this case the mobile phone farming applications, by smallholder farmers in Kenya to facilitate their agricultural production and marketing. The aim of the study was to explore the use of the mobile phone farming applications by the smallholder farmers to access markets and information and to assess the effects of their use on the farmers' farming and marketing experience as well as their well-being outcomes.

The results from the study indicate that the mobile phone faming applications have facilitated the smallholder farmers to access markets and marketing information. These applications have been effective in reducing the information search costs and marketing transaction costs for the smallholder farmers leading to enhanced access to information and markets. The reduced marketing transaction costs have, in turn, led to increased market participation by the smallholder farmers. Evidence from the literature indicates that when smallholder farmers have increased access to market information, their power in the market, in terms of their ability to bargain with traders, increases. In this study, it was also found that the rural farmers had been empowered by their increased access to information and they could, therefore, engage in price negotiation with potential buyers. This, together with access to higher paying markets, led to an increase in the farmers' income. Furthermore, the use of these applications facilitated the farmers to form networks with other farmers and traders. These networks, eventually became, an important source of marketing and production information to the farmers.

In contrast, it was found that the mobile phone farming applications were not effective in providing agricultural production information to the smallholder farmers. As a result, the farmers were using other means to access agricultural production information. These included the use of the internet and the networks and linkages with other farmers to access agricultural production information. However, evidence from the study indicates that, these mobile phone farming applications have a potential of facilitating smallholder farmers' access to information and markets in Kenya.

DEDICATION

To Mum and Pam your prayers kept me going

‘Perhaps not to be is to be without your being.’

Perhaps not to be is to be without your being,
without your going, that cuts noon light
like a blue flower, without your passing
later through fog and stones,
without the torch you lift in your hand
that others may not see as golden,
that perhaps no one believed blossomed
the glowing origin of the rose,
without, in the end, your being, your coming
suddenly, inspiringly, to know my life,
blaze of the rose-tree, wheat of the breeze:
and it follows that I am, because you are:
it follows from ‘you are’, that I am, and we:
and, because of love, you will, I will,
We will, come to be.

Pablo Neruda

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ASAL	Arid and Semi-Arid Lands
BEAP	British East Africa Protectorate
CAADP	Comprehensive Africa Agriculture Development Programme
CCK	Communication Commission of Kenya
DRC	Democratic Republic of Congo
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GNP	Gross National Product
HCDA	Horticultural Crops Development Authority
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
ITU	International Telecommunications Union
KARI	Kenya Agricultural Research Institute
KENFAP	Kenya National Federation of Agricultural Producers
KIPPRA	Kenya Institute of Public Policy Research and Analysis
Kgs	Kilogrammes
KSH	Kenya shillings
MDG	Millennium Development Goals
MUHEC	Massey University Human Ethics Committee
NAFIS	National Agricultural Farmers Information Services
NEPAD	New Partnership for Africa's Development
SAP	Structural Adjustment Programmes
SSA	Sub-Saharan Africa

CHAPTER ONE
INTRODUCTION

1.1 Research Background

The World Bank (2008) has estimated that growth within the agricultural sector is twice as effective in reducing poverty in the developing countries compared to growth in other sectors. This World Bank report, furthermore, suggested that agriculture can reduce poverty directly by raising farm incomes and, indirectly, by creating employment and reducing food prices. The focus of such an initiative, of poverty reduction through agriculture is, therefore, on the rural smallholder farmers since the majority of farmers in Africa are smallholder producers. In order for agriculture to facilitate poverty reduction, it has been suggested by De-Silva and Ratnadiwakara (2008) that this can be achieved through the commercialisation of the smallholder farmers' production through technological adoption and increased market participation. Such a strategy of agriculture commercialisation then puts the focus on the rural poor in Sub-Saharan Africa. However, emerging consensus has pointed out that attaining such growth within the smallholder farmers' production can be daunting because of the structural constraints associated with geographical and historical factors in Sub-Saharan Africa (Delgado, 1999, p. 165).

In the Kenyan context, the agricultural production system has been marked with various problems such as poor infrastructure, weak marketing structures, low technological adoption and high input prices among other problems. However, one of the problems that has persisted for a long time is the challenge that smallholder farmers face in accessing marketing and production information and markets for their produce. To this end, the role of information in agricultural production and marketing has been discussed in considerable amount of literature (De-Silva & Ratnadiwakara, 2008; De Janvry, Fafchamps, & Sadoulet, 1991; Diao, Hazell, & Thurlow, 2010; Pingali, Khwaja, & Meijer, 2005; Singh, 2008). Furthermore, Okello, Oliver, Njiriani, and Gitonga (2011) have highlighted the problems of accessing information by the smallholder farmers and how this has been a barrier to the commercialisation of agriculture in Sub-Saharan Africa.

Despite the challenges in accessing information, in recent years there have been attempts to tackle the problem with the use of information and communication technology (ICT) especially the mobile phone (Aker, 2011). The focus on the use of the mobile phone in agriculture has been facilitated by the rapid adoption of mobile phones in Sub-Saharan Africa

and the perceived weakness of the public agriculture extension[1] system (Gakuru, Winters, & Stepman, 2009). The use of the mobile phone in agriculture has, in turn, offered opportunities for the smallholder farmers to access information and markets at reduced costs and time thereby transcending one of the major barriers to agriculture commercialisation (Lee & Bellemare, 2012).

In the Kenyan context, the last few years have seen the adoption of the use of the mobile phone within agriculture. This has been in various forms from the direct use of the mobile phone to access markets and through the mobile phone farming applications. The mobile phone farming applications are made up of agricultural information services that allow farmers to access agricultural production and marketing information through their mobile phone by texting. This study explored the usage of the mobile phone farming applications by smallholder farmers in five counties in Kenya. The aim of the study was to explore the usage of these applications by the smallholder farmers and to assess their effect on the smallholder farmers' access to information, markets and their overall well-being.

1.2 An Overview of Smallholder Farming in Kenya

At independence in 1963, Kenya inherited a relatively well-developed agricultural sector from the British colonial government with high growth rates compared to other African countries (Gitau et al., 2009; Nyoro, 2002; Pereira, 1997; Strasberg et al., 1999). Through the years, the agricultural sector has continued to play a significant role in Kenya's economy as well as in the livelihood of the majority of Kenyans. With over 70 per cent of the population being rural based, agriculture is the single most important sector in the rural based economy in Kenya (IFAD, 2011, p. 1). This, therefore, makes the sector a key component in the poverty reduction and food security efforts in Kenya (Gitau et al., 2009). At the same time, available data indicates that the smallholder farmers are a major drive in Kenya's agriculture, accounting for over 75 per cent of total agricultural output in Kenya (Government of Kenya, 2009, p. 14) and directly and indirectly employing about 80 per cent of the rural based population in Kenya (Thurlow, Kiringai, & Gautam, 2007, p. 88). It is for these reasons that

[1] Agriculture extension has been defined by Aker (2011) as the delivery of agricultural information to farmers.

it has been pointed out that agricultural growth in Kenya has a wider impact on poverty reduction than growth in other sectors of the economy (IFAD, 2011).

Despite the acknowledged importance of smallholder agriculture in Kenya, the sector has not been performing well in recent times due to production and marketing challenges. Some of the problems that the smallholder farmers have had to contend with involve access to affordable credit, technology and inputs for production, markets for their produce and up to date weather information (Barret, 2009, p. 311). Furthermore, recent challenges from globalisation, climate change and trade liberalisation have threatened the existence of smallholder farming (Nyikai, 2003). Despite the acknowledged challenges, there has been a renewed focus on the role of the smallholder farmers in accelerating agriculture commercialisation for poverty reduction and food security in Africa. Part of the commercialisation process has involved facilitating smallholder farmers' access to technology, credit, inputs, markets and information. The integration of the mobile phones in agricultural is part of the renewed focus of facilitating the smallholder farmers in Kenya to commercialise their production through access to information and markets. Several objectives and research questions were developed to guide this study.

1.3 Research Aim and Objectives

The primary aim of this research was to explore the smallholder farmers' use of the existing mobile phone farming applications and to assess the effect of these applications on their farming and marketing experience as well as their well-being outcomes. The study had two specific objectives and five research questions.

Objective 1: To explore the smallholder farmers' use of the existing mobile phone farming applications and to assess the effect of these applications on their access to markets, production and marketing information. The subsequent research questions were:

i. How are the different smallholder farmers using the mobile phones farming applications to access marketing and production information?
ii. What are the costs of using the mobile phone farming applications and are they affordable to the smallholder farmers?
iii. What have been the effects of using the mobile phone farming applications to the smallholder farmers' production and marketing?

iv. What are the challenges and problems associated with the use of the mobile phone farming applications?

Objective 2: To assess the effect of access to markets, production and marketing information to the smallholder farmers' well-being. The subsequent research question was:

v) How has the use of the mobile phone farming applications impacted on the smallholder farmers overall well-being?

1.4 Layout of the Thesis

In order to answer the above stated research questions, the thesis has been divided into seven chapters as described below.

Chapter One: This chapter presents the background information to the study including introduction to the topic of study, the research aim, objectives and research questions.

Chapter Two: This chapter discusses and analyses the literature on agriculture and development. In addition, the general layout of agriculture and smallholder production in Kenya, the problems facing smallholder producers in Kenya, as well as the role of mobile phones in agricultural production and marketing is discussed.

Chapter Three: This chapter discusses and analyses the capability approach as the theoretical framework guiding the study. The chapter further describes the process of operationalizing the approach in the study to evaluate the smallholder farmers' well-being.

Chapter Four: This chapter discusses the methodology and methods that were used to collect data in answering the research questions. The chapter also discusses positionality, data collection and analysis methods and the fieldwork experience.

Chapter Five: This chapter presents the analysis of the results for research questions one to four. The results include: the smallholder farmers' use of the mobile phone farming applications, the affordability of the applications and their effect on smallholder farmers marketing and production.

Chapter Six: This chapter presents the results for research question five. This comprises of evaluation of the smallholder farmers' well-being outcome by using the capability approach.

Chapter Seven: The final chapter discusses the results of the study and links the findings to the broader literature on the use of mobile phones in agriculture production and marketing. The thesis layout is represented in the figure 1 below.

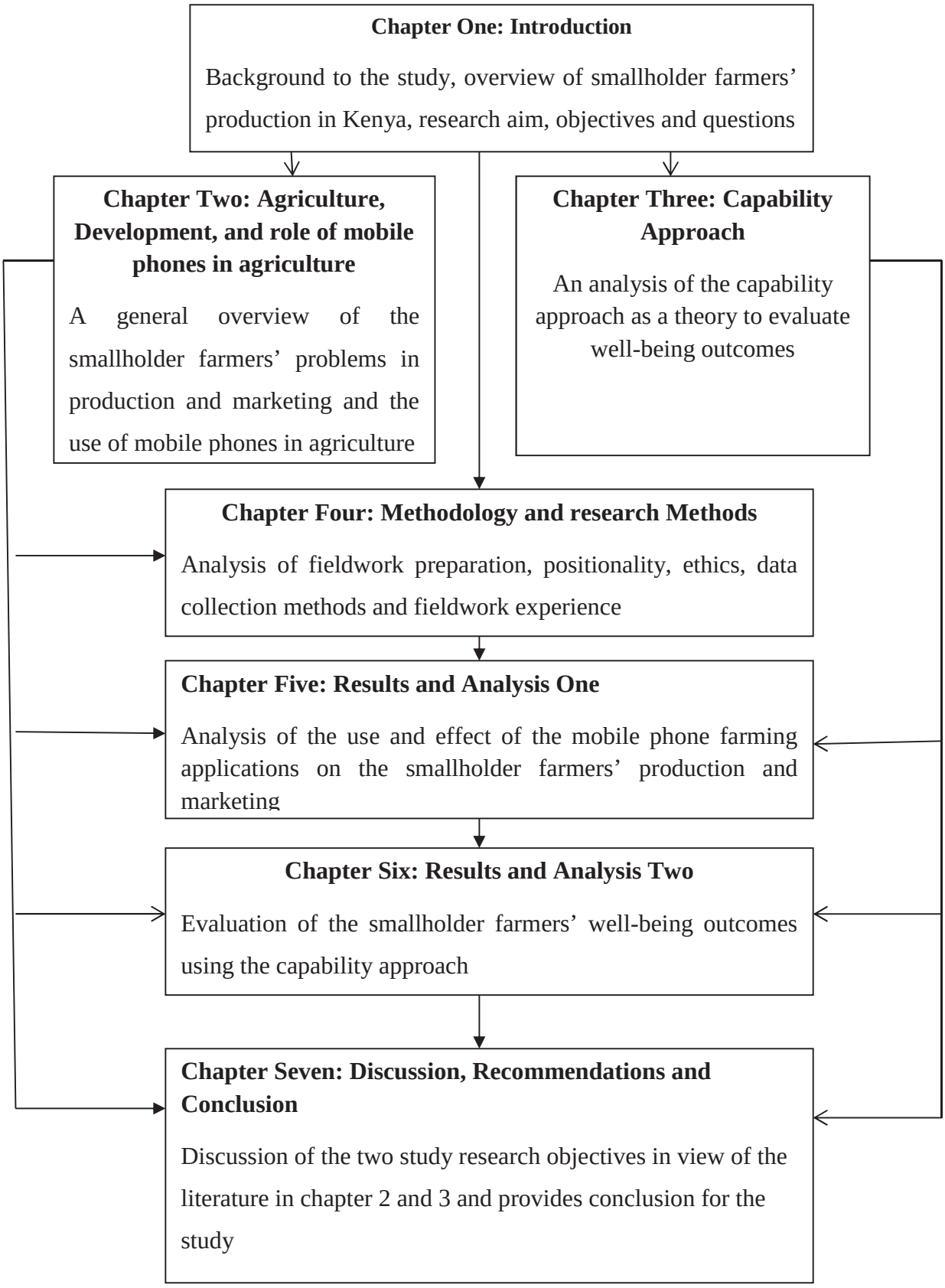

Figure 1: The Thesis Outline

CHAPTER TWO
AGRICULTURE, DEVELOPMENT AND THE ROLE OF MOBILE PHONES IN AGRICULTURE

2.1 Introduction

Kenya's ecological conditions vary greatly across the country and with the ecological variation so does the country's agricultural potential. With a land area of sixty million hectares, Kenya has a large landmass that ranges from below sea level at the coastal region to over five thousand metres at the top of Mount Kenya (Pereira, 1997, p. 8). The latitude varies from 4 degrees north to 4 degrees south of the equator and, as a result, the climate varies from temperate on the high altitude areas to tropical in the Lake Victoria and Indian Ocean basin to arid and semi-arid (ASAL) in the northern part of the country (Pereira, 1997, p. 8). Due to the wide variation in the physical geography of Kenya, the area suitable for agriculture has been estimated to be about 20 per cent with the other 80 per cent of the land being ASAL (Government of Kenya, 2009, p. 13). This chapter analyses the literature on agriculture sector in Kenya first by tracing the historical development of the sector's before analysing the sector contribution to the overall economy. Thereafter, the chapter discusses the problems smallholder farmers face in their production and marketing before the potential role of mobile phone applications in alleviating these problems is discussed.

2.2 Kenya's Agriculture, a Historical Review

The transformation of the Kenyan agricultural sector into its current form is thought to have begun with the arrival of the British colonialists in late 19th century. Before the arrival of the British, agriculture in Kenya was simply subsistence based. The development of the agricultural sector can be divided into three major periods: colonial period, post-colonial period and the liberalisation period and beyond. These periods are discussed below.

2.2.1 The colonial period (1883-1963)

Agriculture has been the leading sector in Kenya's economy from the period dating back to colonial times and even up to the present day. Before the arrival of the European settlers, agriculture in Kenya was fully for subsistence purposes with a few exceptions in the coastal

region where rice was grown to supply the Arab trading dhows[2] (Pereira, 1997, p. 9). The local population was involved in small-scale food production and at times, the surplus would be sold in exchange for what was needed. This was the trend until the arrival of the European settlers in the late 19th century. Although the Portuguese had arrived earlier in the 13th century on the East Africa's coast, they never established commercial agriculture apart from encouraging the locals to grow surplus crops to supply their trading ships (Talbott, 1992). Therefore, the growth of commercial agriculture in Kenya has been associated with the arrival of the British settlers from the year 1883 onwards.

The British government established the British East Africa Protectorate (BEAP), comprising of Kenya and Uganda, in 1895 signalling the arrival of settlers from the United Kingdom (Pereira, 1997, p. 13). These settlers, with the support of the British government, began the process of establishing farms in Kenya. This was to mark the introduction of an evolving and complex agricultural economy in Kenya which slowly replaced the subsistence agriculture that was dominant at the time (Talbott, 1992). Similarly, the settlement by the British began an era of a dual agriculture system comprising of large-scale farming by the settlers and small-scale farming involving the locals.

The settlers brought with them commercial and industrial crops such as tea, coffee and sisal that were regarded as high value export crops. These crops were grown in the high potential European settlement areas that were known as the 'White Highlands'. The increase in the volume of the export crops, coupled with the poor infrastructure, led to the development of the Kenya-Uganda railway line connecting the port city of Mombasa to the interior of Kenya. The railway was to facilitate the movement of agricultural produce to the port for export. With the construction of the railway line, the colonial government adopted a policy of spurring agricultural development in Kenya in order to make the railway profitable (Winter-Nelson & Argwings-Kodhek, 2007, p. 6). This led to an increase in the number of British settlers in Kenya thereby increasing the volume of agricultural produce.

However, as the colonial government was promoting the development of settler agriculture, it adopted a biased agricultural policy towards the locals. The native people were barred from growing export crops and were, therefore, still practising subsistence agriculture (Deininger & Binswanger, 1995). Between the years 1931-1953, there was further consolidation of

[2]A Dhow is an Arab boat that is low in the front, high in the back, and that usually has one or two sails that are shaped like triangles (Merriam-Webster dictionary, 2013)

white settlement in Kenya with the natives being displaced from the high potential agricultural areas which were to be taken over by the settlers (Wamicha & Mwanje, 2000). This period was marked by the domination of the agricultural sector by the European settlers who accounted for about 80 per cent of the total marketed agricultural output (Wamicha & Mwanje, 2000, p. 21).

However, this was to change in 1954 with the publication of the Swynnerton plan by the Swynnerton led commission. The Swynnerton commission, led by Roger Swynnerton, had been established in 1953 to look at ways of improving the natives production and marketing of cash crops (Pereira, 1997). The plan, published in 1954, recommended that the colonial government allows the native people to grow export crops but under regulation (Winter-Nelson & Argwings-Kodhek, 2007, p. 7). The implementation of this plan facilitated the evolution of institutions and policies that were to herald the development of commercial smallholder agriculture in post-colonial Kenya (Otsuka, Yamano, & Place, 2011). The implementation of the plan involved an improved land tenure system, an introduction of commercial agriculture and improved marketing of the natives produce (Wamicha & Mwanje, 2000, p. 21). However, in spite of government regulations, smallholder production of export crops was to expand rapidly especially after independence in 1963.

2.2.2 The post-independence period (1963-1980)

After independence in 1963, there was a massive land transfer from the British settlers, who were leaving the country, to the native people. The land transfers were accompanied by a massive sub-division of the former White Highlands into small land parcels to accommodate the natives (Wamicha & Mwanje, 2000). This meant that within a short period after independence, there was a rapid increase in the number of smallholder farmers. Furthermore, the land transfer system and the full implementation of the Swynnerton plan brought about a rapid expansion of smallholder production, bringing about a transition from subsistence farming to commercial agriculture (Bigsten & Collier, 1995, p. 197). These changes, coupled with the fact that the new government had inherited an export oriented economy with a policy favourable to the agriculture, led to rapid growth of the agricultural sector (Winter-Nelson & Argwings-Kodhek, 2007, p. 1). The government maintained a strong support for the agricultural sector and expanded efforts to commercialise smallholder production. This period was also marked with increased smallholder production of export crops, such as tea

and coffee, with tea production from the smallholder farmers increasing from thirteen thousand metric tonnes in 1960 to forty thousand metric tonnes in 1970 (Wamicha & Mwanje, 2000, p. 6).

The period immediately after independence, from 1965-1972, was marked with consistently good performance from the agricultural sector which was well above the average Sub-Saharan African performance (Bigsten & Collier, 1995, p. 196). The strong growth was because of the political elite who had strong links to farming and due to increased government and donor funding in agriculture (Gitau et al., 2009; Winter-Nelson & Argwings-Kodhek, 2007, p. 1). The government policy consisted of increased allocation of government resources to agriculture with the aim of improving productivity. In the same period, a range of agricultural parastatals[3] were set up to support the smallholders' production and marketing of export crops such as tea, sisal, coffee and pyrethrum (Gitau et al., 2009). However, this was to change in the 1980s.

2.2.3 Liberalisation period and beyond (1980 and beyond)

The 1970s were marked by a decrease in agricultural growth due to the oil shocks and a drop in international commodity prices (Bigsten & Collier, 1995, p. 197). The decreased agricultural growth continued in the 1980s and beyond due to the effect of weak commodity prices, high oil prices and the effect of liberalisation policies. The early 1980s had marked the introduction of the structural adjustment programmes (SAP) in the overall economy and agriculture sector in particular. Due to pressure from the World Bank and the International Monetary Fund (IMF), Kenya's government introduced the SAPs with the aim of making the agriculture sector market driven and competitive (Gitau et al., 2009). The SAPs brought in a new economic era of markets and competition in the agricultural sector.

Amongst the many changes brought about by the SAPs was the removal of government subsidies on farm inputs, the reduction of government agricultural extension services and the removal of price control on agricultural produce. The market reforms led to collapse of some of the agricultural parastatals and institutions that had been set up in the 1960s and 1970s since they could not compete without state protection in the liberalised economy (Nyoro,

[3] A parastatal is an organization, especially in some African countries, having some political authority and serving the state indirectly (Oxford dictionary, 2013)

2002). The smallholder farmers, who relied on the parastatals to market their produce, were left without alternative marketing outlets and were therefore highly affected by the liberalisation. As a result of the market reforms and other factors, the agricultural sector underwent a period of depressed performance leading to increased poverty in the country (Winter-Nelson & Argwings-Kodhek, 2007).

The poor agricultural performance was to continue in the 1990s due to the continued effects of the SAPs and the poor economic management by the government (Nyoro, 2002, p. 12). However, from 2003, the sector recovered with the election of a new government, which set in place strategies for the growth of the agricultural sector. The new government realised that agriculture development was important for overall economic growth and poverty reduction (Government of Kenya, 2009). This led to growth in the sector with a few dips in performance due to weather shocks and the effects of the 2007 post-election violence. With this in mind, the section below discusses the different agricultural production systems in Kenya.

2.3 Agricultural Production Systems in Kenya

The colonial history in Kenya endowed the country with two major agricultural production systems that are still dominant to date: large-scale farming and smallholder farming. After independence, the structure of agriculture in the country was transformed from large-scale dominated production systems to one where the small-scale production has almost dominated the production systems (Nyoro, 2002). The three existing agricultural production systems are discussed below:

2.3.1 The large-scale production system

Prior to independence, large-scale farming was a preserve of the British settlers in the high potential agricultural areas. The farms were used for producing tea, coffee and sisal for export as well as for keeping livestock. The production system was also highly mechanised involving the use of machinery and hired labour from the local population (Pereira, 1997). After independence, the settlers' lands were sub-divided and given to Kenyans for production. However, large-scale farming is still a significant part of Kenya's agricultural

sector and is mostly made up of multinationals companies producing tea, coffee and pineapples for export. Large-scale farms range from 50 to over 30,000 Ha of land and accounts for 30 per cent of marketed agricultural produce in Kenya (Government of Kenya, 2009, p. 13). This production system is mechanised with the farmers having better access to markets as opposed to the smallholder farmers.

2.3.2 The medium-scale production system

In comparison to smallholder and large-scale production, medium-scale farming is not widespread in Kenya. The farms under medium-scale farming range from 3-5 ha of land and the use of technology is high with the farmers having better access to markets compared to the smallholder farmers (Government of Kenya, 2009).

