

**FACTORS THAT AFFECT IMPLEMENTATION OF
INFORMATION COMMUNICATION TECHNOLOGY IN SMALL
HOLDER DIARY COOPERATIVES: A CASE STUDY OF KABETE
IN KIAMBU COUNTY, KENYA**

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**A Dissertation submitted in partial fulfillment for the Award of a
Master of Science Degree in Agricultural Information and
Communication Management in the Department of Agricultural
Economics of the University of Nairobi**

APRIL 2013

Declaration

I, **Ann Mugure Mureithi**, declare that this project report is my original work and has not been presented for examination in any other university or institutions of higher learning

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This dissertation has been submitted for examination with our approval as the University supervisors.

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