2.3.3 The small-scale production system

Despite recurrent predictions that small-scale farming will disappear, this type of farming has proved to be remarkably persistent in Sub-Saharan Africa (Hazell, Poulton, Wiggins, & Dorward, 2010). The growth and resilience of small-scale farming is partly due to the fact that the ratio of land under agricultural production has been reducing and partly due to the economic efficiency of small-scale farming relative to the larger farms (Hazell, 2003). In Kenya, the establishment of smallholder production in commercial agriculture can be traced back to the recommendations of the 1953 Swynnerton plan. Since then, smallholder production has risen to be a key part of Kenya's agricultural system. This type of farming is being practiced in farms averaging 0.2-3 ha and accounts for 75 per cent of the total agricultural output and 70 per cent of the total marketed agricultural produce (Government of Kenya, 2009, p. 13). With over 70 per cent of the population being rural based, small-scale farming plays an important role in the livelihoods of most household in Kenya (IFAD, 2011, p. 1). However, the smallholder producers face many constraints (which are discussed later) that have impeded their production and marketing practices (Nyariki, 2011).

2.4 The Role of Agriculture in Economic Development in Kenya

The role of agriculture in economic development has been explained by the economist Arthur Lewis (Lewis, 1954). In his dual economy model, Lewis argued that agriculture was a precursor to industrial development with the sector providing cheap labour and raw materials to the economy and eventually with time, Lewis argued, agriculture would diminish as manufacturing picks up (Lewis, 1954). To Lewis, the role of agriculture in development was limited up to the point of providing cheap labour to manufacturing and therefore agriculture in itself could not directly play a role in poverty reduction.

However, in the 1960s this view was challenged by the dawn of the Asian green revolution. The green revolution demonstrated the potential of agriculture for development, poverty reduction and food security (Diao et al., 2010). The green revolution demonstrated that agriculture could directly play a role in poverty reduction as opposed to Lewis's model. In addition, the green revolution proved that, with technological support, smallholder farmers could increase their production potential to rival the large-scale producers. In spite of the success of the green revolution in Asia, the same did not materialise in Africa. However, in recent years, there has been revitalised interest in agriculture for development in Africa particularly among the smallholder farmers (Diao et al., 2010).

The contribution of the agriculture sector to Kenya's economy has been discussed in the wider literature (Gitau et al., 2009; Government of Kenya, 2009; Nyoro, 2002; Nyoro, Kiiru, & Jayne, 1999). It is clear that agriculture is the mainstay of Kenya's economy contributing 24 per cent of GDP directly and another 27 per cent indirectly through linkages with the service, manufacturing and distribution sectors (Government of Kenya, 2009, p. 2). The sector is also an important tool for employment creation and poverty reduction accounting for 65 per cent of Kenya's total export earnings and providing 18 per cent of formal employment and a further 80 per cent of informal employment in the rural areas (Gitau et al., 2009, p. 3). Moreover, within the rural areas, agriculture accounts for over two thirds of the rural economy generating over two thirds of the rural based GDP and employing over 80 per cent of the rural population (Thurlow, Kiringai, & Gautam, 2012, p. 88). Therefore, agriculture is the single most important sector for Kenya's general economic and rural development.

Since independence, the sector has played a leading role in the development and poverty reduction efforts in Kenya. It has been highlighted that any significant reduction of poverty

rates in the country should address the problems in agricultural sector especially smallholder farmers' production (Thurlow et al., 2007). In recognition of this, in 2002, the Kenyan government signed the Comprehensive Africa Agriculture Development Programme (CAADP) framework that aimed to increase agricultural production in Africa. The framework, launched in 2002 by the New Partnership for Africa Development (NEPAD), aimed to foster economic growth in Africa by increasing investment in agriculture for poverty reduction and food security (Gitau et al., 2009, p. 2). However, the Kenyan government has not met some of the requirements such as increasing budgetary allocation for agriculture to ten per cent thereby affecting agricultural growth. Because of the low investment in agriculture and other problems in the sector, smallholder farmers have had to contend with problems associated with production and marketing in their farming. Some of these production and marketing problems are discussed below.

2.5 Smallholder Farmers' Production and Marketing Problems in Kenya

Despite the acknowledged importance of smallholder farming in poverty reduction and development, the smallholder farmers in Kenya face many production and marketing challenges. As early as the post-independent period, smallholder producers had to contend with problems associated with the sourcing of farm inputs, unreliable marketing structures, barriers to accessing credit and poor agriculture extension services among other problems. In recent times these problems have been exacerbated by continuous low government investment in agriculture (Gitau et al., 2009). Moreover, the rapidly expanding population has put pressure on the available land leading to a rapid decline of land under smallholder farming (Government of Kenya, 2009).

Some of the problems smallholder farmers face include: low access to agricultural inputs, credit and information to facilitate planting, harvesting and post-harvest management (Kenya National Federation of Agricultural Producers, 2009). The level of use of technology, such as machinery and quality planting materials, is low among the smallholder farmers leading to low production. In addition, the weak agriculture extension system, which was primarily set up to serve the smallholder farmers, has been ineffective in disseminating agricultural technology and information to these farmers (Mukhebi, 2007). Coupled with these is the climate change threat and the increased demands for high quality produce due to

globalisation and increased competition from other countries due to trade liberalisation (Nyariki, 2011).

In addition, the poorly developed road infrastructure system, especially in the rural areas in Kenya, has increased the remoteness of some of the smallholder farmers thus increasing the production costs and denying these farmers access to lucrative markets in urban areas (Chamberlin & Jayne, 2013). Generally the rural areas are served by poor roads due to underinvestment in road maintenance and construction (Asfaw, Lipper, Dalton, & Audi, 2012). The result has been impassable roads during the peak production periods in the rainy season increasing wastages and reducing the farmers' income margin (KIPPRA, 2007). As a result, most of the Kenyan smallholder farmers are still confined to subsistence production with minimal use of technology and machinery.

In the same context, the smallholder farmers have also experienced challenges related to the marketing of their produce. The Kenyan agricultural marketing sector is relatively underdeveloped and fragile with a few companies and traders dominating the sector and thus determining the prices of commodities. This can be traced back to the period after independence when the government created parastatals to buy produce from the farmers (KIPPRA, 2007). The parastatals were the sole buyers of the agricultural produce thereby determining the prices of the commodities. This continued until the liberalisation period in 1980s when the parastatals were either disbanded or most of them collapsed because they could not compete in a liberalised environment (Nyoro et al., 1999).

The sudden liberalisation of the marketing system, in early 1980s, the withdrawal of the parastatals from marketing and the slow development of the private sector to take the place of the parastatals, left the agriculture marketing system in Kenya in disarray especially for the smallholder farmers (Nyoro, 2002). The liberalisation was expected to usher in a competitive private sector thereby benefitting the smallholder producers. However, this did not occur. The private sector was reluctant to invest in agriculture due to the unattractiveness of agriculture as an investment (Nyoro et al., 1999). Thus, because of the poorly synchronised liberalisation process, the expected agriculture marketing reforms did not take place and the smallholder farmers were left without a suitable market for their produce. In recent times, smallholder farmers still face the same marketing challenges. In particular, smallholder farmers have to contend with hurdles impedes them from taking advantage of existing market opportunities and technologies (Fischer & Qaim, 2012). All these have reduced the likelihood of

agricultural growth that is significant for poverty reduction in Kenya. However, the recent introduction of the mobile phone for use in agriculture has raised expectations that some of the problems in smallholder farmers' production and marketing could be reduced through ease of access to information and markets. The section below analyses the potential role of mobile phones in solving some of these problems.

2.6 The Mobile Phone Revolution in Africa

In the course of the history of agricultural development, advances in technology have often had major impact in agricultural production and marketing. One such technological invention that had major impact in grain trading and marketing in the USA and Europe was the telegraph. The telegraph facilitated faster communication between grain farmers and traders in the USA and Europe thereby leading to significant and rapid narrowing of price differentials in the grain markets in USA and the markets between the USA and Europe (Abraham, 2006). In recent times, the advances in ICT, captured by the dynamic evolution of mobile phones, in the developing countries, have been compared to the impact of the telegraph on agricultural markets in the USA and Europe. Recent studies have identified mobile phones as an innovation that can continuously support livelihoods, agriculture extension and marketing system in the developing countries (Duncombe, 2011).

The rapid adoption of mobile phones in Sub-Saharan Africa was never expected due to the low infrastructural development and the fact that the mobile phone was perceived as non-essential item (Zibi, Aker, Roger, & Qiang, 2009). Moreover, the low income levels, high illiteracy and poverty rates in Sub-Saharan Africa, further reinforced this notion (Aker & Mbiti, 2010). In spite of these problems, the growth of the mobile phone telecommunications industry has been remarkable in Sub-Saharan Africa. The first mobile phone in Africa was introduced in Zaire, currently the Democratic Republic of Congo (DRC), in 1987 (Etzo & Collender, 2010). At the beginning, the high regulation of the sector by African governments had impeded the growth of the industry. However, from the late 1990s with the sector being liberalised, the growth of the industry began. The liberalisation provided the catalyst for a rapid adoption of the mobile phones from low levels in 1990s to over 545 million people in 2013 representing the fastest growth in the world (International Telecommunication Union, 2013, p. 3).

The growth was driven by a mix of competition, low regulation, technology deployment and the unavailability of fixed landlines (Zibi et al., 2009). Since this rapid growth was largely unanticipated in a continent largely viewed as a risky place to invest, it has come to be labelled as a revolution (Etzo & Collender, 2010). In due course, the use of the mobile phone has pervaded the socio-economic, governance and political sectors in the continent providing opportunities in different ways that had initially been un-anticipated.

2.7 Mobile Phone Industry in Kenya

In the Kenyan context, the first mobile phone was introduced in 1992 by the government owned Telekom Kenya Company. The adoption of the device was held back due to government regulation and the high cost of the device. However, the rapid adoption of mobile phones began after the liberalisation of the sector in 1999 and the creation of the ICT oversight authority Communication Commission of Kenya (CCK) (Manica & Vescovi, 2008). The liberalisation allowed the establishment of two mobile phone companies: Safaricom Ltd co-owned by the Kenyan government and Vodafone UK and Kencell Ltd (Currently Airtel). The arrival of the two telecommunications companies led to a rapid growth of the sector in Kenya. From a low subscriber base of less than 30,000 in 1999 to a figure of 30.5 million subscribers by June 2013 representing 77.3 per cent mobile phone penetration in the country (Communications Commission of Kenya, 2013, p. 6). Over the years, the Kenyan government has licensed two more mobile phone companies bringing the total figure of mobile operators to four namely: Safaricom Limited, Essar Telecom, Airtel Africa and Orange Kenya.

The rapid growth of the sector has simultaneously led to the overall contribution of the mobile phone sector in growing the economy. The sector contributes 5.6 per cent to Kenya's economy annually and a further 1.9 per cent from intangibles and, at the same time, employs over 250,000 people directly (Deloitte LLP, 2011, p. 2). As in other places in Africa, the use of the mobile phone has expanded into other spheres: from pioneering the mobile phone money transfer system (M-pesa)[4] to other applications in health, education and agriculture; the mobile phone has reduced communication costs and transformed lives through innovative applications (Aker & Mbiti, 2010). Because of the adoption and the innovative applications,

[4] M-pesa: (M is for money while pesa is Kiswahili for money) is a mobile phone money transfer system pioneered in Kenya

there has been a shift in the use of the mobile phone from a simple communication tool to one that could transform lives in rural areas. The mobile phone has transcended the notion of being a simple technological tool to an important development tool that has been used to improve livelihoods and therefore its use in agriculture production and marketing. The section below analyses the problems of information access by smallholder farmers before the potential role of mobile phones to alleviate some of these problems is discussed.

2.8 Information Asymmetry in Kenya Agricultural Production and Marketing

Economic theory has long established that the availability of information is a crucial component in ensuring the efficiency of production and marketing in any context (Zibi et al., 2009). Moreover, while the traditional economic theory has always assumed that information is costless, the same is not true of Sub-Saharan Africa (Aker, 2011). In Sub-Saharan Africa, information is rarely symmetric or costless especially when it comes to the agricultural sector. Well-functioning markets have been distinguished by the free flow of information allowing the participants to engage in optimal arbitrage whenever they desire.

Furthermore, economists have pointed out that information in the markets leads to efficient markets that obey the law of one price[5] (Carmody, 2012). In Kenya, agricultural markets have suffered from the problem of lack of information thereby affecting the production and marketing of produce. Historically, smallholder farmers' access to information has been through face to face meetings, input suppliers, agriculture extension staff traders and neighbours (Okello et al., 2011). The genesis of the problems associated with information asymmetry can be linked to the weak extension system, poor road infrastructure and inefficient agricultural institutions. Such factors have, in turn, driven up the cost of information search.

Kenya's agriculture extension system has been critiqued for its inefficiency and failure to adequately serve the smallholder farmers (Muyanga & Jayne, 2006). Agriculture extension has been described as the process of delivering of advisory services to farmers to help them make the best possible use of their productive resources on their farm (Swiss Center for Agricultural Extension, 2002, p. 13) . Therefore, the extension system plays a crucial role of

[5] The price of a commodity should be the same in all the markets regardless of the distance taking into account transport costs

providing production and marketing information to smallholder farmers. In the recent past, the agriculture extension staffs were the only source of information to the rural based smallholder farmers. This meant that their inaccessibility often inhibited the farmers from accessing information necessary for their production. Even with recent advances in technology, the government run agriculture extension system has been, and still is, the main source of information for farmers in rural Kenya.

Despite being dominant, the extension system has often failed to reduce the information asymmetries related to technology adoption in the developing countries' agriculture (Aker, 2011). The failure has been associated with several factors with some of the factors being: a large numerical disparity between the extension staff and the farmers, poor training of the staff and inadequate facilitation by the government (Muyanga & Jayne, 2008). These have culminated into an extension system that is weak, ineffective, top-down, inflexible and unable to cope with the demands of modern day farmers (Muyanga & Jayne, 2006, p. 4). Similarly, poorly developed road networks have further exacerbated the information access problems in the rural areas. Low investments by subsequent governments over the years have led to the inaccessibility of some of the rural areas in Kenya further alienating the farmers. Such inaccessibility has led to increased costs of accessing inputs and markets therefore reducing the incentives for the smallholder farmers to increase their production (World Bank, 2008).

The combined effect of the poor infrastructure and the inefficient agriculture extension system has had the effect of increasing information search costs and access to markets for the smallholder farmers. Different studies have emphasised the need for information symmetry, which in turn facilitates price setting mechanism within markets, as the most significant information need for smallholder farmers (Carmody, 2012; Duncombe, 2011). In agricultural production, farmers need information to enable planning of their activities and to respond to any price and weather shocks promptly (Mukhebi, 2007; Okello, Kirui, & Gitonga, 2012). In addition, farming activities such as access to seeds and fertiliser, weather updates and credit are determined by the ability of the smallholder farmers to access information (Kazilaslan, 2006).

Moreover, readily available information enables farmers to respond to the prevailing prices of their produce appropriately. Due to the problems of accessing information, Kenyan smallholder farmers have been caught up in a cycle of low production and poor market

access. When smallholder farmers cannot access markets they lack the incentives to increase their production therefore resulting in constrained production (Aker & Ksoll, 2012). Increased access to information reduces marketing costs and encourages smallholder farmers to participate in markets by increasing the returns on their products (Muto & Yamano, 2009). An estimate by De-Silva and Ratnadiwakara (2008, p. 11) in Sri-Lanka found that, with weak institutions and infrastructure, the cost for information search among the farmers, from the time they decide what to plant to the time of marketing, made up 11 per cent of the total cost of production. Therefore, the ease of access to markets should subsequently lead to improved production amongst the smallholder farmers. This study set to determine if the use of mobile phone applications could increase smallholder farmers' access to information and markets.

2.9 Mobile Phone in Agriculture Production and Marketing

The rapid adoption of the mobile phone in Sub-Saharan Africa has led to its use in agriculture in various ways. Before its adoption into agriculture, there was the use of other ICT tools notably the radio, television and newspaper. However, these tools never caught on as much as the mobile phone because their inaccessibility and the fact that they offered one way communication without farmers having a chance to ask questions (Aker & Mbiti, 2010). In contrast, the mobile phone has been found to be adaptable because of its perceived ease of use even for illiterate farmers, its flexibility, its affordability and the fact that it offers two way communication between the farmer and the source of information (Bhavnani, Chiu, Janakiram, Silarszky, & Bhatia, 2008). However, it should be noted that the mobile phone only plays a facilitatory role and that this cannot replace investment in public facilities such as roads and agriculture extension system. The section below reviews some contemporary literature on the use of the mobile phone in agricultural production and marketing.

2.9.1 Mobile phone and agricultural production

Agricultural production is often prone to frequent weather changes, disease and pest threats. It is for this reason that the need for information in agricultural production has been emphasised (Aker & Mbiti, 2010). Farmers' access to weather information or price predictions, in time, can make a difference between making losses and profits in production. With poor infrastructure and a weak extension system, the mobile phone can be used by

farmers to obtain information on potential threats allowing them to make adjustment early enough. Furthermore, ease of access to agricultural technologies can significantly improve the smallholder farmers' production. Mobile phones have been found to significantly reduce the cost of accessing information on technology for the smallholder producers and, thereby, having an impact on their production (Aker, 2011). Some of the studies on the use of mobile phone in agricultural production are discussed below.

The level of use of inputs in agriculture among smallholder farmers in developing countries is comparatively very low to the farmers in developed countries (Wiggins & Brooks, 2010, p. 7). The major cause of this has been the high transaction costs (time, money and distance) associated with acquiring the inputs. However, a study by Bayes (2001), in Bangladesh has shown that the use of mobile phones can facilitate smallholder farmers' access to agricultural inputs (seeds, technology and fertilisers) by reducing the high transaction costs. Bayes compared two villages, one with mobile phone coverage and the other without coverage, and found that the farmers in the village with mobile phone coverage had increased their use of fertiliser and seeds compared to the village without mobile phone coverage. To Bayes, the mobile phone facilitated easier communication on the availability and prices of the farm inputs well in advance thereby reducing some the barriers that had inherently existed. Bayes further argued that, because of access to information, the traders and farmers were able to have a clear impression of the input availability situation in their area thereby avoiding unforeseen contingencies.

In addition, Aker (2011) has posited that the mobile phone has the potential of hastening smallholder farmers' adoption of modern production technology, such as better seeds and fertilisers, to improve their production. For instance, farmers can simply make a call to determine the availability of fertiliser and seeds from an input supplier before visiting to purchase the input. This reduces the costs associated with travelling. Furthermore, the mobile phone can facilitate access to technical agricultural information from agriculture extension staff by either calling or texting thereby eliminating the need for travelling. A study by Aker (2010) in Niger, found that the mobile phone facilitated affordable access to information by the smallholder farmers through texting compared to the previous means which involved travelling to visit the extension staff. This, she argued, could potentially empower the vulnerable smallholder farmers to be in control of their farming practices. This notion has been supported by Jensen (2010) who has suggested that the mobile phone can connect the

smallholder farmers to extension staff, thereby eliminating the need for the farmers to travel for information.

A further study, by De-Silva and Ratnadiwakara (2008, p. 15) in Sri-Lanka, found that the use of mobile phones by farmers to access technical and production information, led to a 33 per cent drop in information search costs. A further study by Xiaolan and Shaheen (2012) in India found that the use of mobile phones had improved the quality and speed of extension delivery to smallholder farmers. The mobile phone can facilitate smallholder farmers' access to production information and technology for use in their farms. This study, however, explored the use mobile phone farming applications by smallholder farmers to access production information. The mobile phone farming applications comprised of downloadable phone apps that farmers could use to access information directly or through sending texts to access the required information.

2.9.2 Mobile phone and agricultural marketing

The potential role of the mobile phone in agricultural markets has been widely discussed in the literature (Abraham, 2006; Aker, 2008, 2010, 2011; Jensen, 2007, 2010; Labonne & Chase, 2009). As mentioned earlier, information is important for the functioning of markets. The mobile phone can facilitate smallholder farmers' access to market information, facilitate their participation in the markets and widen the scope of markets they can access (Etzo & Collender, 2010). The mobile phone in itself has no causative power in the markets except facilitating the ease of information access and thereby lowering the transaction costs associated with information search for both the smallholder farmers and traders (Carmody, 2012). Jensen (2010) has suggested that the effect of the mobile phone in agricultural markets are in two ways: first, by facilitating smallholder farmers' access to market and marketing information and second, by the reduction of price dispersion in agricultural markets.

In relation to the mobile phone facilitating access to markets and information, it has been highlighted by Abraham (2006) that agricultural marketing transaction costs consists of time, effort and money. An increase or decrease in any of the transaction cost components lead to an increase or decrease in the overall costs of information search for the smallholder farmers. A study, by Overa (2006) in Ghana on the use of mobile phones by the smallholder farmers, found that the farmers and the traders benefitted greatly by use of the mobile phone. To

Overa, the mobile phone provided the substitute for transport by allowing farmers to sell their produce to traders over the phone thus saving on time and reducing transportation costs.

A further study, by Muto and Yamano (2009) among Uganda smallholder farmers, found that increased mobile phone coverage increased smallholder farmers market participation especially for those producing perishable crops such as bananas. The study, further, found that the farmers living in remote villages benefitted more from the use of the mobile phone to access markets as it led to an increase in their incomes. In addition, a further study by Jensen (2007) among fishermen in Kerala, India, found that the introduction of the mobile phone led to more fishermen selling their fish directly to the market as opposed to selling the fish from their homes. The study further found that the fishermen could access newer markets beyond their usual markets in Kerala thus increasing the number of markets in which they could participate. Because of the widened market scope, Jensen's study found that the fishermen's profit margins increased by 8 per cent and there was a substantial reduction in fish wastages.

Conversely, it has been suggested that price dispersion in agricultural markets is caused by the lack of information in the markets. Price dispersion occurs when the price of a commodity differs between different markets within the same region (Pingali et al., 2005). However, when traders and suppliers can access the same market information, the price dispersion is reduced leading to the law of one price in the markets. The study by Jensen (2007) in Kerala, India, found that the use of the mobile phone by fishermen eventually led to a reduction in price dispersion over time. Jensen has suggested that since the traders and the fishermen had the access to the same information, the demand for fish was always met with enough supply thereby ensuring stable prices throughout fish markets in the region. In addition, a study by Aker (2008) on Niger grain markets found that the grain traders' use of mobile phones led to significant reduction in price dispersion in the grain markets. The study, by Aker, highlighted the fact that the use of the mobile phone had a significant effect in reducing price dispersion in rural areas with poor road access. Aker has further pointed out that there was a significant reduction in inter-annual price dispersion in Niger's grain markets, a phenomenon that was frequently leading to depressed incomes for farmers and traders.

In the Kenyan context, several studies have been carried on the use of the mobile phone by smallholder farmers (Muriithi, Bett, & Ogaleh, 2009; Okello et al., 2012; Okello et al., 2011). These studies have all concluded that the incorporation of mobile phones into agriculture has enabled farmers to significantly reduce the problems of information asymmetry in production

and marketing. However, it should be noted that the studies above have focused on the use of the mobile phones and not mobile phone farming applications, which this study explored to fill the existing knowledge gap.

2.10 Chapter Summary

This chapter has discussed the historical evolution of commercial agriculture in Kenya. In particular, the chapter has analysed the growth and establishment of smallholder farming from subsistence production before Kenya's independence to commercial production after independence. The chapter has also highlighted the fact that agriculture plays a dominant role in Kenya's economy and therefore any significant reduction in poverty should focus on revitalising Kenya's agricultural. Similarly, the chapter has also analysed the production and marketing problems that exist among the smallholder farmers. From the literature reviewed, it is clear that the weak agricultural extension system and poor roads infrastructure has exacerbated smallholder farmers production and marketing problems. The chapter has also argued that access to information can facilitate smallholder farmers' access to markets. In this regard, the chapter has analysed the potential role that the mobile phones can play in facilitating the smallholder farmers in meeting their information needs. The analysis of literature of different case studies in the chapter has highlighted that the mobile phone can facilitate smallholder farmers' access to production and marketing information and markets. With this in mind, the next chapter presents an analysis of the theoretical framework of the thesis: the capability approach. The capability approach is presented as a welfare theory that facilitates the evaluation of individual's well-being outcomes.

CHAPTER THREE
THE CAPABILITY APPROACH AND EVALUATION OF SMALLHOLDER FARMERS WELL-BEING

3.1 Introduction

In the previous chapter, the role of agriculture in economic development and poverty reduction was discussed. In particular, the role that agriculture has played over the years in Kenyan development was analysed with a key focus on the smallholder farmers and the problems they have faced in their production over the years. The potential of mobile phones in facilitating smallholder farmers' access to information and markets was also discussed. This chapter explored the emergence and the application of the capability approach as a theory and framework in welfare economics, development and well-being evaluation. The capability approach theory was deemed necessary for this study because it provided the framework, which made it possible to analyse and evaluate the well-being outcomes of the smallholder farmers based on their perceived well-being priorities. The theory's components such as capabilities and functionings facilitated the analysis of the smallholder farmers' use of the mobile phone farming applications and the effect of the use of these applications on their well-being outcomes.

The chapter begins by discussing the capability approach as an alternative theory of choice in welfare economics and as a broad framework of capturing the very essence of human development. Drawing on the work of the pioneer of capability approach, economist and philosopher Amartya Sen and the work by philosopher Martha Nussbaum among others, the chapter discusses the evolution of the capability approach and its eventual application in various fields as a framework of evaluating human development. Several key components of the approach such as capabilities, functionings, commodities, agency and freedom are also discussed. Eventually the operationalization of the capability approach, as a framework to evaluate the well-being of the smallholder farmers using mobile phone applications in Kenya, is discussed.

3.2 The Capability Approach

The capability approach has been described by Robeyns (2005a, p. 94), as a broad normative framework for conceptualising and evaluating the individual's well-being, policies and social arrangements in a society. The approach has been used in a wide range of fields in evaluating well-being, development programmes and projects, welfare economics and in philosophical studies. As such the capability approach, as developed by Sen, is not necessarily a theory of justice but rather it is concerned with justice by turning ethical issues into economics and human development (Sen, 1995, p. 87). Therefore, the capability approach, on one hand, focuses on justice and resources and, on the other hand, places emphasis on the conversion of justice and resources to capabilities, freedoms and outcomes. As a result, the approach has provided a theoretical basis for examining and evaluating inequality, poverty and policy analysis (Kuklys, 2005, p. 6).

The capability approach, as highlighted by Sen (1988), has its foundations in the works of earlier writers such as Aristotle and Adam Smith as well as John Rawls in recent times. However, Amartya Sen pioneered the approach in its present form through a series of writings spanning over a decade in different journals, books and lecture series. The first of these writings that introduced the approach was the paper '*Equality of What'* (Sen, 1980) presented at the Tanner lecture series at Stanford University in May 1979. In later years, Martha Nussbaum further added to the approach albeit from a social justice perspective. The study used the evaluative part of the approach to analyse the well-being outcomes of the smallholder farmers in their use of the mobile phone farming applications. The section below provides a broader analysis of capability approach.

3.2.1 Amartya Sen's concept of development

In his seminal paper '*Equality of what*', delivered in the Tanner lecture series at Stanford University in 1979, Sen tackled the question of equality as pertaining to the standard of living. In the paper, Sen asked why income and living standards matter. His answer was that they do not matter since they are simply instruments allowing one to lead the kind of life one desires based on the choices and opportunities available. Sen argued that most of the egalitarian theories, at the time, equated the issue of equality to *something*: for instance to income, welfare, liberties, commodities and utilities (Sen, 1980). Sen argued that the choice

of the framework in which equality is based, eventually, determined which equality we prioritized. For instance, if equality is based on income then we give priority to income as a measure of well-being.

As a result, Sen critiqued the prevailing reliance on primary goods and utilitarian equality as a measure of well-being (Sen, 1980, p. 217). Amartya Sen pointed out that the use of primary goods and utility as a measure of well-being were inadequate and subjective and, therefore, could not constitute a general standard to evaluate well-being (Giovanola, 2005, p. 253). The critique of utility and primary goods was based on the premise that both set of theories were limiting when judging social arrangements and reduced the concept of well-being to happiness and utility (Sen, 1980, p. 217).

Sen's subsequent works, (1983, 1984) further critiqued the reliance on utility and primary goods as a measure of well-being. One such critique was based on Sen's research in South America and Asia on the use of gross national product (GNP) as a measure of well-being (Sen, 1985a). When developing the capability approach, Sen carried out a comparative research on the use of GNP vis-a-vis the capability approach in Asia and South America, using data from the World Bank to measure well-being in particular countries. In his research, he found that the GNP of Brazil and of Mexico were seven times higher than the GNP of China, India and Sri Lanka (Sen, 1985a, p. 75). On the other hand, the quality of life in terms of infant mortality, life expectancy and child death rates was better in Sri Lanka and China compared to India, Mexico and Brazil (Sen, 1985a, p. 76). The study showed that the ranking of countries based on their GNP per capita could be different to rankings based on quality of life. The study further indicated that countries with high income could, at the same time, have very low performance in terms of quality of life. As a result, Amartya Sen critiqued the reliance in economic growth and income as the main characteristic of quality of life (Sen, 1990, p. 42). In place of the traditional reliance on GNP, utility, incomes and commodities, Sen proposed a framework that was to be based on the real opportunities that people have of living the kind of life that they value (Giovanola, 2005). This was to be the capability approach.

3.2.2 The capability approach examined

The capability approach can be defined by its focus on an individual's ability to achieve the kind of life that he/she has reason to value. As mentioned earlier, Sen has acknowledged that the foundation for his work goes back to earlier writers, such as Adam Smith, Karl Marx and Aristotle (Sen, 1990, p. 43). According to Sen, Smith and Marx had explicitly pointed out to an individual's functions and capability to function as a measure of well-being (Sen, 1990, p. 43). To Sen, Marx's contribution was his relating of success of human beings to fulfilling their needs through activities, while Smith had earlier written about the importance of the functioning of one appearing in public without feeling ashamed (Sen, 1990, p. 44).

In addition, Sen (1990, p. 44) also draws out on Aristotle's argument that wealth was merely useful for something else: that wealth was just a means to a subsequent end. Thereby, Sen pioneered the capability approach by integrating the works of the different economists and philosophers and further developing the approach as a main component of welfare economics. Sen, in his different works, argued that human capability was inherently important in judging the quality of life. Therefore, as Robeyns (2005a) has suggested, the capability approach went beyond just providing the standard criticism of welfare economics but provided an alternative approach of measuring and evaluating well-being. As a result, the capability approach has been said to be a theory within the liberal school of thought albeit of a critical strand (Robeyns, 2005a, p. 95)

Amartya Sen has described the capability approach as a framework of analysing people's capability to function (Sen, 1985b, 1988). The theory, as developed by Sen, offers the framework in which we can think through normative issues and make evaluations on an individual's well-being (Robeyns, 2005a, p. 94). It provides the framework in which different aspects of human development, such as poverty, inequality and gender among other issues, can be evaluated and analysed. The approach has subsequently been applied in wide and diverse sectors such as education, health, economics, law and justice amongst others. To understand the capability approach in a clear way Robeyns (2006), has proposed that the approach should be analysed at three different levels of importance. The first level of importance is that the approach is a framework of thought. The second level of importance is that it is a critique of welfare economics, and the third level of importance is as a way of making interpersonal comparisons of welfare.

The first theoretical level of analysing the capability approach, which Robeyns (2006) has stressed as the most important level, focuses on its ability to allow for assessment of an individual's well-being within a framework of expanded informational base. This level focuses on the question of what constitutes a good life, which, according to Sen, has to do with an individual's own definition of a good life. Therefore, the approach is a framework that can be empirically applied in the evaluation of different aspects of an individual's or group's well-being, such as inequality or poverty (Robeyns, 2006, p. 352).

As a result, the approach has provided an alternative methodology in the assessment of quality of life as opposed to the mainstream cost-benefit analysis that has been dominant in the evaluation of development policies. In rejecting utility and primary goods as a measure of well-being, Sen proposed the use of capabilities and functionings. These two components, capabilities and functionings, were to increase the informational base in which the quality of life was to be assessed. Sen defined capabilities as the ability of an individual to live the kind of life that he/she has reasons to value while, on the other hand, he defined functionings as constituting the beings and doings of an individual (Sen, 1999, p. 14). To this end, capabilities and functionings provided the information needed in evaluating the smallholder farmers well-being outcomes in the study.

Furthermore, Sen, distinguished between the means and ends of development (Sen, 1999, p. 36). Sen argued that only the ends of development have intrinsic importance in development while the means are instrumental in reaching the goal of quality of life (Sen, 1999, p. 16). The means of development in this case constitutes resources, commodities, income and primary goods, which, to Sen, are just a vehicle to a prospective end of enhancing the quality of life. Therefore, commodities, resources and primary goods are also important for development but just to facilitate individuals to achieve the kind of life that they value (Sen & Dreze, 2002, p. 82). The ends of development, on the other hand, are constituents of an improved quality of life such as literacy, nourishment, reduced mortality rates, access to information and increased life expectancy amongst others. Thus, when conceptualising development within the capability approach, emphasis is put on the outcomes and the freedom to choose a life that leads to the outcomes. In this study, the commodities consisted of the mobile phones while the ends of development constituted of the smallholder farmers' access to information and markets.

The second theoretical level of analysis of the capability approach focused on its critique of utility and commodity based approaches to evaluating well-being and welfare as discussed in section 3.2.1 above. Sen's critique of these approaches focused on the narrow informational space that they offered in evaluating welfare and instead he proposed capabilities and functionings as a basis of welfare evaluation. The third theoretical level of analysis of the capability approach, as proposed by Robeyns (2006), is based on the economics approaches. At this level, the capability approach is viewed as a formula or a model of carrying out comparison exercise in welfare economics (Robeyns, 2006, p. 353). Economists, in analysing the quality of life, have adopted this third level of analysis. However, this study adopted the first level of the capability approach (discussed above) as a tool for evaluating the smallholder farmers' well-being outcomes. Sen's work in capability approach has inspired others to further develop the approach. One such researcher is the philosopher Martha Nussbaum who, aside from Sen, has contributed significantly to the development of the capability framework.

3.2.3 Martha Nussbaum's capability approach

There have been many inputs into the capability framework originally developed by Amartya Sen. The philosopher Martha Nussbaum is one such scholar who has made notable contributions to the approach albeit from a philosophical standpoint. It should be noted that, both Nussbaum's and Sen's perspectives agree on many concepts of the overall approach such as the focus on the ends of development rather than the means. However, there are also differences. While Sen makes his contribution from an economics perspective, Nussbaum, a philosopher, makes a philosophical argument inspired by Aristotle's work (Nussbaum, 2000; p. 13). Moreover, in articulating the meaning of capabilities approach, Nussbaum argues that capabilities entail what people are able to do or be, informed by the intuitive idea of life that is worthy of human dignity. Therefore, while Sen's work focuses on the capability approach as a normative framework for evaluating well-being, Nussbaum's contribution focuses on the capability approach as a partial theory of justice (Robeyns, 2005a, p. 95). Nussbaum, through her work, has sought to extend the approach beyond its mainly evaluative and instrumental role, as developed by Sen, into a tangible foundation for a fully-fledged ethical political theory of social justice (Kurstak, 2012, p. 1).

Nussbaum shifted the focus of the approach from the assessment of quality of life to a theory of social justice that is intended to serve as a basic analysis of social injustice (Barclay, 2003, p. 6). Furthermore, Nussbaum (2000) presented the notion of a capabilities threshold below which no human being should live. In achieving this threshold, Nussbaum advocated for distributing among individuals, what she termed as, "the highly basic freedoms to do things that are essential to live the life that is minimally decent" (Kurstak, 2012, p. 3). She further argued that it was the role of governments throughout the world to ensure that their citizens achieved such basic capabilities (Nussbaum, 1999).

As a way of achieving these basic freedoms, Nussbaum proposed three categories of capabilities: basic capabilities, internal capabilities and combined capabilities (Nussbaum, 2000; p. 13). She went further and developed a list of ten capabilities, which she suggested could be used to evaluate social justice and human rights. Much of Nussbaum's work has been applied to diverse fields, such as social justice, feminism, disability studies, constitutionalism, governments and development studies amongst others. However, this study used Sen's capability approach framework and some components of Nussbaum work in the analysis of the smallholder farmers' well-being outcomes. The sections below analyses the major components of Sen's capability approach.

3.3 The Components of the Capability Approach

In the use of capability approach as a framework and as a tool for evaluation, distinction has to be made of its different components. The key components that make up the approach are: capabilities, functionings and commodities in one hand, and on the other hand, well-being and agency. These components are key in measuring and evaluating an individual's well-being. These components, as was used in the study, are discussed below.

3.3.1 Capabilities and functionings

The major constitutive parts of the capability approach used in well-being evaluation are capabilities and functionings. Capabilities has been described by Sen as the ability of individuals to live the kind of life that they value and have reason to value (Sen, 1999, p. 18). This kind of life may consist of a list of several things that the individual values or gives

priority to, such as going to school, having a job, living a long life and having a large family among other factors. Sen, therefore, points out that the sum total of alternative combinations of things that a person can be, or do, represents their capabilities set (Sen & Nussbaum, 1993).

At a given time, an individual may have a capability set comprising of all the capabilities that he/she will achieve and those that he/she will not, thus capabilities set comprises of the range of choices available to one (Lister, 2004, p. 16). For instance, a person may want to have a large family and, at the same-time, work in a highly paying and demanding job. The individual, in this case, may not be able to have a large family and, at the same time take up the demanding job; he/she will have to choose one and forego the other, for instance take up the very demanding job and forego the large family. However, when evaluating the well-being of such a person, all the capabilities sets available to the individual will be measured. The measure of the whole capabilities set focuses on evaluating the freedoms that the individual has of living the kind of life he/she values. This is one of the strengths of the capabilities approach over other approaches of assessing well-being as it focuses on the complete set of opportunities available to an individual (Walker & Unterhalter, 2007).

Whereas capabilities represent the potential to achieve a valued life, functionings, on the other hand, represent the achieved outcomes (Sen, 1999; Sen & Nussbaum, 1993). Functionings are the doings and beings of an individual for instance; reading, writing, being well fed, being healthy amongst others (Sen, 1988, p. 15). If we take the example above, of the person with the capabilities set of either choosing a highly paying and demanding job or having a large family, if the individual chooses the job over the large family then the functionings in this case will be the highly paying and demanding job. Therefore, the functionings of an individual comprises of what the individual has achieved and, as a result, the functionings tells us what an individual is doing or achieving. Thus, the difference between an individual's capabilities and functionings is represented by the opportunity to achieve (capabilities) and the actual achievement (functionings) (Walker & Unterhalter, 2007).

In the context of this study, capabilities and functionings can be differentiated with the following example. If, for instance, we take two farmers in a village in Kenya to illustrate the functioning of being able to access the market for their produce, both farmers are based in a village 250 kilometres (km) from Nairobi and they both grow tomatoes. The first farmer

(farmer A) has a pick-up truck and therefore sells her tomatoes in Nairobi at good prices. The second farmer (farmer B) desires to sell his tomatoes in Nairobi, too, but does not own any means of transport and is therefore forced to sell his tomatoes in the village market at low prices. Although they both manage to sell their tomatoes, farmer B has not achieved his functionings since his preferred market outlet is Nairobi and not the local market. However, farmer A has the freedom to live the kind of life she values thereby achieving her functionings while farmer B does not have such freedom and thereby fails to achieve his functionings.

Such a distinction between capabilities and functionings was important when evaluating the well-being of the smallholder farmers in the study. This was because, when evaluating the smallholder farmers well-being, focusing on their capabilities set as opposed to functionings allowed for expanded informational space of judging whether they were living the kind of life that they valued or not. Walker and Unterhalter (2007) have argued that focusing on functionings only may give the false impression that one is living the kind of life they value, while the true case is that they are not. Therefore, focusing on both the functionings and capabilities was important, in the study, since some farmers may have been achieving some outcomes, for instance access to rural markets, while the freedom to live the life that they desired was not there, for instance, access to urban markets. Therefore, when evaluating well-being, focusing on both an individual's capabilities and functionings has been recommended by Sen (1988, p. 15) .

Moreover, Sen has argued that the achievement of functionings is causally related to the possession of commodities by a person (Sen, 1988, p. 16). Commodities in this case may consist of goods or services that one owns or has access to. In this respect, Sen suggests that commodities are to be viewed in terms of their characteristics to enable an individual achieve desired outcomes and not in terms of ownership (Sen, 1983, p. 161). Commodities have specific characteristics which, when utilised by an individual, facilitates the individual in achieving functionings (Sen, 1983). Therefore, securing amounts of commodities gives the person the command over the commodities corresponding characteristics (Sen, 1985a, p. 9). For instance, in this study, the commodity of interest comprised of the mobile phone and the corresponding characteristics including: the mobile phone farming applications and other characteristics such as calling and texting. The mobile phone and the corresponding characteristics enabled the smallholder farmers to achieve their desired functionings of enhanced access to markets and information.

When using a commodity, conversion factors such as personal (age, sex and education), social and environmental factors determine how an individual interacts with the commodity to achieve the desired functionings (Lister, 2004; p. 16). For instance, in the study, the smallholder farmers' conversion factors, such as education level and literacy, sex (male or female), locality (urban or rural), determined how the farmers interacted with the mobile phone farming applications and their corresponding capabilities set. For instance, the rural farmers had more informational needs compared to urban farmers due to their remoteness. Therefore, just knowing the kinds of goods that a person owns is not enough for the understanding of which functionings the person can achieve. In this regard, Robeyns (2005a, p. 99) has argued that we need to look at the circumstances under which an individual is living in order to evaluate his/her well-being sufficiently. The section below analyses the differences between well-being and agency freedom.

3.3.2 Well-being freedom versus agency freedom

Within the capability approach, Sen has differentiated two types of freedoms: well-being and agency in the evaluation of well-being outcomes (Sen, 1984). Sen has defined well-being freedom as directly related to the well-being aspect of an individual while agency freedom has been defined as the general goals that an individual chooses to pursue or value and that he/she regards as important (Sen, 1985c, p. 203). Sen further points out that well-being freedom is specific and directed towards a direct objective, for instance improved access to food, and therefore it does not reflect the overall freedom of an individual. On the other hand, Sen argues that agency freedom is more general and includes freedom to choose whatever an individual chooses to pursue and includes all the objectives and outcomes that one engages in and goes beyond personal well-being (Sen, 1984, p. 37). Therefore, agency freedom, as pointed out by Ibrahim and Alkire (2007, p. 1), comes close to capturing the concept of empowerment.

In this regard, Kabeer (1999, p. 438) has defined agency, within the capability approach, as the ability of an individual to define one's goals and act upon such goals. Kabeer therefore, relates agency and empowerment to choice in this case, the acquisition of the ability to make choices in life where such ability never existed before. In the operationalization of agency in the capability approach, Kabeer, has stated that this may take the form of: empowerment, the ability to have choices, decision making, bargaining and negotiation with the idea that an

individual is able to live the kind of life that they value. To differentiate between well-being and agency freedom in the study, the example below is used.

One of the farmers in this study, Farmer K, was a rural based male smallholder farmer. This farmer has several needs, which included access to commodity prices and production information and access to markets with better prices. Since these were specific needs of the farmer that he could meet by the use of the mobile phone farming application, they comprised of the farmer's well-being freedom. When the farmer had achieved these outcomes, he realised that he could get better prices for his produce by negotiating with potential buyers and deciding which trader to sell to since, he could access price information for his produce. As the farmer could now access price information that he could not access before, he was empowered and could negotiate with potential buyers. The farmer, therefore, achieved his agency freedom of being empowered.

In the context of this, Sen (1999), further makes the distinction between the two roles of freedom in the evaluation of well-being; the constitutive role and the instrumental role of freedom. The constitutive role of freedom includes the basic capabilities that ensure that one avoids deprivations such as hunger, premature death and illiteracy amongst others (Sen, 1999, p. 36). On the other, the instrumental role of freedom consists of the expansion of all forms of capabilities basic and non-basic (Sen, 1999). Sen has further argued that, distinguishing the different roles of freedoms is important in the process of evaluating well-being since the assessment of development has to be informed by such consideration. Therefore, one has to define which level of capabilities to evaluate in a well-being assessment, whether constitutive or instrumental. However, such a definition of capabilities level is often determined within the context of the evaluation since a non-basic capability, for instance market access, in one area may end up being a basic capability in another area since it directly affects household livelihood. The definition of capabilities level can be done when operationalizing the capability approach for well-being evaluation as described below.

3.4 Operationalization of the Capability Approach

This section discusses the process of operationalizing the capability approach for well-being evaluation. The theoretical richness of the capability approach has proved to be a challenge when it comes to its empirical application in the evaluation of an individual's well-being.

Sen, while developing the capability approach, avoided recommending a set of methodologies for its practical application in the evaluation of well-being. As a result, there have been diverse and varied methods developed by specialists in different fields on the application of capability approach in evaluation of well-being. Such methods have included econometric models for instance by Kuklys (2005), to quantitative and qualitative methods developed by Robeyns (2005b) and Comim, Qizilbash, and Alkire (2008). However, this study adopted the qualitative methods developed by Robeyns (2003) and Alkire (2002) in operationalizing the capability approach. In the operationalization of the approach, Robeyns (2006, p. 353), has suggested a three stage process.

The first step in the operationalization involves specifying the well-being component to be evaluated. This involves stating whether the evaluation will focus on the capabilities or functionings of the individuals or a combination of both. This distinction is important because capabilities (the range of choices) and functionings (the outcomes thereof) are different and because of this, the informational base needed for the evaluation may be different. In deciding which component to evaluate, Robeyns (2006, p. 354), has pointed out that it depends on whether the evaluation is looking at either the well-being outcomes or the choices and opportunities available to individuals. For this study, the focus was on both the capabilities and functionings of the smallholder farmers.

The second step in the operationalization of the approach, according to Robeyns (2006, p. 355), involves the selection of actual capabilities to be evaluated. The selection of functionings does not matter since functionings are often outcomes from capabilities. In achieving this, Sen (2004) has recommended a process of democratic public reasoning to be applied in coming up with a capabilities list. This may involve the use of participatory processes such as interviews and focus group discussions. Putting this into practice Robeyns (2003, p. 70), has suggested a two-stage process in developing the capabilities list. The first stage involves coming up with what Robeyns has called an unconstrained list of capabilities. An unconstrained list of capabilities is developed by the researcher through a process of practical reasoning involving listing all possible and potential capabilities that the population of study may have before embarking for the fieldwork. After developing the unconstrained capabilities list, the second step involves refining the unconstrained list of capabilities to a pragmatic list of capabilities through participatory research methods. This involves engaging the research participants, through interviews or focus group discussion, to describe their desired capabilities. Therefore, while the unconstrained list is developed without considering

the social, economic, environmental and personal factors that may inhibit some capabilities, the pragmatic list is developed with these factors in mind and through a participatory process.

The final step in the operationalization of the capability approach involves the aggregation of the weight and measures to be assigned to the functionings being assessed (Robeyns, 2006, p. 357). In other words: how does the researcher determine which outcome is more important, to the individual or community, than other achieved outcomes? Such aggregation can be done at two levels, as recommended by Robeyns, at the individual level (*intra-personal aggregation*) or at the group level (*inter-personal aggregation*). If the well-being evaluation is at an individual level then *intra-personal aggregation* is adopted. In contrast, if the evaluation is at a community level then inter-personal aggregation is used. To achieve the aggregation Alkire (2005), has recommended the ranking of the functionings by the research participants, from the most important to the least important, with the participants describing why they perceive certain outcomes to be more important than the rest. However, for this study, the ranking of functionings was not done since the farmers were interviewed separately and therefore it was not possible to develop a single list of aggregated functionings. The actual operationalization of capability approach, for well-being evaluation of the smallholder farmers in this study, has been discussed in section 4.6 in the following chapter on methodology.

3.5 Chapter Summary

The chapter has analysed the capability approach, its application for well-being evaluation and its operationalization in the study. The capability approach is a welfare theory that puts emphasis on an individual's quality of life. In the capability approach, the quality of life is measured by two key components: capabilities and functionings. While capabilities include the opportunities available to individuals to live the kind of life they have reason to value, functionings, in contrast, include the achieved opportunities. Therefore, when evaluating and measuring the quality of life, Sen has recommended the use of these two components. This theory was selected, for this thesis, because of its suitability in the evaluation of well-being outcomes of individuals in different contexts. In operationalizing the approach, the three-step process recommended by Robeyns (2006) was used. The process of operationalizing the approach in the study was successful in capturing the capabilities of the smallholder farmers and the well-being outcomes at a personal level as discussed in results section chapter 6. The next chapter describes the methods that were used data collection for the study. The chapter

also describes the actual operationalization of the capability approach in the study using the methods that are described below.

CHAPTER FOUR
METHODOLOGY AND RESEARCH METHODS

4.1 Introduction

The previous chapter has discussed the capability approach, its relevance for the study and its operationalization in the study in the well-being evaluation of the smallholder farmers. In operationalizing the capability approach in the study, interview data collection method was used to develop the pragmatic list of capabilities and to finally evaluate the smallholder farmers' well-being outcomes. Therefore, this chapter, in consideration of the study research questions and the theoretical framework, discusses the methodology and the methods that were used to answer the research questions posed and describes the operationalization of the capabilities approach for this study. The chapter begins with a description of the fieldwork process, thereafter, the ethical process, the positionality of the researcher, the sampling process, an overview of the qualitative methodology and philosophical background, the data collection and analysis methods and the fieldwork experience, are discussed

4.2 Research Preparation

Being the first time that I carried out an academic field research activity, I had anticipated the process to be daunting with many unexpected eventualities in between. In order to be ready for the fieldwork process and the unexpected eventualities, I had to undertake an adequate preparation process before embarking for fieldwork in Kenya. Below is the description of the activities that I had to consider or undertake before embarking for the fieldwork. The sub-section discusses: the preparation for fieldwork, the research ethics and positionality in the field.

4.2.1 Preparation for fieldwork

Fieldwork has been described as the processes and techniques that are aimed at producing an account of facts and experiences of people captured in their own context of words, actions or behaviours through a series of data collection methods (Blommaert & Jie, 2010, p. 5). For the success of my fieldwork, I had to adequately prepare myself in order to facilitate a smooth process of data collection and to minimise any chances of causing harm to the research

participants. The basis for the fieldwork preparation was that I would be able to totally participate in the field allowing for observation and experience of the social setting from the research participants point of view and thereby achieving a positive outcome from the field (Leslie & Storey, 2003). Some of the issues that I considered as part of the fieldwork preparation included: familiarising myself with the study area, choosing the appropriate time for fieldwork and the data collection methods to use.

Before beginning the fieldwork, I engaged in a critical review of the literature (see Chapter Two) to get a clear understanding of the research topic. The review of the literature was key to grasping the current issues and debates on the topic under research as well as in facilitating a comprehensive understanding of current and previous research on the research topic. This entailed reviewing and reading books and journals of relevance, research reports from various organisations and governments as well as conference papers and magazines. I further reviewed the literature related to the theory of interest, in this case the capability approach (see Chapter Three), as well as literature on research methods. The development of the theoretical and conceptual framework and the research questions facilitated the selection of the right methodology and methods to be used in answering the research questions. In addition, I went through an in-house ethical process before embarking on the fieldwork. These processes were aimed at ensuring that the research process was ethically sound and caused no harm to the research participants.

4.2.2 Ethical aspects in the fieldwork and participants recruitment

In recent years, ethical issues in research, which comprises of fieldwork, the use of data thereof and the analysis and interpretation of the results, have become significant aspects in the landscape of qualitative research (Miller, Mauthner, Birch, & Jessop, 2012, p. 2). As such, as posited by Sultana (2007), fieldwork has come to be defined by the need for ethical issues to be considered before the fieldwork begins, throughout the fieldwork and even after leaving the field. Furthermore, Sultana (2007, p. 374) has argued that research carried out in the Global South often portends more challenges and barriers (issues of literacy, access to places, bureaucracy and corruption among others) than in the Global North and, as such, ethics become more important. Therefore, for this research, the purpose of ethics was to ensure that the research process did not cause any physical and/or psychological harm to the research participants. Some of the issues that I considered under ethics were the process of

participants' recruitment, the data collection techniques, obtaining informed consent from research participants, the confidentiality of the data and anonymity of participants as well as potential risks of the research to the participants and the researcher.

The first step involved reading and familiarising myself with the Massey University Human Ethics Committee (MUHEC) code of ethics in research. After that, as recommended by the MUHEC document, I completed the ethics-screening questionnaire and the departmental ethics form and submitted both to the first supervisor. Thereafter, I attended a departmental ethics review consisting of my two supervisors and an independent lecturer from the department. Based on the responses to the screening questionnaire, the research was characterised as posing a low ethical risk and thereby a low risk notification approval was sought from MUHEC through the supervisors. MUHEC approved the research as low risk before I embarked for my fieldwork.

The second step involved obtaining a research permit from the National Council for Science and Technology (NCST) in Kenya as required by Kenyan law. The research permit was applied for to ensure that the research met the guidelines and requirements of the Kenyan government. I applied for the research permit while still in New Zealand with the fieldwork site specified as Kiambu County in Kenya. However, on arriving in Kiambu County and meeting the various gatekeepers, I realised that I could not get the population of research interest in Kiambu County. As a result, I had to change my fieldwork site from Kiambu County different counties in Kenya where I could find research participants thereby necessitating a re-application for another research permit from NCST.

After obtaining the research permit, the next process involved recruiting participants for the study. From the beginning the process of recruiting research participants was to be a top-down process involving the use of various gatekeepers since the farmers using these applications were not many and therefore their identification could only be successful through the use of the gatekeepers. Gatekeepers have been described as consisting of individuals, groups or organisation within a community or area that acts as intermediaries between researchers and participants (Clark, 2011; p. 486). Gatekeepers, therefore, play the role of supporting the research process by being the intermediary between the researcher and the community. For this research, I used various gatekeepers, at national and county level, comprising of personnel from the Ministry of Agriculture and various organisations of

interest, such as mobile phone farming service providers. With the assistance of the gatekeepers, I was able to contact eight farmers based in various counties for interviews.

At the various levels, I approached the gatekeepers and explained my research to them. I thereafter asked for guidance in identifying the smallholder farmers who were using the mobile phone farming applications. After identifying the research participants of interest, I then contacted them by calling them, introduced myself and explained my research to them. I thereafter asked them if they would be willing to participate in my research. For those who were willing, the next step involved scheduling an appointment with them for an appropriate day, time and place for the interview.

During the interviews and observation, I first introduced myself to the participants explaining that I was a student from Massey University and the purpose of the research. I then sought informed consent from the research participants to carry out the interviews. Informed consent as described by Nnebue (2013, p. 5) is the process in which the research participants learn key facts about the research including potential risks and benefits before deciding to participate in the research. Therefore, I clearly explained to the participants their rights as research participants, the data collection process to be used, in this case in-depth interviews, and how the data obtained would be used. I further explained to the research participants that the interviews were to be recorded on a voice recorder and asked for their permission to record the interviews. The research participants were also informed that they had the right to withdraw from the study at any time during the data collection process if they felt uncomfortable.

Moreover, I reassured the research participants of the confidentiality of their responses and their anonymity when reporting the findings. Confidentiality has been defined by Bell (2005, p. 48) as the promise that the researcher gives to the research participants that they will not be identified or presented in an identifiable form during data collection and the presentation of the results. I explained to the participants that their views and opinions would be used in reporting of results but their names and identity would be kept in confidence and not revealed to anyone else. After the interviews and observation, the voice interviews were transferred to a password-protected laptop while the observation documents were kept in a secure locker under lock and key with restricted access. Furthermore, confidentiality was maintained during reporting of the research findings by removing any participants identifying marks.

4.2.3 Positionality and power relationships

At the beginning of fieldwork, one challenge that a researcher may often encounter may involve the positionality of the researcher as well as the power relations between the researcher and the research participants (Bachmann, 2011). The power differences between the researcher and the participants can be at two levels as pointed out by Scheyvens, Nowak, and Scheyvens (2003, p. 149): the difference in money, career and other resources and the perceived differences in the mind of the research participants that they are inferior to the researcher. Therefore, the dynamics of fieldwork, as regarding power relations, often varies from one researcher to another depending upon the researcher's positionality. A researcher may take the position of an insider or an outsider or somewhere in-between along the positionality continuum during fieldwork. Indeed, (Taylor, 2011, p. 6) has pointed out that a researcher can never assume totality in their position as either an insider or as an outsider, because the boundaries of such positions always change. Therefore, for my fieldwork, it was important for me to have a clear idea of my position in the field during the entire fieldwork process.

Two types of positionality have been articulated in the literature: the insider position and the outsider position. The outsider positionality has been said to occur when one carries out research in an area and culture unfamiliar to him/her (Corbin-Dwyer & Buckle, 2009). This could involve carrying out research in a foreign country or within one's own country but in a different part of the country with a unique sub-culture that the researcher is not familiar with. On the other hand, Corbin-Dwyer & Buckle have suggested that the insider positionality occurs when a researcher conducts fieldwork within a population in which they are also members and share an identity or language. However, despite such clear dichotomies, Karnieli-Miller, Strier, and Pessach (2009, p. 284) have stressed that the power relations and positionality in research should be viewed as a continuum from a hierarchical power to egalitarian with no clear cut absolutes. Therefore, a researcher in most cases occupies the space between the insider-outsider dichotomy and neither falling completely on one side or the other (Corbin-Dwyer & Buckle, 2009). For my study, I had to take different positions, within the positionality continuum, at different times in the field and this had to be constantly negotiated from one time to another for the successful completion of the fieldwork.

During the fieldwork, I began as an outsider even though I was familiar with the country. This was because some of the fieldwork sites such as Narok, Nyandarua and Kajiado Counties were new places that I had not lived in nor visited before. This made me an outsider with no clear knowledge or experience of the sub-cultures in the field sites, the local language spoken and the local value system. In addition, being educated and from the middle-class made me an outsider in these areas, which are predominantly made up of smallholder farmers with little or no education. This, therefore, presented a challenge of gaining entry into the study area. To overcome this challenge, I used the community gatekeepers to gain access into the community. This involved a process of critical reflection and continuous engagement with the community gatekeepers who comprised of local government staff in various ministries, village elders and different organisations within the community. This was done to earn their trust as well as to negotiate my entry onto the fieldwork site.

On the other hand, I also operated within the insider position for the fact that my fieldwork was based in my home country. However, returning home for my fieldwork then posed a dilemma to me: was it to be home or field? As has been correctly pointed out by Sultana (2007, p. 377) sometimes what constitutes the 'field' versus 'home' is a problematic distinction, as returning to Kenya to do fieldwork was by no means returning 'home'. However, my insider positionality had several advantages during the fieldwork such as being easily accepted around, being able to blend in and having a comprehensive understanding of the general language and culture of the community.

Furthermore, the insider position was reinforced by the fact that I had earlier worked within the agricultural sector in Kenya for several years. The insider positionality proved to be useful at the beginning of my fieldwork. At the very beginning of participants' recruitment with assistance of various gatekeepers, I had taken the outsider position with the knowledge that such a position would enable me to maintain neutrality. However, after trying for two weeks to recruit participants from various gatekeepers to no avail and, after discussion with the supervisors, I decided to change position and take an insider position. As a former employee of the Ministry of Agriculture, I decided to use contacts within the ministry to assist me in recruiting participants. A case in point is when a former colleague contacted Mfarm on my behalf to inquire from them if they could assist me in identifying farmers that were using their services. This proved to be very fruitful as the Mfarm staff obliged to assist me in identifying the farmers using their services after initially turning me down. This may have posed a conflict of interest, however, this strategy caused as little conflict as possible

since I had decided not to reveal my previous work experience to the research participants in order to avoid intimidating them and affecting their responses.

Therefore, for this research, having contacts within the Ministry of Agriculture and the larger agricultural sector in Kenya was helpful in facilitating the research process. Corbin-Dwyer and Buckle (2009, p. 58) have alluded to this by pointing out that the insider position can be effective in the field as it gives the researcher the legitimacy and allows for a rapid acceptance of the researcher. However, as earlier mentioned, I decided not to reveal my previous work with the Ministry of Agriculture to research participants in order to maintain neutrality and avoid getting biased responses.

4.2.4 Entering into the field and the sampling process

For my fieldwork the process of gaining access into the different fieldwork sites was crucial as it determined the level of trust that the community offered and thereby the quality of data that I collected. For this research, the process of entering into the field began with visiting various gatekeepers within the community of study. On the first day of arrival in the different field sites, I first had to visit the local office of Ministry of Education to present the research permit from NCST as required by Kenyan law. Earlier on in Nairobi, I had visited the offices of various mobile phone farming service providers to get information on the farmers using their services. From the service providers, I was able to obtain contacts of eight smallholder farmers using their services whom I contacted directly and scheduled interview appointments.

The use of gatekeepers, in participant recruitment was helpful in recruiting two types of participants who were not easily accessible: the smallholder farmers who had been using the mobile phone farming services but had stopped, as well as those who had never used the services before but had knowledge and information about the service. The participants who had heard about these services but were not using them comprised of farmers who had earlier been trained on the use of these services but had not yet adopted their use.

The total number of participants interviewed was fifteen smallholder farmers comprising of: twelve farmers who were using the applications, two who had knowledge of the applications but were not using them and one farmer who once used the applications but had stopped using them. During fieldwork, various sampling methods were used to select participants for interviews and observation. Participant recruitment involves the process of selecting

individuals from the study population to participate in the study (Hennink et al., 2011, p. 84). Qualitative research, as recommended by Hennink et al, does not always require a representative sample since the aim of qualitative study is not always to generalise the study findings to the entire population. Therefore, qualitative studies tend to use flexible and non-random methods of sampling to recruit participants. Furthermore, since qualitative research focuses on the depth of data rather than breadth, the number of research participants is most often limited (Ritchie, Lewis, & Elam, 2003, p. 83). As a result, for my study, two non-random sampling methods were used to recruit the participants. This involved the use of purposive sampling on one hand and snowballing sampling on the other. The choice of these sampling methods was also based on the fact that the research participants had specific characteristics that were not evenly distributed to the entire population.

Purposive sampling involves the selection of research participants with a specific characteristic and experience that can contribute to the study topic (Hennink et al., 2011). Purposive sampling was the main sampling procedure for the study. In the case of selecting smallholder farmers currently using the service, various gatekeepers were used to recruit a self-selecting sample. I first described to the various gatekeepers the type of participants I was looking for to interview. After acquiring research participants' contacts, I contacted them to arrange for interviews. This way I ended up with a self-selecting sample.

In contrast, the smallholder farmers with the other two characteristics: those who had never used the service before and those who once used it but had stopped, were selected through targeted sampling. The gatekeepers facilitated the selection of this sample especially the mobile phone farming service providers. In addition, snowballing sampling method was also used to identify and interview subsequent participants. The first participants to be recruited and interviewed were the farmers recommended by the gatekeepers. Seven more smallholder farmers were selected through snowballing method. Snow balling involves asking people who have already been interviewed to identify other people they know who fit the selection criteria (Ritchie et al., 2003, p. 94). In the field, farmers who had already been interviewed were asked if they knew other smallholder farmers who were using the same service, and if so, to refer the researcher to such a farmer. Participant recruitment through snowballing can be advantageous as suggested by Hennink et al. (2011) in that the next participant is linked to the study by a trusted person and thereby alienating any mistrust. This process was repeated until the point of information saturation was reached and then the interview process was stopped.

4.3 The Study's Philosophical Underpinning

The philosophical underpinnings of research has been said to influence the choice of research methodology and the methods of data collection (Hennink et al., 2011, p. 21). Furthermore,Bryman (2012, p. 20) has suggested that the philosophical paradigm chosen by a researcher ultimately influences the rationale for the research as well as the research framework. Therefore, it was important to have a clearly stated philosophical standing before the fieldwork began. The philosophical influence on a study can be in two positions: ontological and epistemological. The ontological position of the study was based on constructivism while the epistemological position was based on the interpretive paradigm.

The ontological perspective has been described by Waring (2012, p. 17) as what forms the basis of the social world to be researched. For this study, the ontological position was based on constructivism. The constructivist perspective holds that reality is neither objective nor singular but multiple as constructed by individuals (Waring, 2012, p. 17). To a constructivist, reality is mentally constructed by individuals and thus, for this study it was accepted that there exist multiple realities for the smallholder farmers on the use of the mobile phone farming applications. Therefore, the participants interviewed all had multiple reasons for using the applications and similarly multiple perceptions on the benefits of the applications to their well-being.

In contrast, epistemology has been described as being concerned with the ways of learning and knowing about the social world (Snape & Spencer, 2003, p. 13). This study was based on the interpretivist stance. The interpretivist stance focuses on the processes by which meanings are created, negotiated, sustained and modified within a specific context of human action (Schwandt, 1994, p. 119). This paradigm is reflected in social science by the importance of understanding people's perspective in their context and circumstances of their lives. The aim of the interpretive paradigm is to understand people's lived experiences from their own perspective by focusing on the subjective meanings that they attach to their lives within the context in which they live (Hennink et al., 2011, p. 14). In this study, the subjective meanings was clearly indicated by the differences in the needs and use of the mobile phone farming applications between the urban and rural smallholder farmers. The rural based farmers had increased information needs and thus their demand on the use of the application was increased compared to urban-based farmers. This was because the different environmental and socio-economic factors between rural and urban areas invariably defined

the smallholder farmers' needs thereby influencing their use of the mobile phone farming applications. The philosophical underpinning influenced the choice of research methodology, data collection methods and the type of questions that were asked.

4.4 Qualitative Research Methodology

Qualitative methodology has been construed by Bryman (2012, p. 36) as referring to the research strategy that places emphasis on ways in which individuals interpret their social world based on descriptions they associate with things, places and people. This type of research enables a study to examine people's lives in detail using a specific set of research methods and data collection techniques such as focus groups discussions, interviews, observations, content analysis among others (Hennink et al., 2011, p. 9). The main advantage of using qualitative research in this study was that it allowed for the understanding of meanings and interpretation that the smallholder farmers attached in their use of the mobile phone farming applications. Moreover, Bryman (2010, p. 50) has suggested that qualitative study may sometimes involve triangulation[6] in order to secure an in-depth understanding of the study phenomenon. Therefore, for this study, two methods of data collection were used: in-depth interviews to directly explore and assess the participants' experiences in their use of the mobile phone farming applications and participant observation to observe how the smallholder farmers interacted with the mobile phones farming applications.

Qualitative methodology was found to be suitable for this study since it provided the means to interact with the smallholder farmers in their own setting and to hear and probe their responses in answering the research questions. The study was exploratory in nature with the aim of understanding the smallholder farmers lived experiences in their use of mobile phones farming applications. Qualitative methodology provided both the means to both directly talk with the farmers to get their responses and observe them in their own environment. Moreover, qualitative methodology provided the means to operationalize the capability approach in evaluating the smallholder farmers' well-being. As such, qualitative methods offered the best instruments to understand the farmers' experiences. The data collection methods used is described below.

[6] Triangulation involves using different sources/methods of information in order to increase the validity of a study. Guion, L. A., Diehl, D. C., & McDonald, D. (2011). Triangulation: Establishing the validity of qualitative studies.University of Florida IFAS extension

4.5 Data Collection Methods

In-order to answer the research questions and operationalize the theoretical framework, the study employed three different methods of data collection techniques. The primary data collection method consisted of the use of semi-structured interview schedules and observation. The secondary method consisted of document analysis. The various methods that were used are described below.

4.5.1 Semi-structured interviews

Interviewing has long been the method of choice for most qualitative researchers (Mears, 2012). Interviewing in itself can be in three major forms: structured interviews, semi-structured interviews and unstructured interviews. This study, adopted the semi-structured interview as the main tool for data collection. Semi-structured interviews involve a one on one method of data collection in which the interviewer and the interviewee discuss the topic of interest in detail (Hennink et al., 2011, p. 109). This method of data collection has been recommended for a type of research that intends to capture the depth of topic under inquiry (Mears, 2012; O'Leary, 2010).

Interviewing was the main method of data collection for the study as well as a first step in the operationalizing of capability approach (see Chapter Three) in the evaluation of the smallholder farmers' well-being. This method was selected because it provided the means of capturing in detail the smallholder farmers' opinions and views in their use of the mobile phone farming applications as well as the opportunity to probe their responses. A semi-structured interview guide (see the appendix for details) was first developed comprising of a set of questions to guide the interview. The guide was simply used to give direction to the interview with probing and extra questions being asked during the actual interviews. The probing allowed for a comprehensive understanding of the smallholder farmers' thoughts and opinions on the topic of research. The interviews were generally carried out in English and, in some cases, Kiswahili which had to be translated to English during the data transcription.

The questions in the guide were in four parts: first icebreaker questions to open the interview and create a rapport, second background questions to understand smallholder farmers' farming background, third knowledge questions to explore the use of the mobile phone

farming applications and finally concluding questions to wrap up the interview. During the actual interview, I had to establish a rapport with the interviewees before commencing with the interview in order to build trust and get honest answers. I explained to the interviewees that their responses were to be recorded in the voice recorder and asked for their permission to do so before beginning the interviews. The interview questions were asked in an open and empathic way to encourage the interviewees to fully participate in the process. In addition, the interviewees were motivated to tell their story by probing their responses. Participant observation method was also used in data collection.

4.5.2 Participant observation

Participant observation is the data collection method that enables the researcher to observe and record people's behaviour, actions and interactions systematically while participants are in their own setting (Hennink et al., 2011, p. 170). This type of data collection is rarely used as by itself but rather to complement other methods of data collection such as interviews (Angrosino, 2012, p. 165). Participant observation has the advantage of allowing the researcher to gain a detailed description of the social settings or events in which the study is taking place and situate people's behaviour within their own social-cultural context. In most cases, the participant observation method can be carried out concurrently with interviews. As such, Hennink et al. (2011, p. 171) have suggested that observational methods can be used when: one wants to explore a new topic, provide the context of the study, describe a specific place or social setting or people's actions and to explain people's actions in context.

For this study, I adopted the participant observation method, which involved participating in the daily life of the research participants yet maintaining a distance in order to observe the participants in their own setting (Hennink et al., 2011, p. 179). This involved first explaining to the research participants what the observation was about and describing the procedures that I was to use in the observation process. After this, I asked for the participants' permission to be observed. I further informed the participants that I was to also observe their environment and take notes during the interviews. However, I was also able to spend a whole day with a smallholder farmer on his farm to carry out observation on how he goes about using the mobile phone farming application to look for markets and information.

4.5.3 Secondary data analysis

Secondary data analysis has been described by Rubin and Babbie (2008, p. 268) as a form of research in which the data collected and processed for a prior study are reanalysed and used in a subsequent study which may be different from the original study. Such data may come from government reports, industry studies, books, journals, magazines and newspapers among other materials. As such, research may begin with the exploration and analysis of available secondary data to determine what has been done in the area of research interest and explore what remains to be done (Silverman, 2010, p. 352). Therefore, for my study, secondary data was useful in determining and defining the topic of research, suggesting the questions to be answered and providing guidance on how the research questions were to be answered.

In analysing the secondary data, I retrieved, reviewed and analysed a wide range of materials consisting of academic journals of relevance to the study, books, organisational and government reports as well as magazines and newspapers. This was done prior to the fieldwork and continued throughout the thesis preparation stages of data analysis, presentation of results and discussion. The purpose of this was to assist in getting a clear understanding of the topic, define the problem to be studied, the theory to be used to evaluate the study and the subsequent methods to be used in data collection and analysis. The secondary material was useful for this study as it provided the guidance and information for the literature and theoretical review and methodology section of the thesis.

4.6 Application of the Capability Approach in the Study

In operationalizing the approach to evaluate the well-being of the smallholder farmers, the first two specifications suggested by Robeyns (2006) that were discussed in Chapter Three section 3.4 were applied. The first step involved specifying what was to be evaluated, which in this case, was the well-being outcomes for the smallholder farmers from the use of the mobile phone farming applications. However, to assess the well-being outcomes for the smallholder farmers, a list of the smallholder farmers' capabilities was developed. This was done in two stages as prescribed by Robeyns.

The first step involved developing a list of unconstrained capabilities (see Figure 2 below). This was done through a process of evaluating/reviewing the probable and potential capabilities of the smallholder farmers. This involved listing all the probable smallholder farmers' capabilities without consideration of the personal, environmental, social or economic factors that may have inhibited some capabilities. The second step involved developing the pragmatic capabilities list (see Figure 2 below). The Pragmatic capabilities was developed in the field through the interview process. This involved asking the research participants to think through and describe the choices and opportunities available to them to live the kind of life that they value as pertaining to the use of the mobile phone farming applications in their farming. The capabilities listed by the smallholder farmers comprised the pragmatic capabilities set.

The final step involved using the specified capabilities (pragmatic capabilities) to evaluate the smallholder farmers' well-being outcomes. This was done through interviews. The smallholder farmers were asked to describe what they have been able to achieve from their earlier specified capabilities list because of using of the mobile phone farming applications. This included direct and observable well-being outcomes, such as the ease of access to markets and information and increased income, to indirect ones, such as the ability to negotiate with traders and having more time to spend with their families. Interviewing and observation methods were the main methods used to apply the capability theory in the study. The operationalization of the capability approach was conceptualised in the Figure 2 below:

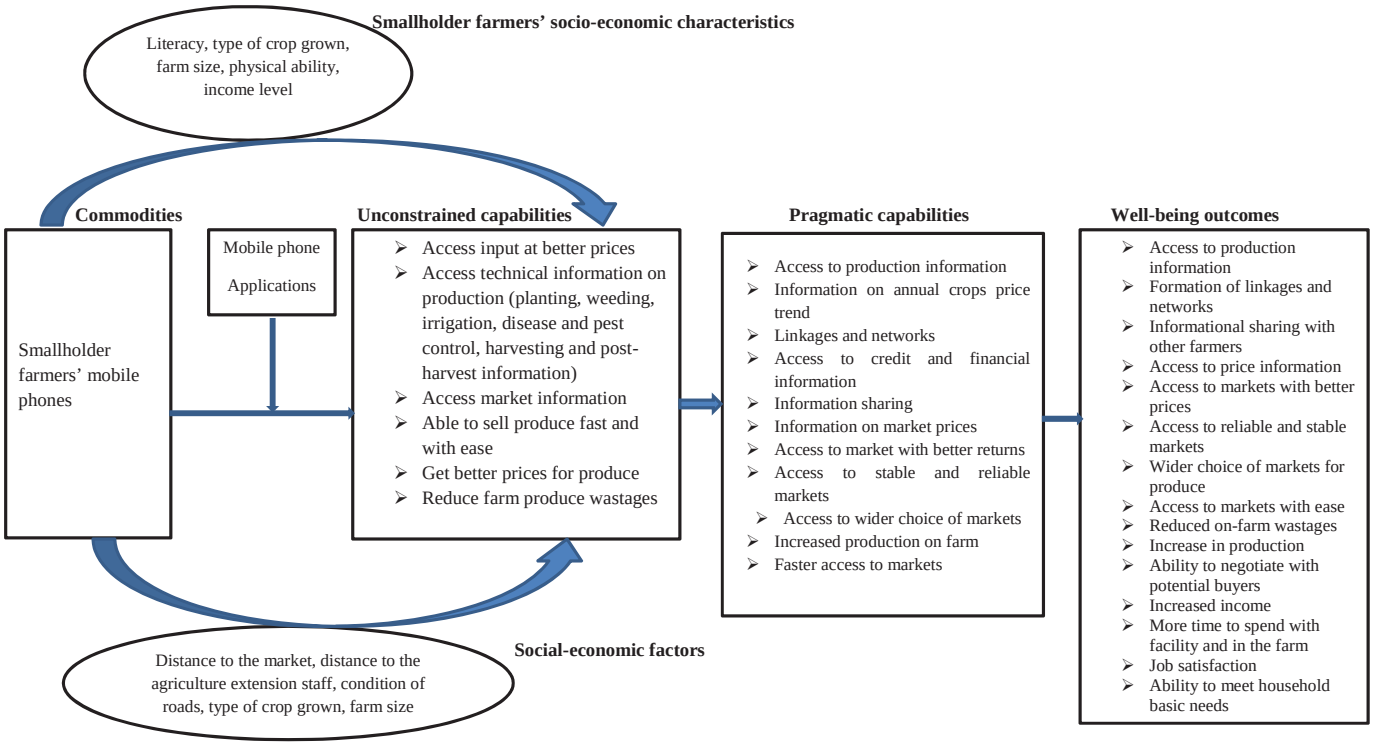

Figure 2: Conceptual framework of the capability approach in evaluation of smallholder farmers' well-being

The commodities consisted of the mobile phones and the corresponding characteristics included the mobile phone farming applications and the texting function of the phones. The unconstrained capabilities list comprised of the list that I had developed prior to the fieldwork consisting of smallholder farmers' probable capabilities. In contrast, the pragmatic capabilities consisted of the real capabilities of the smallholder farmers developed through interviews. The well-being outcomes comprised of the achieved functionings of the smallholder farmers. The socio-economic characteristics and factors consisted of the probable factors that influenced and affected the smallholder farmers' use of the mobile phone farming applications.

4.7 Field Work Experience and Limitations

While it is important to acknowledge that the prior preparation for fieldwork was important in making the entire fieldwork successful, it is also crucial to point out that there were some difficulties, which occurred despite the adequate preparation. This section analyses some of the difficulties that were experienced in the field and how I overcame them.

The first problem that I encountered, and which persisted throughout my fieldwork, was the identification of the research participants for interview. At the start, I had scheduled the fieldwork to be in Kiambu County. However, after I had visited the local agricultural offices in the different divisions within Kiambu County, I realised I had to change my fieldwork site. This was because it was difficult to identify research participants even with the assistance of the gatekeepers in the area. I decided, therefore, to reschedule my fieldwork site to other counties within Kenya. The second challenge arose in that I had to re-apply for another research permit from the Kenyan government thereby causing further delays to the fieldwork.

The third problem was the actual identification of research participants. The use of mobile phone farming applications in Kenya is a relatively new concept and therefore there are not many famers using these applications. After failing to get any participant in Kiambu, I decided to contact the service providers (Mfarm, Mfarmer and NAFIS) directly in Nairobi. However, my first visit to the Mfarm offices did not yield any results. The staff there informed me that they were not willing to assist me in contacting the farmers using their services. After experiencing this difficulty, I decided to contact some of my former colleagues based with my former employer, the Ministry of Agriculture, to assist me in

contacting the mobile phone farming service providers. One of the former colleagues contacted Mfarm and presented my case on my behalf. This elicited positive response from Mfarm as they eventually agreed to assist me contact some of their farmers. Due to the difficulty in accessing farmers using the mobile phone farming applications, fifteen farmers were interviewed for this study. This comprised of twelve farmers using the mobile phone farming applications, two farmers who were not using the applications despite having knowledge about them and one farmer who formerly used the applications and had stopped using them.

Throughout the fieldwork, I realised that by sometimes mentioning that I once worked with the Ministry of Agriculture, it facilitated the process of getting the information that I needed from either my former employer or other organisations of interest. As much as this may be frowned upon as potentially being unethical because it may have led to a bias in selecting research participants, or to a conflict of interest and intimidate the gatekeepers and farmers, it was clear during the fieldwork that, without using my contacts within the Ministry of Agriculture, I would not have been successful in accessing the research participants.

I experienced the same participant access problem with the other mobile phone service organisation Mfarmer. The first time I visited their offices they were willing to assist me in contacting some of their customers. However, this was not to take place even after visiting their offices every day for two weeks and making numerous calls to the organisation. After this, I decided to contact a former employee of Mfarmer whose contact details I found on the Mfarmer webpage. I explained to the former Mfarmer employee the difficulties I had undergone in trying to get assistance from Mfarmer. The former Mfarmer employee then contacted his previous employer and again presented my case, which immediately yielded positive results.

For the government run service, NAFIS, gaining access was easier although it had its challenges also. With NAFIS, I was assisted promptly and was given the email addresses of over 100 farmers to contact. I therefore had to write over 100 emails to each of the farmers explaining my research to them and asking them to contact me if they did not mind being interviewed. Unfortunately, I did not get any response from any of the farmers I had contacted.

The fieldwork itself involved a lot of travelling since the counties where the farmers were based were scattered. The fieldwork was carried out in the following counties: Nairobi,

Kajiado, Narok, Nyandarua and Nandi (see maps in the following chapter). In the field itself, some of the interviews were held in restaurants, especially in Nairobi and Eldoret, since the farmers involved had requested to be met in such places due to their work schedule. Moreover, a few of the scheduled interviews did not take place as the farmers either did not appear on the interview day or had switched off their phones on the actual interview day and therefore could not be reached. However, in general, the fieldwork experience was successful with enough data collected for the thesis. When meeting with the research participants, I chose not to mention my previous work experience with the Ministry of Agriculture in Kenya to avoid getting biased responses or intimidating them. Despite the obstacles, I believe I gathered unbiased and relevant data that facilitated the writing of this thesis. To achieve this, I had to be flexible and innovative to get through the bureaucracy or obtain assistance from various people and organisations while strictly adhering to the ethical process.

4.8 Chapter Summary

This chapter has presented the research methods that were used to collect data and to operationalize the capability approach. The study used qualitative methodology therefore employing qualitative methods in data collection. This included the use of semi-structured interviews and participant observation. The chapter has also highlighted the ethical processes that were considered prior to the fieldwork, during the fieldwork and after the fieldwork. These included going through the MUHEC ethical review, acquiring a research permit in Kenya and ensuring that the participants' concerns were adhered to. The chapter has analysed the interviewing process followed as well as the use of the interview to operationalize the capability theory in the study. The chapter has also highlighted the process of operationalization of the capability approach in the study using the steps recommended by Robeyns (2006). Finally, some of the problems encountered during the fieldwork have been highlighted, such as the difficulty in accessing research participants and the process that was used to overcome this. The next three chapters present the analysis and discussion of the results. Chapter Five below presents the results on the use of the mobile phone farming applications by the smallholder farmers to access markets and information.

CHAPTER FIVE
RESULTS AND ANALYSIS ONE – MOBILE PHONE FARMING APPLICATIONS IN AGRICULTURAL PRODUCTION AND MARKETING IN KENYA

5.1 Introduction

The previous chapter has described the process that was used in the data collection. This chapter presents the results from the analysed data pertaining to smallholder farmers' use of the mobile phone farming applications to access information and markets. The chapter primarily explores the use of the mobile phone farming applications to access markets and information. The chapter is divided into various sections. The first section describes the five fieldwork sites in Kenya. The second section describes the research participants' profiles and thereafter the smallholder farmers' use and interaction with the mobile phone farming services is presented. The next section analyses the costs of the use of the mobile phone farming services by the farmers. The final parts of the chapter comprises: an analysis of the use of the mobile phone farming applications by the smallholder farmers to access information and markets, the challenges of using these services and an analysis of the use of the mobile phone directly outside the mobile phone farming applications and the internet to directly access information.

Just as it was mentioned in the study limitations section, the challenges faced in the field in identifying the farmers using the mobile phone farming applications, had an effect on the number of farmers interviewed. In presenting the results, it was taken into consideration that only twelve farmers using these applications were available to be interviewed. Similarly, the fact that it was difficult to find smallholder farmers using these mobile phone farming applications, indicated the low level of adoption of these applications amongst the farmers. These results, therefore, cannot be generalised to the entire population of study.

5.2 The Fieldwork Sites

The study was based in five different counties[7] in Kenya. The fieldwork sites were selected based on the availability of the population of interest for the study. In selecting the fieldwork sites, the various gatekeepers played a vital role by providing the list of farmers using their services and the counties where these farmers were located. As such, the fieldwork sites were chosen based on the information given out by the mobile phone farming companies. As a result, the fieldwork was carried out in five counties, which included: Nairobi, Kajiado, Nyandarua, Nandi and Narok. The details about the different counties are discussed below.

5.2.1 Field site one: Nairobi County

Nairobi County was the first site of my fieldwork. Nairobi County is the capital city of Kenya as well as the largest commercial and industrial hub in the Eastern Africa region. The city has a population of about 3,138,369 people and an area of 695.1 Km^2 (Commission on Revenue Allocation, 2013a). The main economic activities in Nairobi includes: business, finance and commerce, manufacturing and industrial activities, building and construction and tourism. The city also hosts the seat of the government of Kenya as well as several international organisations, such as the United Nations Environment Programme (UNEP) headquarters, and several research institutes, such as the International Livestock Research Institute (ILRI).

Despite being a large city, there are also agricultural activities that have taken root in the county in what has been called as urban agriculture[8]. The agricultural activities in Nairobi can be separated into two: agricultural activities within the informal settlements mostly done by the urban poor and the commercial agricultural activities taking place within the middle class suburbs of Nairobi involving greenhouse farming of vegetables and cut flowers for local and export markets. For my study, the participants in Nairobi included one farmer from the informal settlement known as Mukuru and two greenhouse farmers from the Lavington area of Nairobi. All three farmers were involved in intensive production of tomatoes, capsicums, spinach and long beans for the local markets. The map of Nairobi County is shown below.

[7] A territorial division of some countries, forming the chief unit of local administration: (Oxford dictionary 2013)

[8] It is the growing, processing and distribution of food crops and animals products within an urban environment. See http://extension.missouri.edu/foodsystems/urbanagriculture.aspx

Source: Commission for Revenue Allocation (Kenya)

Figure 3: Map of Nairobi County

5.2.2 Fieldwork site two: Kajiado County

Kajiado County was the second fieldwork site for my study. The county of Kajiado is located approximately 30 km south of Nairobi and, because of its close proximity to Nairobi, some of the people who work in Nairobi reside in Kajiado. The county is found within the former Rift Valley province and borders Tanzania on its southernmost tip. The county is generally sparsely populated with a population of about 687,312 people in an area with a size of 21,901 Km^2 (Commission on Revenue Allocation, 2013a). The sparse population is because the county is mainly made up of the Maasai people practising nomadic pastoralism.

The main economic activities in the county include: agriculture, livestock production and pastoralism, mining and tourism. The main centre for crop production within the county is the Kitengela area where there is growing of vegetables and cut flowers for local and export markets. This is because Kitengela's climate is favourable for greenhouse production due to its semi-arid climate and its proximity to a major international airport in Nairobi thereby facilitating the export of the vegetables and flowers. For my study, the participants in Kajiado County included two greenhouse farmers from Kitengela region within the county. The farmers were involved in the growing of capsicums and tomatoes for the local markets. The map of Kajiado County is represented below.

Source: Commission for Revenue Allocation (Kenya)

Figure 4: Map of Kajiado County

5.2.3 Fieldwork site three: Nyandarua County

The third fieldwork site was in Nyandarua County. The county of Nyandarua is found within the former central province and is located about 170 km north of Nairobi. The county has a population of 596,268 people within an area of 3,245.3 Km^2 (Commission on Revenue Allocation, 2013a). Due to the dense population in the area, the county is therefore predominantly made up of smallholder farmers involved in intensive dairy farming and vegetable production. The proximity of the county to the Aberdare Ranges has made the climate favourable for agricultural production due to the high amount of rainfall experienced throughout the year. As a result, the main economic activity in the county is agricultural production.

The main crops grown in this county consist of various vegetables including: Irish potatoes, tomatoes, carrots, peas and spinach. My fieldwork was located in the Nyandarua North area within the county. This area is mostly made up of smallholder farmers involved in the intensive production of Irish potatoes and export vegetables. However, despite the high agricultural production, the county has a bad road network, which has hampered the expansion of agricultural activities due to the problems of marketing especially during the rainy season. For my study, the participants in this county consisted of four farmers involved in intensive production of Irish potatoes and snow peas for the local market. The county is represented in the map below.

Source: Commission for Revenue Allocation (Kenya)

Figure 5: Map of Nyandarua County

5.2.4 Fieldwork site four: Nandi County

The fourth fieldwork site was in Nandi County. Nandi County is located within the former expansive Rift Valley province about 310 km north of Nairobi. The county has a population of 752,965 people and an area of 2,884 Km^2 (Commission on Revenue Allocation, 2013a). The county is best known for its agricultural activities, such as tea and dairy production, as well for producing excellent long distance athletes. The county's main economic activity is

agricultural production due to the good climate with major enterprises being dairy, tea, coffee, maize and vegetable production.

The county's farming population consists of a combination of smallholder farmers involved in intensive agriculture as well as medium and large-scale farmers. The smallholder farmers mainly grow tea, coffee, vegetables, passion fruit and maize. My fieldwork was located in two areas within the county: Nandi North and Nandi East. For the study, the research participants were made up of three smallholder farmers involved in growing fruits. Nandi County is represented in the map below.

Source: Commission for Revenue Allocation (Kenya)

Figure 6: Map of Nandi County

5.2.5 Fieldwork site five: Narok County

The fifth and final site for my fieldwork was in Narok County. The county of Narok is located within the former Rift Valley province about 150 km west of Nairobi. Narok has a population of 850,920 people in an area of 17,944 km^2 (Commission on Revenue Allocation, 2013a). Narok County is mainly known for its tourism due to the presence of the world famous Maasai Mara game reserve in the county. However, in recent years, the county has embraced large-scale wheat farming thereby earning the name of the 'breakfast basket' of Kenya. The main economic activities in the county are therefore tourism, agriculture and livestock production.

The county has large, medium and small-scale farmers. My fieldwork was based in the Narok North area, which is predominantly made up of smallholder farmers involved in intensive vegetable production. For this study, the participants in Narok County comprised of three smallholder farmers involved in production of Irish potatoes, cabbages and snow peas for the local markets. The county is represented in the map below.

Source: Commission for Revenue Allocation (Kenya)

Figure 7: Map of Narok County

5.3 Research Participants Profiles

This section describes the profiles of the study research participants. The participants generally had similar characteristics in terms of the type of farming, the crops they grew, their market preferences and their use of the mobile phone farming applications. However, they also exhibited varying characteristics, which were based on their locality, gender and professional background, for instance, full-time or part-time farmers. Five of the farmers were based in Nairobi or the surrounding area of Kitengela. The other ten farmers were rural–based, spread out in the other three counties. In terms of the use of the mobile phone farming applications: twelve of the respondents were using the mobile phone farming applications,

two respondents had never used the mobile phone farming applications despite having knowledge about the application and the other remaining research participant had formerly used the application but had stopped using them. In terms of marketing, the smallholder farmers' other/previous marketing outlets included the greengrocers, supermarkets, open markets and middlemen. These characteristics are represented in the table below followed by an analysis of the marked differences among the respondents.

Table 1: Research Participants Profile

County	Gender	Mobile phone farming application	Urban or rural farmer	Full-time or part-time farmer
Nairobi	1 female and 2 males	Mfarm	Urban-based	Part-time farmers
Kajiado	2 males	1 Mfarm and 1 Mfarmer	Peri-urban	Part-time farmers
Nyandarua	1 female and 3 males	Mfarmer	Rural-based	Full-time farmer
Nandi	1 female and 2 males	1 Mfarm and 2 not using the applications	Rural-based	Full-time farmer
Narok	3 males	2 NAFIS and 1 had stopped using Mfarmer	Rural-based	Full-time farmer

Source: The author's fieldwork notes, 2013

5.3.1 Mobile phone farming applications

Three mobile phone farming applications were explored during the fieldwork. These included Mfarm and Mfarmer, which were operated by private organisations, and NAFIS, which was operated by the Ministry of Agriculture in Kenya. These applications are further described in section 5.6 below.

5.3.2 Urban based farmers versus rural based farmers

In the study, five urban-based and ten rural-based farmers were interviewed. From the interviews and observation, there were differences in the two categories of farmers based on

their farming style and needs, their use of the mobile phone farming application and power relations between the farmers and the traders. The urban-based farmers were mostly greenhouse farmers involved with a single farming enterprise such as growing a particular vegetable or fruit. In contrast, the rural based farmers practised mixed farming with each farming household having more than one farming enterprise. The crops grown by these farmers were mainly vegetables such as Irish potatoes, snow peas, capsicum and cabbages. The probable reason for the rural farmers having diversified enterprises was that these farmers depended fully on farming for their income and, therefore, they diversified their production to avoid complete losses in case of disease attack. In addition, the rural farmers had more time, since they were full time farmers, as opposed to the urban farmers, who also had salaried jobs, and therefore the rural-based farmers could grow more crops.

In terms of their educational level, the urban-based farmers were all graduates with salaried jobs. These urban farmers were working in different organisations in Nairobi and were practicing farming on a part time basis. In contrast, the rural-based farmers had mixed educational levels. Some of the rural farmers were retired professionals who had resorted to farming after retiring from their previous positions. Other farmers had little or no educational background. As a result, the rural based farmers were practicing full-time farming and, as such, they were totally reliant on farming for their income and livelihood.

5.3.3 Smallholder farmers male-female differences in using the mobile phone farming applications

Although the study did not set to determine the differences between the female and male farmers in terms of their use of the mobile phone farming applications, there were some marked differences between them. The male participants often mentioned that their main reason for using the mobile phone farming applications was to access stable markets, from linkages with other farmers and access price and market information. In contrast, the female farmers indicated that their priority for using the mobile phone farming application was to access markets with better returns.

One of the female respondents indicated that:

> Respondent G: “I am not employed, so a good income source from my farming is important to me. I joined the Mfarmer service because I wanted to be able to sell my

> passion fruits to traders' based in Nairobi where the prices are better compared to the rural traders". (*Source: Fieldwork notes 2013*)

In contrast, one of the male farmers indicated that:

> Respondent B: One of the benefits of Mfarm is that I have been able to access stable markets. As a farmer who also has a full-time job in Nairobi, the guarantee of having a stable market at hand is important since I do not have to go about looking for a market and information. I am able to save time, which I use on my farm. (*Source: Fieldwork notes 2013*)

Moreover, there were also differences between the female and male respondents in the use of the extra time on their hands due to the ease of access to markets and information. The female farmers mentioned that they generally used the extra time to take care of their families, volunteer in their children's school and carry out household chores. In contrast, the male farmers mentioned that they spent the extra time they had on their farms. The men also mentioned that the saving on fuel and transport costs, which were previously, incurred searching for markets and information, was important to them.

One of the female respondents indicated that:

> Respondent A: "These days I do not have to go out and look for markets so I have some extra time on my hands. I use this time to do household chores in the house since, as a woman, I am required to take care of my family. Sometimes I also volunteer in my daughter's school helping out in the school library. (*Source: Fieldwork notes 2013*)

In contrast, one of the male respondents indicated that:

> Respondent D: "These days I have extra time which I use on my farm. I have been able to add other crops on my farm and I avoid employing a casual worker since with the extra time, I can handle most of the work in the farm. I also do not have to drive to Eldoret town to inquire about prices of the passion fruit or even to search for buyers. So I have saved on fuel costs". (*Source: Fieldwork notes 2013)*

5.3.4 The Smallholder Farmers Other Marketing Structures

In order to understand the effect of the mobile phone farming applications on the smallholder farmers' marketing, it was necessary to first explore the other marketing outlets that the smallholder farmers had previously used. The previous marketing outlets that the farmers used consisted of greengrocers, supermarkets and open markets for the urban-based farmers while the rural farmers marketed their produce through middlemen. However, as much as these marketing outlets consisted of previous marketing system for the smallholder farmers, some of the farmers still used these marketing systems occasionally when it suited them. These different marketing outlets are explored below.

5.3.4.1 The greengrocers, supermarkets and open markets

The urban-based farmers were mainly using the green grocers, supermarkets and open markets[9] to market their produce. The farmers mentioned various green grocers[10] located in several shopping malls in Nairobi such as Zucchini, Foodies and The Corner Shop. The other marketing outlets consisted of supermarkets and open vegetable markets. The supermarkets mentioned were mainly Tuskys', Uchumi and Nakumatt. While the greengrocers and supermarkets were high-end outlets with good returns, the open markets were used by the farmers as a last resort when other marketing outlets were not available or when the other outlets had failed to honour a standing order. However, there was no contracting involved among these three marketing outlets and, as a result, the farmers' experienced frequent rejection of their produce. One of the respondents said that:

> Respondent D: "When I started growing the capsicums, I would sell the produce to the greengrocers operating in various malls in Nairobi. I had these standing orders with the Zucchini greengrocers in the Ngong Junction Mall and The Corner Shop greengrocer in the YAYA Centre Mall. One day I turned up with my capsicums and both Zucchini and The Corner Shop informed me that they could not buy my produce since they had already bought capsicums from other farmers. I was left stranded with over 300 kgs of capsicums and I was forced to look for an alternative market and sell

[9] A public market at which farmers and often other vendors sell produce directly to consumers. http://www.answers.com/topic/farmers-market#ixzz2pNa3JYMU

[10] A retailer for fresh vegetables and fruits. Oxford dictionary 2013

the capsicums at very low prices. I was very disappointed but there was nothing I could do about it". (*Source: Fieldwork notes 2013)*

5.3.4.2 Middlemen and brokers

While the urban-based farmers had marketed their produce through formal marketing outlets, the rural based farmers indicated that they had relied on middlemen as their main marketing outlet. Middlemen and/or brokers consisted of individual traders who bought produce from the farmers and then sold the same produce to other traders in the major urban areas. These traders are often referred to as middlemen because they are a link between the farmers in rural areas who find it difficult to access the urban markets and the traders in the urban areas who, in most cases, are reluctant to directly buy their produce from farmers in the rural areas. The rural-based farmers lacked access to other reliable marketing outlets and therefore they marketed their produce mainly through the middlemen.

5.4. Smallholder Farmers, Experiences with the Other/Previous Marketing Outlets

As a prelude to discussing the use and effect of the mobile phone farming systems on smallholder farmers, this section discusses smallholder farmers' experiences with their previous marketing outlets before the adoption of the mobile phone farming applications for marketing. This section captures the response of the twelve farmers using the mobile phone farming applications. The farmers indicated that their level of satisfaction with the previous marketing outlets was generally low due to several factors including: the unreliability of these marketing outlets, frequent price fluctuations, difficulties in accessing these markets, difficulties in accessing market price information and the unilateral determination of prices by the traders in these marketing outlets. These experiences are analysed below.

Most of the interviewed farmers indicated that the marketing systems were unreliable. For the rural-based farmers, the unreliability of the marketing systems was propagated by the remoteness and inaccessibility of some of the areas, especially in rainy season, due to bad roads. The middlemen tended to avoid going to the rural areas when it rained and would only be available when the rains subsided. As a result, their availability was often not guaranteed and the farmers had to be frequently on the lookout for the availability of the middlemen.

Market unreliability was further propagated among rural farmers due to their dependency on a single marketing outlet: the middlemen. The lack of other marketing structures and the poor road infrastructure in the rural areas resulted in most of the farmers relying on a few traders to buy their produce. The result of this was that the farmers were often in constant search for the next middlemen who would buy their produce. One of the farmers narrated that:

> Respondent F: The roads in this place are often bad especially in the rainy season. During the rainy season, we cannot move here because the roads are flooded. Because of this, the middlemen are often reluctant to come here and as farmers, we are often left stranded with our Irish potatoes and cabbages. Sometimes the produce rots in the stores because the middlemen are not available until the rains stops. *(Source: Fieldwork notes 2013*)

In contrast, the urban farmers had a wider market choice. However, some of the marketing outlets were unreliable due to the traders in such markets failing to honour delivery agreements between them and farmers. The urban farmers mentioned that the greengrocers and supermarkets would often reject their produce without any notice resulting in the farmers' to search for alternative markets. The reasons for the rejection of the produce varied from: poor quality, over-supply of the produce, high prices among other reasons. The farmers mentioned that the traders were often not ready for negotiation when the produce had been rejected. Most of the farmers indicated that the market unreliability had the effect of limiting their ability to plan for their farming as well as the motivation to increase production. One of the respondents in Nairobi put it this way:

> Respondent A: "Imagine coming into the green grocer with your tomatoes accompanied by your little daughter and then the greengrocer tells you 'sorry we cannot take your tomatoes today since we already have enough tomatoes'. When you try to reason with him, he simply ignores you. So you have to take your tomatoes back, tugging your daughter along and who wonders why you have to take the tomatoes back to the farm. In due course you learn to have a plan B and C so that when one market fails, you quickly go to the other one". *(Source: Fieldwork notes 2013*)

The farmers also mentioned frequent price fluctuations as a common feature of these marketing outlets. The price fluctuations were due to the seasonality of production and the availability of buyers especially in the rural areas. The farmers, especially the rural ones,

mentioned that it was common for the prices of their produce to fall sharply during the peak production period and rise again during the low production period. The price fluctuations in rural areas was compounded by the production and marketing of the same produce in a given rural area resulting in a sharp drop in prices. Since the farmers could not access other markets, they mostly ended up selling their produce to the same traders, who would often lower prices due to the increase in supply of the same produce. These price differentials were reflected in the commodity's prices between the urban and rural areas with rural areas exhibiting low commodity prices, while in urban areas, high prices. The rural farmers mentioned that the urban-rural price differentials were often precipitated by the lack of information flow between the rural and urban markets thereby leaving the market open for manipulation by traders. One of the rural respondents mentioned that:

> Respondent J: "The big problem I experienced was that I never knew how much I would eventually sell my produce for. The prices of Irish potatoes would often go up and down depending on our production. Sometimes when you visited a relative in Nairobi, you would be surprised at the high prices of Irish potatoes in Nairobi while the same is very low in Narok. I believe the middlemen were taking advantage of us farmers". (*Source: Fieldwork notes 2013*)

Moreover, the farmers, especially the rural based ones, mentioned that the unilateral determination of produce prices by the traders was also a common factor in these marketing outlets. The cause of this was the lack of information flow in the rural markets and, as a result, the rural farmers often had no idea about the cost of their produce when selling. The farmers mentioned that they felt disempowered by not being able to participate in the setting of prices for their produce. However, there was evidence that the farmers' prospects for negotiating prices was inhibited by the fact that they had limited access to market information and therefore, in most cases, they had no idea of the prevailing prices for their produce. As a result, the farmers relied on the traders to determine the prices. The farmers mentioned that the power relationship between them and the traders was always top-down with the traders having the final decision on the selling price for produce. One of the rural farmers narrated his experience by saying:

> Respondent M: "Those days it was very difficult to access price information for the crops I was growing. There was nothing I could do about it and therefore, I often ended up accepting any prices offered by the middlemen. I would often want to

bargain and negotiate with the buyer of my produce, especially if he/she was offering low prices but I could not. How can you negotiate for a price when you had no idea about the price of what you were selling?" (*Source: Fieldwork notes 2013*)

As a result, of the low levels of satisfaction with the previous marketing outlets, the farmers indicated that they had decided to search for better alternative marketing outlets. This, therefore, led the interviewed farmers to begin to use the mobile phone farming applications. The use and effect of the applications on the farmers' production and marketing is discussed in the sections below.

5.5 Smallholder Farmers' use of the Mobile Phone Farming Applications

This section analysed Research Question One, which was:

i) How are the different smallholder farmers using the mobile phone farming applications to access marketing and production information?

The section analysed the various mobile phone farming applications that the study explored and the smallholder farmers' experiences in interacting with these mobile phone farming applications to access production and marketing information. The three mobile phone farming applications explored included Mfarm, Mfarmer and the NAFIS. The section below describes the three mobile phone farming services and how each operates.

5.5.1 Mfarm mobile phone farming service

Seven smallholder farmers who used the Mfarm services were interviewed. Mfarm was a Nairobi based, privately run Agribusiness Company, which began its operations a few years ago. Two individuals launched it after they won a weekend boot camp competition for developing mobile phone applications. The aim of the Mfarm service, according to their website, was to provide a platform for farmers to access markets, information and inputs (M-Farm, 2013). Mfarm provided these services to the farmers either through texting to the number 20255 or through a downloaded app suited for smartphones. In some instances, the farmers also called the service directly, but this was rare. Farmers using this application had to undergo some training lasting for a day or more, depending on the level of knowledge of the farmer on how the application operates. Mfarm offered a contract farming system to the

farmers whereby the farmers and buyers signed an agreement stipulating the produce to be sold, the price, the delivery intervals and other details.

However, all the farmers interviewed using Mfarm application were using text to access information since none of them owned a smartphone. For instance, if a farmer wanted to get information about the price of a particular crop for example price of tomatoes in Nairobi, the farmer texted 'tomatoes in Nairobi' and sent the text to the number 20255. After a while, the farmer got a reply with the price of the tomatoes in the city of interest. The price information could be accessed for a certain number of crops in the five major urban centres (Nairobi, Mombasa, Kisumu, Nakuru and Eldoret) in Kenya. For my research, I was able to interview seven farmers using the Mfarm services based in different parts of Kenya. Mfarm offered contracting buying and selling between farmers and traders. Farmers and traders signed a contract stipulating an agreement on the crop sold, the prices, the quality and quantity and the period of contract. These ensured farmers had guaranteed markets for a period of time.

The participants interviewed mentioned that they each joined Mfarm at different times and in various ways. Most of the participants using this service began using Mfarm between 2010 and 2012, either through the recommendation by a friend or, by searching through the internet. The rural farmers mostly joined the service through the recommendation by a fellow farmer. The farmers mentioned that they got to know about Mfarm through a fellow farmer who had been using it for a while and, because of the trust they had on such a farmer, they too joined the service. In contrast, the urban farmers mentioned that they got to know about Mfarm by their own individual initiative through searching for information on the internet, in newspapers or by attending agricultural trade fairs. After getting the information about Mfarm, the farmers then proceeded to contact the service provider by either emailing them or visiting their offices for additional information. After the initial contact between the farmers and Mfarm, the next step involved the farmers training on the use of the service by the service provider.

The Mfarm training aimed to introduce the farmers on how to use the service and to inform them of their obligation to Mfarm. The training covered concepts such as: how to go about looking for information using their phones, contacting a potential buyer, the farmer and buyer contract requirements and the transaction of a sale between the farmer and the buyer. Although the training was similar between the urban and the rural farmers, the rural farmers training was more detailed and longer because of their low educational level compared to the

urban farmers. The detailed training for the rural farmers covered issues of farm planning, financial management and budgeting. Mfarm collaborated with other organisations such as banks to provide the additional training to the rural farmers.

The farmers mentioned that one of the key concepts emphasised by Mfarm was loyalty to the service. Loyalty was important in Mfarm because of the contract farming involved. The contract was between the farmers and the buyers. Because of the contracting, the farmers and the traders were required to remain loyal to each other throughout the contract period and in the case either party wanted to withdraw from the contract, then the party had to issue a two-week notice to Mfarm. Therefore, Mfarm was the link between the farmers and the traders ensuring that none of the parties reneged on the contract. Although the farmers were satisfied with the contracting since it ensured stable prices for their produce, some of the farmers complained that sometimes the prices of the produce were higher in the market than in the contract.

5.5.2 Mfarmer and NAFIS mobile phone farming service

Mfarmer and NAFIS operated differently from the Mfarm service. The Mfarmer service was also a privately run agribusiness solutions company based in Nairobi. The company was formed a few years ago and aimed to provide a platform for smallholder farmers to access information and markets. The study interviewed three farmers using this application. Just like in Mfarm, the farmers using this application had to undergo some training on how the application operated. The process of accessing information in Mfarmer was similar to Mfarm where farmers would send texts to the number 8988 inquiring about the information they required. However, Mfarmer service did not have a downloaded app for smartphones thereby the farmers used only texts to access information.

Mfarmer operated in the following way: a farmer with a particular produce would send a text with information including the produce name, quantity, quality and probable price to the service provider. This information was then sent out to various traders subscribed to the service. An interested trader would then contact the farmer directly and, thereafter, the farmer and trader would agree on the price, quantity and quality and the modalities of delivering the crop. The same process was repeated when a farmer wanted to find a subsequent buyer.

In contrast to the other two services, NAFIS service was operated by the Ministry of Agriculture in Kenya. NAFIS offered a combination of internet based and mobile phone services to farmers to access a broad range of information on crops' production, marketing, pricing and a platform for farmers to network. Therefore, NAFIS had more information to offer compared to the other two services. The operation of the NAFIS service was similar to Mfarmer whereby farmers connected to potential buyers by texting.

While Mfarm operated on a contract basis, Mfarmer and NAFIS did not offer contracts to the farmers. Instead, the farmers contacted potential buyers directly through the service system. In the case of these two services, it was common for the farmer and the buyer to transact business without meeting each other especially if the farmer was rural based. This, therefore, required a lot of trust between a farmer and a trader. To deliver the produce to a trader based in an urban centre, a farmer would use the public transport system. This operated as follows: the farmer and the trader would link through Mfarmer or NAFIS and then agree on the price, quality and quantity of produce. Thereafter, they would agree on the delivery day and the mode of delivery. If it was through the public transport buses, the farmer would put the produce onto a particular public transport bus and give instructions to the driver of the bus to deliver the produce to a particular point. The farmer would then give the trader the vehicle's registration number and the driver's mobile phone number. On receiving the produce, the trader then paid the farmer through the mobile phone money payment system. Trust was, therefore, important to operation of these two services since the contacts between farmers' and traders were limited.

5.6 The Costs and Affordability of the Mobile Phone Farming Applications

This section analysed Research Question Two, which was:

ii) What are the costs of using the mobile phone farming applications and are they affordable to the smallholder farmers?

Twelve farmers, seven using Mfarm, three using Mfarmer and two using NAFIS were asked about the cost of using these services. The costs for sending a text or making a call through the mobile phone farming services were similar to the normal charges of sending a text or

making a call in Kenya which was about one Kenya shillings (Ksh[11]) (Less than 1 New Zealand cent) for texting and Ksh 3 per minute (Less than 1 New Zealand cent per minute) for calling. All the farmers interviewed agreed that the cost of using these services was affordable to them. Most of the costs incurred involved texting or calling the service provider for information and marketing. Some farmers mentioned that even if the costs were higher, they would still use the mobile phone farming service because the benefits of having stable and reliable markets were higher. One of the farmer's in the rural area said:

> Respondent F: "For me the costs are not an issue, one shilling per text is affordable and sometimes Mfarm and the trader also call me so we share the cost. But even if the costs were a little higher I would not mind as long as I can access better markets". (*Source: Fieldwork notes 2013*)

The main users of the service, the farmers and the traders, had also adopted ways of sharing the costs of using the service among themselves. In most cases, the farmers would send a text instead of calling the buyer because the costs of texting were lower than the costs of calling. Calls were only made when it was necessary and the message to be sent was long. In some cases when a farmer wanted to contact a trader he/she was familiar with, the farmer would call the trader and disconnect the call before the trader picked up and then the trader would call the farmer back. It was called 'beeping' and it was a signal to the other recipient to call the caller back. Sometimes the traders would also do the same for the farmers. Through beeping, the farmers and the traders shared the costs of calling each other. This innovativeness was necessary since, as I observed, the farmers would make several calls a day looking for information and markets. By beeping, the parties involved ensured that no individual in the transaction incurred higher costs contacting each other. However, what remains to be seen is why the usage of these services is low among the farmers despite the low costs of their usage.

5.7 Information and Market Access through the Mobile Phone Farming Applications

This section discussed Research Question Three, which was:

[11] Ksh is the unit of currency used in Kenya. 1 New Zealand dollar is approximately equivalent to 72 Kenya shillings

iii) What have been the effects of using the mobile phone farming applications to the smallholder farmers' production and marketing?

The section analysed and discussed the experiences and effect of the use of the mobile phone farming applications by smallholder farmers to access information and markets. The section looked at the differences, if any, that the mobile phone farming application has made to the farmers in terms of accessing information and the effect of this on their marketing and production. This analysis was based on the interview of the twelve farmers using Mfarm, NAFIS and Mfarmer.

5.7.1 Mobile phone farming and smallholder farmers access to information

In order to understand the effect of the mobile phone farming in accessing information among the smallholder farmers', this section first analysed the smallholder farmers' experiences with their previous modes of accessing information. Twelve farmers who were using the mobile phone farming services were interviewed. As a starting point, the farmers were asked how they previously accessed information before the adoption of mobile phone farming applications. Most of the farmers stated that their main means of accessing information previously was either through the radio, agricultural extension staff, marketing outlets such as middlemen and green grocers, the newspapers or agricultural shows and fairs. Some also stated that they simply did not look for information since doing so was time consuming and expensive.

Several of the farmers stated that the radio programmes were generally educative in terms of production information but were unreliable in giving market information. Furthermore, using the radio had the on-demand disadvantage of requiring one's availability when the programme was running. On the other hand, the newspapers were far too expensive for the rural farmers and their access in the rural areas was limited. In addition, the newspapers only gave out agricultural information occasionally and therefore could not be relied upon. In the same vein, some of the farmers mentioned that accessing the agricultural extension staff was often difficult due to the distance involved and their unavailability, thereby making it very expensive and time consuming. The urban farmers preferred the agricultural shows and trade fairs. These farmers mentioned that these shows and fairs were good sources of production

information. However, they often took place once a year and were, therefore, an unreliable source of information. One of the rural based farmers narrated that:

> Respondent K: "Accessing the information that I needed as a farmer was difficult. In most cases, I never bothered looking for information since it was difficult to go to the agriculture extension staff because of the distance. I mostly just planted my crops and when it came to selling, I accepted the prices offered by the middlemen since I had no way of knowing the right price". (*Source: Fieldwork notes 2013*)

Moreover, the urban farmers, because of their locality, sought market information directly from the buyers such as the greengrocers and supermarkets. This too was expensive and time consuming as one had to move from one greengrocer to another. In most cases the price information would often change so that when the farmer was ready to sell his/her produce, the price offered, by the trader, would be different from the earlier price. One of the urban-based respondents narrated her experience as follows:

> Respondent A: "The organisations which were supposed to help farmers such as the Horticultural Crops Development Authority (HCDA) and Fresh Producers Association of Kenya (FPEAK) were not helpful when I was making inquiries on the marketing of my capsicums. They told me that they dealt with large producers and not small producers like me. Eventually I had to go around weekly to supermarkets and greengrocers inquiring about the price of capsicums. This was time consuming and expensive". *(Source: Fieldwork notes 2013)*

Therefore, the question is whether the mobile phone farming applications have had an effect on the smallholder farmers' access to information. From the interviews, it was evident that the use of the mobile phone farming service has facilitated the farmers' access to information at affordable costs and a faster rate. The mobile phone farming service enabled the farmers to meet most of their information needs ranging from produce price information, access to buyers and availability and price of inputs. Among the three mobile phone farming application providers, there were differences in the effectiveness in the type of information accessed. All the mobile phone farming applications were effective in providing price and market information to the farmers as well as connecting them to potential buyers. However, in terms of providing production information, the NAFIS service was more effective because of its integration of mobile phone and internet in providing such information. One farmer using NAFIS narrated that:

> Respondent M: “NAFIS provides detailed production information. If you want detailed information on dairy farming or even greenhouse farming you just go to their webpage and you can access the information. I did this when I was establishing my tea farm and it was very relevant. I did not have to ask for information somewhere else”. (*Source: Fieldwork notes 2013*)

There were several effects of the use of these applications on the smallholder farmers. The first effect was that access to information was cheaper and faster. The farmers mentioned that they were able to afford the texting costs and internet charges associated with accessing information on the service. In addition, the farmers also mentioned that the access to information was faster with the service providing prompt replies to different inquiries, such as prices of produce, thereby enabling farmers to make decisions. The second effect was that the information was reliable and current, therefore the farmers could use it in their farming. With current and reliable information, the farmers were able to make prompt marketing decisions depending on the market offering higher returns. The third effect mentioned by the farmers was the linkages and networks that the farmers had formed because of using these services. The linkages, which were built through trust, consisted of traders and other farmers and these in turn became the main source of production information to the farmers.

Moreover, access to information had empowered the farmers so that they could negotiate with potential buyers about the price of their produce as well as engage in organised and planned farming. The farmers mentioned that since they could access price information, they were able to engage with the buyers and agree on a suitable price. The farmers said that this made them feel empowered. Similarly, some of the farmers stated that access to information had enabled them to anticipate price changes in the market, thereby, they were able to plan their production in order to benefit from the seasonal price changes. With the information, the farmers knew which crops had higher returns and thereby they planted such crops. This was especially among the rural farmers who were engaged in growing of export crops. One of the respondents said that:

> “Respondent L: “The good thing about this Mfarmer service is that it allows me to get price information for my crops in any town I want. For now, I know the prices of my produce and when I am selling I can insist on better prices if the buyer is offering low prices.” (*Source: Fieldwork notes 2013*)

With this in mind, the next section discusses the effect of the access to information through these applications to smallholder farmers' access to markets.

5.7.2 The effect of mobile phone farming applications on the smallholder farmers' access to markets

In view of the above analysis, this section explores the effect of access to market information to the smallholder farmers' marketing experience. In an earlier section (section 5.5), the research participants' experience with their previous marketing outlets showed that the participants experienced market unreliability and price fluctuations. The twelve farmers mentioned that they were generally satisfied with marketing through the mobile phone farming applications. The effects mentioned by the farmers of marketing their produce through the mobile phone farming applications included: reliable and stable markets, access to better paying markets, reduced marketing transaction costs, ability to access a wider range of buyers and faster access to markets.

First, the farmers stated that they were able to access stable and reliable markets. The stable and reliable marketing outlets were due to the contract-selling concept and the ability to access more markets. The Mfarm service offered the farmers the opportunity of contract selling thereby guaranteeing them markets for the contract period. Mfarm enforced the contracts so that when a buyer wanted to opt out of the contract, the buyer was required to give the farmer a two-week notice in order for the farmer to look for an alternative buyer. The other farmers that accessed markets through Mfarmer and NAFIS, despite not committing to contracts, were accessing markets more easily. Through texting, the farmers were able to connect to buyers from different parts of Kenya. Several of the farmers mentioned that it often took less than a week to link up with an interested buyer. Furthermore, the networks and linkages formed using the services extended the farmers' market reach as well as access to produce price information. One of the farmers narrated that:

> Respondent D: "I can easily access a buyer through NAFIS, so now I have peace of mind. This service has made my marketing easier than before since I can access a buyer from Nairobi and Nakuru. Even if I have excess produce I just use the service to access a buyer". (*Source: Fieldwork notes 2013*)

The second effect of the use of the mobile phone farming applications to the farmers was that they were able to get better prices for their produce. This was especially among the rural farmers who were able to access markets beyond the rural boundaries. Most of the rural-based farmers were selling their produce directly to traders in different towns where the prices of the commodities were higher. Similarly, the urban-based farmers were also able to access better paying markets. Part of the reason for this was that the farmers were able to negotiate with the buyers and they were able to insist on better prices. In addition, the farmers' access to produce price information shielded them from being exploited by potential buyers. One rural farmer narrated this:

> Respondent F: "I sell all my passion fruit to traders in Eldoret because of the better prices I can get. But even if sometimes I get a local buyer, I insist on a better price since I know what the real price of passion fruit is in Eldoret. I have also been able to avoid the frequent price fluctuations in the local markets since I can access the Eldoret market where prices are more stable". (*Source: Fieldwork notes 2013*)

The third effect the farmers mentioned was the reduced marketing transaction costs in terms of money and time. The farmers mentioned that they were able to access price information through their phone at an affordable cost thereby reducing information search costs. In addition, marketing transactions costs, such as transport, time and produce wastages, were reduced enabling the farmers to benefit more from the markets. The overall benefit was that the farmers could access markets and information at lower costs and faster rates thereby increasing their participation in the markets. One of the farmers narrated that:

> Respondent L: "The trader most often pays for transport costs when he picks the Irish potatoes. I have been able to save a lot from that since, if I was to pay for transport, I am sure I would not be able to afford the costs. Now I have been encouraged to sell all my produce to these traders since I do not have to pay for transport costs". (*Source: Fieldwork notes 2013)*

The fourth effect that the farmers mentioned was the increased marketing opportunities. This was because the use of these applications allowed the farmers to access a wide range of potential buyers located in different towns. Furthermore, the farmers could also access other buyers through the linkages and networks that they had established with the use of the mobile phone farming applications. The overall effect of this made the farmers' produce more

competitive, therefore, they could get better prices for their produce. One of the farmers mentioned that:

> Respondent M: “Sometimes when I use NAFIS to access a buyer, I get two or more interested buyers of my produce. I then simply choose the one offering the highest price for the produce”. (*Source: Fieldwork notes 2013*)

The fifth effect the farmers mentioned was that they were able to access markets at a faster rate. This meant that the time involved in searching for a buyer had reduced. This was particularly so to the rural based farmers who had to contend with poor road infrastructure. The contracted farmers had to remind the buyer about the agreed sale date a few days before harvesting in order for the buyer to come and pick the produce in time. Through observation it was evident that most of these farmers did not have a storage facility for their produce since, as some farmer mentioned, they were able to sell their produce the same day they harvested the produce. This was significant taking into consideration that these farmers had small pieces of land and every space on the farm that was free was utilised for farming. Therefore, by not being forced to own a store, more land was freed for farming. Faster access to markets also had the overall effect of more extra time for the farmers, which they used either on their farm or with their families.

5.7.3 Mobile phone farming and its effect on smallholder farmers production

Although it was difficult to relate the effect of the use of the mobile phone farming services to production, there were indirect effects. The indirect effects were related to the farmers’ motivation to increase production due to several factors such as: easier access to markets, the availability of better paying markets, increased time on their hands and less price fluctuations. It was evident that the farmers were accessing production information through the mobile phone farming service although, in comparison, their preference were markets and market information compared to production information.

The effects and benefits associated with marketing provided the impetus for the farmers to increase their production capacity by either adding other enterprises on their farm or increasing the land under production. Some farmers engaged in more than one enterprise, such as growing crops for the local markets and high value vegetables for export markets, in order to benefit from both markets. In addition, the extra time that the farmers had, due to

easier market access, enabled them to spend more time on their farm. However, some farmers were also accessing production information through the applications especially information on input availability and their prices and using such information directly on their farm. One farmer in Narok mentioned that he had learnt about a new and better performing variety of Irish potatoes through Mfarmer and consequently, he had introduced the variety onto his farm. The farmer mentioned that:

> Respondent J: "I just learned a few months ago about this variety of Irish potatoes that could be stored for long without going bad through Mfarmer and I decided to introduce it in my farm. Sometimes I can also inquire about the prices of fertilisers and their availability through the application". (*Source: Fieldwork notes 2013*)

Moreover, the linkages, which the farmers had formed through using these services, had become a major source of production information. Through these networks and linkages, the farmers were able to exchange production information amongst themselves. It was more like peer-peer education. However, the farmers also mentioned some challenges in using these applications. Some of the challenges are analysed below.

5.8 Smallholder Farmers' Challenges of Using the Mobile Phone Farming Applications

This section analysed Research Question Four, which was:

iv) What are the challenges and problems associated with the use of these mobile phone farming applications?

Although the farmers were generally satisfied with the use of these applications, they had experienced some problems with their use. In order to get a comprehensive view of the challenges the farmers had faced, three types of participants were interviewed. These included: 1) farmers that were using the applications 2) a farmer who once used the service but had stopped and 3) two farmers who had heard about the service but had never used it before. The respondents gave varied opinions.

First, the farmers who were using the mobile phone farming applications mentioned the following as some of the challenges that they had experienced. The mobile phone farming applications were not providing information on annual price trends for crops despite some farmers desiring such information for planning their production. The urban-based farmers

stated their desire for price trend information to enable them know the best time to plant their crops in order to get higher prices. The other problem mentioned by the farmers was the slow response of the system to their text message inquiries. This was not a frequent problem but it occurred occasionally. Several of the farmers mentioned that in such cases their ability to contact a buyer or inquire about prices was hampered, thereby affecting their decision-making.

Moreover, the farmers also mentioned that these applications were not giving sufficient production information. In comparison to market information, these farmers were limited in their access to production information through these services. This was a challenge since, compared to price information, which was only a few sentences long and could fit a text message, production information could be long exceeding the text message length. The farmers were, therefore, forced to search for production information from other sources such as the internet and through the established network and linkages. One of the farmers mentioned that:

> Respondent A: "I have realised that I cannot get information on how to grow my capsicums or even how to control the pests and diseases from Mfarm. So now, I have been forced to get such information from other farmers I have links to or from the internet. I think Mfarm should improve on access to production information". (*Source: Fieldwork notes 2013)*

Secondly, the farmer who had stopped using the mobile phone farming applications indicated that his main reason for opting out was because of the breakdown of trust between him and a buyer he had contacted through Mfarmer. This farmer mentioned that a trader he had contacted through Mfarmer had rejected his produce because of quality issues despite the fact that the trader had inspected the produce earlier. The farmer mentioned that he ended up making losses and therefore he decided to stop using Mfarmer service. As earlier mentioned, trust is an important component in the operation of the mobile phone farming applications and any loss of trust can lead to breakdown in the operation of the services. This farmer narrated that:

> Respondent P: "When the trader rejected my Irish potatoes even after transporting them from Narok to Nairobi at my own cost, when I contacted Mfarmer they did not come to assist me, I decided to stop using their service. What is the need of a poor

farmer like me using a service that takes advantage of me? I'll rather deal with a local trader whom I know and trust". (*Source: Fieldwork notes 2013*)

Thirdly, the other two farmers who had never used the mobile phone farming applications despite having the knowledge about them, mentioned that their main reason for not using these applications was that they had not achieved an optimal production point where they could comfortably market their produce through these applications. These farmers mentioned that they believed that they had to increase their production to over 200 kgs of passion fruit per week before they could start using these services. To these farmers, using these services meant that they had to increase their production in terms of quantity and quality to merit joining. Their perception of using the mobile phone farming service was that the traders contracted through Mfarm or Mfarmer were large buyers who would demand a large quantity of produce from them.

The problem here was that Mfarm and Mfarmer had not reached out to the farmers in various parts of the country to educate them on their services. As a result, the farmers relied on word of mouth from their colleagues and fellow farmers. The consequence of this was that the farmers based their idea of joining the service on the perception of their neighbours or colleagues who were producing large volumes of produce thereby deterring other farmers producing smaller quantities from joining the service. This could be the main reason for the low usage of these services; the service providers have not reached out to farmers to educate them about the use of their services. From the study, it was also evident that the farmers were using the internet and their mobile phones directly (outside the mobile phone farming applications) to access information and markets. This is discussed below.

5.9 Smallholder Farmers' Access to Information and Markets Directly Through Their Mobile Phone and the Internet

Though the study did not intend to explore the smallholder farmers' use of their mobile phone to directly access information and markets outside the mobile phone farming applications, it became evident in the course of the fieldwork that the farmers were using their mobile phones and the internet to access information and markets. The direct use of the mobile phone involved the farmers calling other farmers and traders outside the mobile phone farming services to search for certain information and markets. The farmers and traders

formed linkages and networks with each other and used such links to access different kinds of information. In particular, the networks provided useful production information, which was difficult to access via the mobile phone farming applications.

Most of the farmers mentioned that accessing production information through the links with other farmers was easy and the information sought was often relevant since it had been tried and tested by other farmers growing similar crops. This was more like networking and experience sharing among farmers over the telephone. A farmer facing a certain problem, for instance a crop disease, would call a fellow farmer growing the same crop and inquire about the problem and potential solution in case the farmer had such knowledge. In case a farmer had no knowledge on such a disease, he/she simply referred the farmer to another farmer. This would continue until the farmer finally got the needed advice. Although this was time consuming, the farmers' were able to meet their production information needs. These networks transcended boundaries with farmers in one rural area networking with other farmers in either an urban centre or another rural area.

Market information was also shared through these networks and linkages. Farmers in one area would inquire about the price of their produce to farmers in another area in order to compare prices and determine the best markets. Similarly, farmers were able to refer each other to the best traders who could be trusted and offered the best prices. In addition, a trader who needed certain produce his/her client farmer was not growing would often be referred to a third party farmer in the network that had such crops. The networks and linkages therefore formed an important part of the farmers' use of their mobile phone and the mobile phone farming applications. One of the farmers narrated that:

> Respondent B: "Marketing through Mfarm and directly through the links I have formed with other traders are both important and each serve me in a unique way. I use Mfarm to sell to an exporter who pays me well and I use the networks and linkages to market my produce to retailers who sell the produce directly to consumers so I can get feedback from the consumers on the quality of my produce. If my produce is bad they inform me and I improve on that". (*Source: Fieldwork notes 2013*)

The farmers also relied on the internet to access production information. The farmers accessing the internet indicated that they used the internet function on their phone to get production information. They visited the relevant sites to access required information. In

comparison, the farmers were using more of the internet to access production information compared to the mobile phone farming applications. One of the farmers indicated that:

> Respondent K: "I actually get most of the production information through the internet. The Mfarmer service does not have enough production information covering the diseases and pest I sometimes come across on my farm. But the internet is very reliable in terms of such information". (*Source: Fieldwork notes 2013*)

Therefore, the farmers were using other means to access production information since the mobile phone farming applications were not sufficiently providing such information to meet the farmers' needs.

5:10 Chapter Summary

The chapter has analysed the first four study research questions. Furthermore, the chapter has also analysed how the farmers use their established linkages and networks to access information and markets. From the beginning, it has been mentioned that one of the key limiting factors for the study was the limited number of participants. This was taken into consideration when presenting the results in order to try to avoid the generalisation of the findings. However, despite this, it was evident that the mobile phone farming applications were facilitating access to markets and information for farmers. There were several benefits associated with the use of the applications to access information and markets, such as access to stable markets, markets with higher returns and wider access to markets. In addition, the farmers were using their established networks and linkages to access information and markets. Similarly, the farmers were also using the internet to access production information since the mobile phone farming applications were limited in providing such information. The next chapter analyses the well-being outcomes for the smallholder farmers, in their use of mobile phone farming applications, using the capability approach.

CHAPTER SIX
RESULTS AND ANALYSIS TWO– ANALYSIS OF SMALLHOLDER FARMERS' WELL-BEING OUTCOMES

6.1 Introduction

The previous chapter analysed the effect of the use of the mobile phone farming applications to smallholder farmers' access to information and markets. This chapter looks beyond access to information and markets and analyses broader well-being outcomes of the smallholder farmers using the capability approach framework. The chapter begins by briefly recapturing the main concepts of capability approach theory and discussing its application in the study setting. Thereafter, the chapter analyses the influence of the smallholder farmers' personal characteristics and socio-economic factors in their well-being achievement. In conclusion, the chapter analyses the smallholder farmers' capabilities set and their eventual well-being outcomes in their use of the mobile phone farming applications. For a comprehensive analysis of the smallholder farmers' well-being achievement, the capabilities set were grouped into three main components:

v) Livelihood-based capabilities
vi) Information-based capabilities
vii) Market-based capabilities

These three capabilities sub-sets provided the information needed in evaluation of the smallholder farmers well-being achievement. The section below recaptures the concept of the capability approach and its application in the study.

6.2 Application of the Capability Approach in the Study

Amartya Sen's capability approach was the study's theoretical framework. The capability approach, (see Chapter Three) focuses on the opportunities that are available to individuals to live the kind of life that they value. The capability approach offers the framework that enables the evaluation of individual's well-being outcomes in different contexts. Two main components of this theory are important in well-being evaluation: *capabilities*, which are the opportunities available to individuals to live the kind of life they have reason to value and *functionings*, which are the well-being outcomes of individuals in living the kind of life that

they value. In this study, *quality of life* was defined in terms of the good farming life and the wider livelihood outcomes that the smallholder farmers had reason to value. The focus was on the smallholder farmers' ability to access information and markets (in case they valued these) and the broader outcomes from access to markets and information. In achieving the valued quality of life Sen (1988, p. 16), has suggested that individuals may put to use commodities and the characteristics of the commodities to achieve the desired well-being outcomes. For this study, the commodity in use was the mobile phone and the corresponding characteristics of interest were the mobile phone farming applications.

Furthermore, in analysing the smallholder farmers' well-being achievement, the influence of the farmers' personal, environmental and socio-economic characteristics were taken into consideration. This was in line with the recommendation by Robeyns (2005a, p. 99), who has pointed out that an individual's personal, environmental and socio-economic characteristics may often bring about differences in well-being achievements. In consideration of this, it was necessary to differentiate between the rural and urban-based farmers when looking at their use of the mobile phone farming applications and the eventual well-being outcomes. The socio-economic, environment and personal differences between the rural and urban farmers necessitated the differentiation in analysing their well-being outcomes.

In the evaluation of the smallholder farmers' well-being outcomes, the capabilities were first sub-divided into three components to facilitate merging of information about the farmers. The capabilities sub-set included: information, market and livelihood based capabilities. Eventually, the information contained in the capabilities sub-sets was used in the evaluation of the smallholder farmers' well-being outcomes. To achieve this, the procedure described in Chapter Four (section 4.6) was followed. This involved asking the farmers, during interviews, to describe the outcome they have been able to experience in their use of the mobile phone farming applications from their earlier stated desired quality of life list. The outcomes stated by the farmers comprised the functionings/well-being outcomes list. The capabilities and the well-being outcomes thereof are further discussed below.

6.3 Smallholder Farmers Well-Being Achievements

This section analysed Research Question Five, which was:

> v) How has the use of the mobile phone farming applications impacted on the smallholder farmers' overall well-being?

As a prelude to discussing the research question above, this section first analyses the capabilities of the smallholder farmers. The capabilities consisted of the opportunities available to the smallholder farmers to live the kind of life that they valued. These consisted of what the farmers perceived to be important components of their farming, which, if they achieved, would make their life better. These were divided into three:

a) Information-based capabilities consisting of smallholder farmers':
   - Access to production and extension information
   - Access to produce price information
   - Access to annual crops price trends to facilitate planning for production
   - Formation of linkages and networks with other farmers and traders
   - Access to credit, financial and farm planning information
   - Information sharing with other farmers

This capabilities sub-set was made up of information about smallholder farmers' opportunities or desire to access market and agricultural production information, for instance access to annual crop price trends. There were similarities and differences between the information capabilities set between the rural and urban farmers. The similarities were that all these farmers were in need of produce price information, production and extension information, linkages and networks and information sharing with each other. In contrast, the differences were that the rural farmers were in need of credit, financial and farm planning information while the urban farmers' information-based capabilities included access to annual crops price trends information to facilitate their planning for production. The differences in capabilities set were determined by differences in smallholder farmers' personal and socio-economic characteristics. The rural farmers lower educational and income levels made them in need of farm planning information and credit facilities compared to the urban farmers who did not have such needs. In contrast, the urban farmers were in need of annual crops price trends to facilitate their planning in the farm in order to benefit from higher prices.

b) Market- based capabilities consisted of the smallholder farmers' access to:

- Markets with better returns
- Reliable and stable markets
- Wider choice of markets
- Ability to access markets with ease and at a faster rate
- Less on-farm wastage due to better access to markets
- Increase in volume of on-farm production

This capabilities sub-set consisted of the smallholder farmers' desired marketing opportunities that they thought, if they achieved, would make their life better, such as access to markets with better returns. The marketing capabilities set for the different farmers was determined by the type of crop they grew and the distance to the nearest urban centre. The farmers growing highly perishable crops such as tomatoes were in need of a wider and faster access to markets in order to reduce the losses. This was the same with the rural-based farmers who needed wider market access in order to reduce flooding of the market with the same produce thereby creating price fluctuations. The urban farmers needed stable and reliable markets since all of them were in salaried employment and therefore they had limited time for searching for markets. The final capabilities sub-set was livelihood based.

c) Livelihood-based capabilities consisted of smallholder farmers:

- To Increase their income from farming
- To be empowered in order to engage with buyers as equals
- To be able to organise the farming cycle to benefit more from prices and rainfall
- The ability to meet family basic needs such as food, education and healthcare
- The opportunity to have more time to spend on the farm and with the family
- To experience job satisfaction
- To be respected in the community because the family is doing well
- To be able to employ a farm hand to assist on the farm

This capabilities sub-set consisted of the larger benefits being accrued from the use of the mobile phone farming applications. The differences in the smallholder farmers' socio-economic characteristics differentiated their livelihoods-based capabilities set. The rural-based farmers, who were all reliant on farming for income, indicated that they needed increased income from their farming to meet their family's basic needs such as food, good housing, clothing and school fees for their children in schools and colleges. This was in

contrast to the urban farmers, who all had salaried jobs, and therefore were able to meet their family's basic needs. Furthermore, the women farmers were keen on the extra time to spend with their families compared to the male farmers who desired the extra time to use on their farms and attend agricultural trainings. Some of the capabilities set were intangibles such as being empowered or gaining respect in the community because one has been successful. These capabilities were made up of the wider effect of the use of the applications on the farmers' life. For instance, access to markets with higher reruns would potentially bring better income therefore leading to the farmer being able to provide for his/her family and therefore gaining respect in the community. The information contained in these capabilities sets were eventually used to evaluate the well-being outcome for the smallholder farmers. This is discussed below.

6.3.1 Smallholder farmers' well-being outcomes

In evaluating the well-being outcomes, the capabilities list provided the informational base for doing this. The well-being outcomes for the smallholder farmers were also sub-divided into three sub-sets just like the capabilities. This comprised of: information, market and livelihood based well-being outcomes. This section analyses the three well-being outcomes using the information in the capabilities lists above.

a) Information-based well-being outcomes

The focus of this well-being outcome looked at what the smallholder farmers have been able to achieve in terms of access to both market and production information in their use of the mobile phone farming applications. The farmers were asked to describe what/how the use of the mobile phone farming applications had enabled them to achieve in terms of accessing information. To assess achieved information-based well-being outcomes, the corresponding capabilities set (listed above) were used. These consisted of what the smallholder farmers listed as their farming informational needs that were necessary for them to meet their farming needs and objectives. From the listed information-based capabilities, the smallholder farmers were able to achieve the following well-being outcomes:

- Access to production and extension information
- Access to produce price information
- Formation of linkages and networks with other farmers and traders

- Information sharing with other farmers

Most of the farmers mentioned that the mobile phone farming applications had enabled them to access production and extension information although to a limited extent, produce price information, formed linkages and networks and achieved information sharing with other farmers. In terms of the difference between the rural and urban farmers in well-being achievement, both the rural and urban farmers had achieved all the listed well-being outcomes. However, not all the interviewed farmers had achieved the well-being outcome of accessing production and extension information and even those who had achieved this, were still using other means to access this information. This was because the mobile phone farming applications were not sufficiently providing all the production information the farmers needed and as a result, most of the farmers were using the internet or mobile phones directly to get this type of information.

In addition, the farmers had not achieved the well-being outcomes related to access to annual crops price trend information and access to credit, financial and farm planning information. The mobile phone farming applications were still at the nascent stage and maybe that is why they could not provide such information. Their focus was more into providing market information compared to other types of information. However, the farmers were satisfied with achieving the other capabilities such as access to produce price information, which they viewed as more important.

b) Market-based well-being outcomes

The focus of this well-being outcome was the smallholder farmers' ability to access markets and other benefits associated with markets. Just like in information-based capabilities, the farmers were asked to describe what they had been able to achieve in terms of market access using the mobile phone farming applications. The corresponding capabilities set (listed above) was used to assess the well-being outcomes.

In terms of well-being achievement, the smallholder farmers were able to achieve all the listed capabilities set. These included access to:

- Markets with better returns
- Reliable and stable markets
- Wider choice of markets

- Ability to access markets with ease and at a faster rate
- Less on-farm wastage due to better access to markets
- Increase in volume of on-farm production

Although all the market-based well-being outcomes were achieved, the achievements were unequally distributed among the farmers with some farmers achieving some particular well-being outcomes and missing out on others, while others achieving on some and missing on others. For instance, some farmers had not witnessed an increase in their production due to easier access to markets but they had achieved access to markets with better returns and reliable markets. There were no differences in market-based well-being achievement between the rural and urban farmers. This indicates that the mobile phone farming applications were very effective in providing the markets and marketing information to the farmers.

c) Livelihood-based well-being outcomes

This type of well-being outcome focused on the broader achievements that the farmers had accrued from the effect of access to information and markets. Some of these outcomes were intangibles such as being empowered. The corresponding capabilities set (listed above) were used to evaluate the outcomes. From the capabilities set, the smallholder farmers were able to achieve the following well-being outcomes:

- Increased income from farming
- Empowered to be able to negotiate with traders
- Ability to meet the family's basic needs such as food, quality housing and clothing and pay school fees for the children in school
- Having more time to spend with the family, on the farm and attend agricultural trainings
- Experienced job satisfaction
- Employed farm hands in the farm to assist with farm jobs

The farmers were able to achieve six well-being outcomes from the list of capabilities. All the farmers interviewed indicated that they had witnessed an increase in their farm income due to better access to markets with higher returns. The increases in farm income enabled the farmers in return be able to meet their family's basic needs such as providing food. In addition, the farmers indicated that they felt empowered since they could now negotiate on the price of produce with potential buyers. This was especially among the rural farmers who

had earlier mentioned that they had been exploited by middlemen since they could not access produce price information. Similarly, the farmers indicated that due to ease of access to information and markets they had extra time on their hands, which they were using to either do household duties (for women) or spend on in the farm (for men). Some of the farmers also indicated that they were experiencing satisfaction from their farming while other indicated that they were able to employ extra hands to assist in the farm. However, some of the capabilities were not met such as the ability to organise farming in order to benefit more from the information available and the aspect of gaining respect in the community. Some of these capabilities, such as the two not achieved, were only possible to be achieved in the medium to long-term period.

In conclusion, the evidence presented indicates that the mobile phone farming applications were effective in meeting some of the farmers' needs and this affected their overall life. This is further discussed in the next chapter, which analyses the results and links these up with the wider literature on the capability approach and mobile phone use in agriculture.

6.4 Chapter Summary

The chapter has analysed the well-being outcomes of the smallholder farmers in their use of the mobile phone farming applications to access information and markets. The results have shown that, the farmers were able to achieve most of their information, market and livelihood capabilities. The farmers were able to access market and production information, which enabled them to plan for their farming. Similarly, the farmers were able to achieve most of their market requirements such as access to better markets at a faster rate. The livelihood based outcomes comprised of the broader benefits such as being empowered and being able to provide for the family. Capability approach was very effective in analysing and evaluating the smallholder farmers' well-being outcomes. The next chapter discusses the findings further and ties down the findings to the existing and relevant literature.

CHAPTER SEVEN
DISCUSSION, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

The aim of this study was to explore the smallholder farmers' use of the mobile phone farming applications and to assess the effect of these applications on their farming and marketing experience as well as their overall well-being. Exploring the research aim, the two objectives and the subsequent research questions, has led to a long winded road of reviewing the literature, the capability theory, carrying out data collection and analysis in the attempt to answer the questions. Finally, this chapter discusses and locates the findings within the broader relevant literature. Chapter Two detailed/discussed the problems and the challenges of smallholder farmers in Kenya in accessing information and markets. Chapter Three reviewed the capability approach and showed how to operationalize it in this study with the aim of evaluating the smallholder farmers' well-being outcomes. Chapters Five and Six analysed the results from the fieldwork presenting the findings, which indicated that the mobile phone farming applications have facilitated smallholder farmers to access markets and information and subsequently to achieve their well-being outcomes.

This chapter picks up from the previous two chapters and further discusses the results linking these with the literature presented in Chapter Two and Three. This is done by discussing the two research objectives. The first objective discusses the broader use of mobile phone farming applications and their effect on marketing and information access while the second objective discusses the well-being achievements of the smallholder farmers.

7.2 The Place of Mobile Phone Farming Applications in Agricultural Production and Marketing

This section discusses the Research Objective One which was:

1) To explore the smallholder farmers' use of the mobile phone farming applications and assess the effect of these applications on their access to markets and production and marketing information.

The subsequent Research Questions under this objective were:

i. How are the different smallholder farmers using the mobile phones farming applications to access marketing and production information?
ii. What are the costs of using the mobile phone farming applications and are they affordable to the smallholder farmers?
iii. What have been the effects of using the mobile phone farming applications to the smallholder farmers' production and marketing?
iv. What are the challenges and problems associated with the use of the mobile phone farming applications?

This section first discusses the use of the mobile phone farming applications by the farmers before discussing its effect on the farmers' marketing and production.

First, concerning the use of the mobile phone farming applications by the smallholder farmers (Research Question One), the study found that the farmers accessed information through the application by the use of text messages. Although the Mfarm application had a downloadable app which the farmers with Android powered smartphone could use to directly access information, most of these smallholder farmers could not afford these smartphones and were, therefore, using their basic phones. As a result, the main method of accessing information and markets for these farmers was by text messages for all the three services: Mfarm, Mfarmer and NAFIS. It was also found in the study, that the farmers were using these applications mostly to access marketing information in comparison to production and extension information. In relation to this, Aker and Ksoll (2012), and the World Bank (2008), have suggested that smallholder farmers are often interested in accessing markets and marketing information since the ease of access to better markets often acts as an incentive for increased production. This was true for this study. However, the other reason for the farmers' access to market information in comparison to production information, was due to the inadequacy of these applications in providing production information. However, it was evident that the smallholder farmers' priority was to access better markets for their produce.

Secondly, concerning the costs of using these applications (Research Question Two), it was found that the costs were low and therefore affordable to the smallholder farmers. With the costs of sending the text message costing less than 1 New Zealand cent, most of the farmers interviewed indicated that the costs of the service was affordable. This is consistent with Etzo's and Collender's (2010, p. 659), assertion that the mobile phones have consistently provided cheaper and quicker mode of communication in Africa. At the same time, the

farmers also pointed out that they were not much concerned about the costs but more about accessing the information and markets for their produce since they had faced marketing problems for a long time and these applications provided the best mode of accessing markets.

Thirdly, in regard to the effect of the mobile phone applications to the smallholder farmers' production and marketing experience (Research Question Three), the study found that these applications had a positive effect on both the smallholder farmers' access to marketing information and markets and a limited effect on the farmers' access to production information. This research question is discussed further below.

7.2.1Mobile phone applications and smallholder farmers access' to production information

The study found that the mobile phone farming applications were not effective in providing the farmers with production information resulting in the farmers using other means, such as the internet, to access such information. In agricultural production, access to information facilitates farmers access to weather updates, current technology, input prices, pest and diseases updates and other issues of importance (Kazilaslan, 2006; Okello et al., 2012). Access to such information enables the farmers to be able to plan and increase their production and to take advantage of new production technologies in agriculture (Aker, 2011). As such, with an efficient mobile phone farming application that provides comprehensive production information, the farmers can be able to benefit from the low costs of accessing such information to improve on their production. A study by Bayes (2001), in Bangladesh, found that the use of mobile phone by the smallholder farmers increased their access to agricultural inputs by reducing the transaction costs involved in searching for such information. Therefore, when production information can be provided to farmers at lower costs, it is expected that farmers would increase their access to such information thereby improving on their production.

The same view has been advanced by De-Silva and Ratnadiwakara (2008), through their study in Sri-Lanka. De-Silva and Ratnadiwakara (2008, p. 11) found that production information search costs made up 11 per cent of the total production costs of smallholder farmers in Sri-Lanka. Therefore, ease of access to production information would significantly reduce the cost of production information search. In the same context, De-Silva's and

Ratnadiwakara's (2008, p. 15) study found that the farmers using mobile phones to access production information were able to reduce search costs for such information by 33 per cent. This notion, of mobile phones reducing production information search costs, has been supported by Akers's (2010) study in Niger, which found that the use of the mobile phone by smallholder farmers to access production information significantly lowered the search costs associated with such information. However, for this study, the access to such information was low due to the limitations of the mobile phone farming applications in providing production information. Moreover, it was also evident that accessing production and extension information via the mobile phone farming applications would have been a challenge since production information may be bulky compared to price information and, therefore, it may have been difficult to send such information using text messages. Because of the limitation of the mobile phone farming system to provide production information, the smallholder farmers were using other means such as the internet and the networks and linkages to access such information.

In addition, it was difficult to assess the direct effect of access to extension and production information to the smallholder farmers' production. Part of the reason for this was because the farmers were not extensively using the mobile phone farming applications to access production and extension information. Despite this, the farmers mentioned that their access to extension and production information had improved due to the low costs involved in accessing this information via the mobile phone farming application. The effect of the use of these applications on the smallholder farmers' production was found to be related to the farmers' improved access to markets. This finding supports the notion advanced by Muto and Yamano (2009) and The World Bank (2008), that when smallholder farmers have ease of access to markets then this provides the incentives for the farmers to increase their production. It was evident in the study that the farmers were using the application more to access market information compared to production information, since the access to better markets provided the direct impetus of improving their production. However, the study notes that, it would be important if the service providers increased the content of production information and improved the dissemination of such information. This would allow farmers to benefit from both markets and new technologies in agricultural production. The next section discusses the effect of the use of these applications to smallholder farmers' access to marketing information and markets.

7.2.2 Mobile phone applications and smallholder farmers' access to markets and marketing information

Information in agricultural markets has been cited by Jensen (2010, p. 5), as important for the efficient functioning of the market since it facilitates price setting mechanism in markets. In this study, the farmers indicated that the mobile phone farming applications were effective in meeting their need for accessing markets and marketing information. In this regard, Carmody (2012) and Duncombe (2011), have pointed out that market information is often the most significant information that smallholder farmers are often in need of. As such, the study found that the use of the mobile phone farming applications enabled the smallholder farmers to access market information at: cheaper and faster rates, access up-to date market information which facilitated their prompt decision making, facilitated formation of linkages and networks with other farmers and empowered the farmers to be able to negotiate with potential buyers in determining the prices of their produce. Jensen (2010), has suggested that mobile phones in agricultural markets work in two ways: first by facilitating the smallholder farmers' access to markets and marketing information and second, as a result of the access to information, by reducing the price dispersion in the agricultural markets.

The first effect of using the mobile phone in agricultural marketing, as proposed by (Jensen, 2010), consists of facilitating smallholder farmers' access to markets and marketing information. For this study, there were four main effects of the use of the mobile phone applications by the smallholder farmers in their marketing experience. The first finding was that the mobile phone farming applications had facilitated the smallholder farmers' access to markets and marketing information. This supports the findings by (Aker, 2008, 2010) in Niger, Overa (2006) in Ghana, Jensen (2007) in India and Muto and Yamano (2009) in Uganda, that the mobile phone can facilitate the smallholder farmers' access to information and markets. The lower cost for the use of these applications provided the smallholder farmers' with the impetus to increase their access to information and their participation in markets.

The second finding was that the use of the mobile phone farming applications had led to a reduction in marketing transaction costs. This finding supports the argument by Muto and Yamano (2009), that reduced transaction costs, mostly involving the free flow of information and lower costs of accessing information, can enable smallholder farmers to access markets with ease. In the study, the farmers' ease of access to marketing information was facilitated in

two ways: first through the reduction in the market and information search costs and second, in the reduction of the time and effort involved in searching for markets and information. Abraham (2006), has highlighted that agricultural marketing transaction costs often consist of time, effort and money and the reduction in any of these lead to substantial reduction in transaction costs. Moreover, Abraham's study in Ghana has shown that the use of mobile phones by farmers and traders in marketing can lead to a reduction in the transaction costs. Therefore, when marketing transaction costs have been reduced, smallholder farmers will most likely increase their participation in markets as shown by Jensen's (2007), study in Kerala India, that found that fishermen were able to increase their participation in markets due to reduced marketing transaction costs. Jensen (2010), further asserts that when information search costs are low, in due course, the farmers' participation in markets is increased due to increased competition for their produce from different traders.

The third finding was that the smallholder farmers were able to access markets offering better prices for their produce. Jensen (2010), has drawn our attention to the fact that when smallholder farmers are able to access price information and information on potential buyers, their market power increases and competition for their produce is enhanced among different traders. Jensen's argument is that when farmers are provided with price information, buyers are often willing to raise their offer prices which increases competition for the farmers' produce among several buyers. This study's findings agreed with Jensen's argument since it was found that the smallholder farmers' participation in markets had increased and, in addition, they were able to get better prices for their produce. Part of the reason for the better prices was because the farmers were able to avoid price manipulation by traders due to their increased power in the markets and because they were able to access better paying markets in urban centres.

Moreover, Jensen (2010), has highlighted the fact that information symmetry in agricultural markets sometimes leads to the transfer of some of the benefits, such as higher profits, from traders to farmers potentially leading to higher produce prices. This is because traders are often willing to transfer some of their benefits, such as higher profits to farmers when both traders and farmers have access to market information leading to higher produce prices for farmers. For this study, this was especially so for the rural farmers who indicated that their access to market information prompted the middlemen to raise the buying price of the produce. Muto and Yamano (2009), have also pointed out in their study in Uganda that the use of mobile phones by smallholder farmers often prompts farmers, to seek better markets

for their produce in urban areas. When urban centres offer better prices than rural markets, the farmers are attracted to the urban centres' markets in order to get higher returns. This was true for this study with most of the rural farmers selling their produce to traders from urban centres due to the better prices they were offering.

The second effect of the use of the mobile phone in agricultural markets, as suggested by Jensen (2010), consists of reduction of price variability in agricultural markets. Although it was not possible for this study to assess the overall reduction in price fluctuations in the agricultural markets in Kenya, it was evident that the smallholder farmers using the rural farmers' using mobile phone farming applications were able to avoid the price fluctuations. This was because the rural farmers' were able to directly access urban markets where the prices for commodities were more stable. In this regard, Carmody (2012) and Duncombe (2011), have both highlighted the fact that information on the agricultural markets facilitates the price setting mechanism within markets. A different study by Jensen (2007), in Kerala India, found that the use of the mobile phone by the fishermen to market their fish and search for market information had reduced price dispersion in the fish markets in Kerala. Jensen pointed out that the use of the mobile phone facilitated both the traders and the fishermen to have access to the same information and as a result, the demand for fish was always met with the supply leading to stable markets and prices.

A further study by Aker (2008) in Niger, found that the use of the mobile phone by the traders and farmers was able to reduce the frequent price dispersion in the grain markets in Niger. This was because both the traders and farmers were able to access grain supply and demand information from each other. In this study, the rural farmers had complained of frequent price fluctuations in the local markets before their adoption of the mobile phone farming applications. However, the farmers mentioned that since they could now access urban markets, the frequent price fluctuations had marginally reduced. The ease of access to marketing information allowed the smallholder farmers to sell their produce at the prevailing market prices rather than at the prices determined by traders. The farmers were able to access market prices of commodities in five different urban centres therefore; they were able to avoid price manipulation by traders. Jensen (2007), has argued that when farmers and traders have access to the same market information, market stability is often established. In this study, the rural farmers were able to experience some price stability for their produce. The next section discusses the smallholder farmers' well-being outcomes.

7.3 The Smallholder Farmers' Well-Being Outcomes

The above section discussed the use of the mobile phone farming applications and its effect on the smallholder farmers' production and marketing. This section analyses the well-being outcomes and quality of life improvement of the smallholder farmers as a result of the use of the mobile phone farming applications. The Research Objective Two discussed was:

2) To assess the effect of access to markets, production and marketing information to the smallholder farmers' well-being

The subsequent Research Question was:

v) How has the use of the mobile phone farming applications impacted on the smallholder farmers overall well-being?

In analysing the well-being outcomes for the smallholder farmers, the capability approach theory (see Chapter Three) was used. The capability approach has been defined by Robeyns (2005a, p. 94), as a framework for conceptualising and evaluating individual's well-being and quality of life. Therefore, the capability approach focuses on the individual's ability to achieve or live the kind of life that they have reason to value. Two components of the approach have been used in evaluation of individual's well-being outcomes: *capabilities* and *functionings* (Sen, 1990). Capabilities has been defined by Sen (1999, p. 14) as comprising of the opportunities available to individuals to live the kind of life that they have reason to value. Sen (1999) further defines functionings as constituting the beings and doings of individuals. Therefore, these two components, capabilities and functionings, were the key measure of an individual's well-being achievement in this study.

In this study, the approach was applied to look at the well-being achievement of the smallholder farmers from their use of the mobile phone farming applications to access markets and information. In simple terms, the focus was to analyse if the mobile phone farming applications had enabled the smallholder farmers to achieve the kind of life they valued in regard to farming. In the process of evaluating the well-being outcomes, the functionings were divided into three: information-based, market-based and livelihood-based outcomes.

The information-based well-being outcomes, as was analysed in Chapter Six, consisted of the smallholder farmers' access to production and extension information, their access to produce

price information, the formation of the linkages and networks with other farmers and traders and information sharing with other farmers. First, it was evident that the mobile phone farming applications were not sufficiently meeting the extension and production information needs of the smallholder farmers. As a result, the smallholder farmers were using other means to access such information, which included the internet and the linkages and networks with other farmers. Second, it was evident that mobile phone farming applications had enabled the farmers to form linkages and networks with other farmers and traders thereby meeting their well-being outcomes of forming such linkages and networks. To this end Okello (2013), has highlighted the fact that the mobile phone can facilitate farmers and traders to form trade linkages, which can facilitate trade among the farmers and traders. In this study, it was found that the networks and linkages played the role of information sharing among the farmers and between the farmers and traders.

The market-based well-being outcomes consisted of the smallholder farmers' access to markets with better prices, access to reliable and stable markets, access to wider markets choice, the ability to access markets with ease, a reduction of on-farm wastages and increased farm production. On this level of well-being achievement, the mobile phone farming applications were effective in enabling the smallholder farmers to achieve their desired well-being outcome. As earlier discussed in section 7.2 above, The World Bank (2008) and Muto and Yamano (2009), have drawn attention to the fact that the smallholder farmers' most important need is often to find markets and marketing information. With this in mind, the study found that most of the farmers' market information needs had been met by the use of the mobile phone farming applications. Moreover, the farmers' were able to access stable and reliable markets as well as a wider choice of markets.

Lastly, the smallholder farmers' livelihood-based well-being outcomes consisted of: increase in income, the ability to meet family basic needs, being empowered to be able to negotiate with potential buyers, need for extra time to spend with the family and work in the farm, to experience job satisfaction and the ability to employ a farm hand to assist on the farm. The access to markets with better prices led to increased household income among the farmers. As earlier alluded to, Jensen (2010), has pointed out that farmers access to market information sometimes prompted traders to raise their offer prices leading to higher returns for farmers. The increased household incomes in turn enabled the farmers, especially the rural farmers, to be able to meet their family's basic needs such as providing food, quality housing and education. The improved incomes also enabled the urban farmers to be able to

hire farm hands to assist on the farm. This was important since all the urban farmers also had full time employment, therefore the ability to hire a farm hand facilitated their farming.

In addition, the farmers had been empowered, as they were now able to negotiate with potential buyers of their produce. Empowerment, which in the capability approach is the agency component, has been defined by Kabeer (1999, p. 436), as the expansion of people's ability to make life choices. Kabeer has argued that empowerment inhibits a change process, whereby, a previously disempowered individual becomes empowered. Within the capability approach the operationalizing of the agency component entails the process of acquiring the ability to make decisions, negotiate and bargain (Kabeer, 1999, p. 437). In this study, it was found that the smallholder farmers had been empowered by accessing information enabling them to be able to negotiate with potential buyers and turn down any low price offers from buyers. The access to price information enabled the farmers to engage with buyers and participate in the price setting process for their produce. This had not been possible before because the farmers were not able to access price information. As earlier mentioned Jensen (2010), has argued that farmers access to market information increases their power in markets power in the market thereby enabling them to demand for more benefits from traders. The benefits may include higher prices for their produce and control over their farming. This study, found that the mobile phone farming applications facilitated the smallholder farmers to achieve most of their well-being outcomes.

7.4 Conclusion and Summary of the Study Findings

This thesis has presented an analysis of literature and fieldwork data in the answering of the five research questions. From the data and results, five main conclusions can be made from the study. First, the study title had asked the question 'Market in their palms?' The study found that the mobile phone farming applications were facilitating the smallholder farmers to access markets and marketing information. The smallholder farmers using these applications were able to market their produce through the phone in the comfort of their own homes. This was because the mobile phone farming applications had facilitated the reduction in marketing transaction costs. It was evident that the smallholder farmers were using these services to mostly access markets and marketing information compared to agriculture production information. This was partly because of the difficulty in accessing production information through these applications and, partly, because the smallholder farmers' priority was access

to markets. As it has been shown in the discussion part of the thesis, evidence indicates that smallholder farmers often prefer marketing information compared to other types of information in farming. The study found that this was true with the farmers prioritising access to markets over other types of needs. Eventually, the access to markets had the effect of providing the incentives for the smallholder farmers to increase their production because of the potential gains from the markets.

Secondly, the study found that the use of the mobile phone farming applications had facilitated the formation of networks and linkages among farmers and between farmers and traders. As the farmers and traders interacted through the mobile phone farming applications, they ended up forming networks, which they continually used outside the mobile phone farming applications. These networks proved to be an important source of marketing and production information. The farmers would often use the networks to inquire about the prices of produce in markets away from their area through other farmers and traders. Similarly, traders would use the network to source produce from farmers. In addition, the farmers used the networks to access production information and input prices and availability from other farmers. Since these networks were built through trust, the parties trusted the information passed along, resulting in the direct use of such information.

The third finding was that access to information had empowered the farmers to be able to negotiate with buyers of their produce. The access to information increased the farmers' market power enabling them to be able to engage with traders. Information enabled the farmers to be able to operationalize their agency component thereby being empowered. The fourth finding was that the mobile phone farming applications were not effective in providing agriculture extension and production information to the smallholder farmers. These farming applications were more focused on providing marketing information, with a well-developed farmers-traders interface, and the provision of produce price information. In contrast to market information that could be provided easily by text messages, production information tended to be bulky therefore its dissemination through text messages was a challenge. However, in the case of these applications, it seemed that their focus was connecting farmers to the market with little priority given to the provision of production information. The result was that the farmers were using other means to access production information. This included the use of the internet and contact with other farmers through a formed network comprising of other farmers.

The fifth finding was that there was no exclusivity in the use of the mobile phone farming applications among the smallholder farmers to access information and markets. The smallholder farmers who were using these applications were also using other means to access markets and information. This indicates that these technologies may not be sufficiently meeting farmers information and markets needs thereby requiring investment in public goods such infrastructure and other agricultural institutions. This thesis acknowledges that these mobile phone farming applications cannot fully be relied upon to comprehensively meet farmers' needs and demands. Their effectiveness and reliability can only be up to a certain point and, therefore, complementing their services with investment in other areas is encouraged.

Lastly, despite some of the positive findings indicated above, the fundamental question is why then is the adoption of these mobile phone farming applications low among farmers? The answer to this question may be difficult and may require further research. However, some probable reasons for this stand out. Firstly, it was evident that most of these mobile phone farming applications were recent start-ups. Therefore, they were still in their infancy stage of operation and operating with minimal staff. Secondly, because of the minimal staff that these services had, they were unable to reach out to more farmers and thus most farmers were not aware of their existence. Thirdly, the fact that these services operated on trust and contract farming may have been a discouraging factor to some farmers joining.

In conclusion, the mobile phone farming applications have the potential of facilitating commercialisation of smallholder farmers' production. This includes facilitating these farmers access to markets and information, which is a key ingredient to agriculture commercialisation. The twelve farmers interviewed, all explained that the applications had facilitated their access to markets and information. Therefore, it is probable that the same benefits may occur if the services were expanded to other farmers.

7.5 Suggestions for Future Research

As was discussed earlier in Chapter Four section 4.7 on limitation of the study, it was difficult to access research participants because most of the mobile phone farming applications are new initiatives. Therefore, a repeat study with an increased number of participants is recommended, especially after few years, when the use of these applications

has expanded. In addition, it would be interesting if a quantitative study of the same could be done to determine the level of significance of the effect of the use of these applications to the smallholder farmers' access to information and markets. Furthermore, a comparative study could be carried out between the rural and urban farmers to determine their preferences in the use of these services. In the same vein, a study looking at the experiences, challenges and existing opportunities for the mobile phone farming applications service providers could also be carried out. This could assist in understanding the best ways of expanding the use of these applications to more farmers in Kenya.

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APPENDICES

Appendix 1: Semi-Structure Interview Schedule

My name is Fredrick Odhiambo, a student from Massey University in New Zealand. I am carrying out a research project on the use of the mobile phone farming applications by the smallholder farmers in Kenya. I wish to request that you kindly to participate in the study by providing the information requested below. I appreciate your voluntary participation and your responses will be confidential and will be used only for the purposes of this study. During the interviews, I am going to ask questions on your farming, your use of the mobile phone farming applications and marketing of your produce among other issues.

1) Smallholder farmers currently using the service

Main questions	**Additional question**	**Clarifying question**
When did you begin doing farming?		
How has your farming enterprise evolved over the years?	What have the low points? What have been the high points?	
So how have you been accessing farming and marketing information throughout that period?	What problems have you encountered while trying to access information over the years? What have been the advantages of accessing information though this way?	
How did you get to know about prices of the farm produce and inputs an interested buyer?	Did this work well for you?	
Okay now we will talk about your use of the mobile phone farming service. How did	Which year was that? Did somebody refer you to it?	

you get to know about it and begin to use it?	Which mobile phone farming services are you using? Which ones are effective?	
What are the costs of using these services?	Monthly average? Is it expensive for you or affordable? If it is expensive then why do you still continue using the services?	
For what purpose do you use the service for?	Production, marketing? Describe.	Has it been effective?
What to you consists of good farming life?	Why do these things matter so much to you as a farmer?	Have you achieved them so far? If not why?
Which of these things that you have achieved are the most important?	Why and how are they the most important?	
What are the challenges of using these mobile phone farming services?		
Is there any other way you use your phone in your farming?		Some examples?
How different is this experience compared to using the mobile phone farming services?		

2) Smallholder famers who have stopped using the service

Main question	Additional question	Clarifying question
How long have you been doing farming?	What crops do you grow?	
When did you begin to use the mobile phone farming service?	What attracted you to the service? How long did you use the service?	
What were you using it mainly for?	Marketing? Production?	The benefits?
So why did you stop?	When was this?	
How do you go about accessing information now?	Is it better for you?	
What do you think need to be done to the mobile phone service to attract you back?		

3) Smallholder farmers who have never used the service

Main question	Additional question	Clarifying question
How long have you been doing farming?	What crops do you grow? Where do you sell? How do you access extension information?	
Where did you hear about the mobile phone farming service?	Who told you? What did you hear?	
Why haven't you used the service?	Have you inquired form the service provider directly about their service?	
What can be done to make you use it?		

Appendix 2: Participant Observation Guide

Category	Includes	What to note
Appearance	Age, gender and physical appearance	Anything that might indicate membership in groups or in sub-populations of interest to the study, such as profession, social status, socioeconomic class
Household surrounding	Type of house, size of house and availability of a store	Anything that might indicate the farmer's well-being, what type of house is it, the size, does the farmer's family look well, availability of a store for farm produce, general surrounding in the compound
The farm	Crop grown, the acreage, condition of crops	Indication of the value of crop grown, the type of agricultural production, the condition of the crops
Use of the mobile phone application	Which application is being used, how is it used, how often, what message being frequently searched for, how do the farmer make a sale through the the application	Indication of the type of mobile phone application used, the cost of usage, the frequency of usage, the message being searched for, the reliability of the service

Appendix 3: Massey University Human Ethics Low Risk Notification

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

5 June 2013

Fredrick Ajwang
1 Massey Street
PALMERSTON NORTH 4414

Dear Fredrick

Re: Market in their Palms? Exploring Smallholder Farmers' Use of the Existing Mobile Phone Farming Initiatives and the Impact of the Initiatives on their Wellbeing: A Case Study of Kiambu County in Kenya

Thank you for your Low Risk Notification which was received on 28 May 2013.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
Chair, Human Ethics Chairs' Committee and
Director (Research Ethics)

cc Mr Gerard Prinsen
School of People, Environment and Planning
PN331

Mrs Mary Roberts, HoS Secretary
School of People, Environment and Planning
PN331

Appendix 4: Research Permit

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550
Mobile: 0713 788 787 , 0735 404 245
Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RCD/10/013/32**

Date: **12th June 2013**

Fredrick Odhiambo Ajwang
Massey University
New Zealand.

RE: RESEARCH AUTHORIZATION

Following your application dated **6th June, 2013** for authority to carry out research on "***Market in their Palms? Exploring Smallholder Farmers' use of the Existing Mobile-Phone Farming Initiatives and the Impact of the Initiatives on their well-being. A Case Study of Selected Counties in Kenya.***" I am pleased to inform you that you have been authorized to undertake research in **Selected Counties** for a period ending **31st August, 2013.**

You are advised to report to **the County Commissioners and County Directors of Education, Selected Counties** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. M. K. RUGUTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:
The County Commissioners
The County Directors of Education
Selected Counties.

OFFICE OF THE COUNTY COMMISSIONER
RECEIVED
25 JUN 2013
NAIROBI COUNTY

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development".

Appendix 5: Information Sheet

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

School of people environment and planning
Institute of development studies

Market in Their Palms? Exploring Smallholder Farmers' Use of Mobile Phone Farming Applications And Its Effect on Their Farming, Marketing And Well-Being.
A Case Study of Selected Counties in Kenya

INFORMATION SHEET

My name is Fredrick Odhiambo a Master's student in Development Studies at Massey University in New Zealand. I am currently doing my Master's thesis research in order to fulfill the requirements of the Master's degree. The aim of my research is to explore the use of the mobile phone farming applications by smallholder farmers to access information and markets in Kenya.

The proposed study will be a qualitative study involving the use of interviews and observation. In the course of the interviews, the conversation will be recorded in a digital voice recorder. If you are willing to participate in the study I would like to have an interview session with you which will be as brief as possible. If you are not comfortable to be recorded kindly inform me. It is your right to accept or decline to participate in the study and to withdraw from the study at any given time you feel uncomfortable. During observation I will be making some notes and if you feel uncomfortable with this, kindly inform me. Similarly, it is up to you to decide whether you want your name to appear in the final published material or remain anonymous. It you would like to remain anonymous, I would discuss with you further how I will do this.

The data collected here, will be used to produce my masters thesis which can be made available to you if you would like. The thesis will also be available online on the completion of this research. Thank you.

Appendix 6: Participants Consent Form

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

School of people environment and planning
Institute of development studies

Market in Their Palms? Exploring Smallholder Farmers' Use of Mobile Phone Farming Applications And Its Effect on Their Farming, Marketing And Well-Being. A Case Study of Selected Counties in Kenya

PARTICIPANT CONSENT FORM - INDIVIDUAL

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the interview being sound recorded. *Agree* ☐ *Disagree* ☐

I wish/do not wish to have my recordings returned to me. *I wish* ☐ *Do not wish* ☐

I wish/do not wish to have data placed in an official archive. I wish ☐ *Do not wish* ☐

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature: ..... **Date:** .....

Full Name - printed .....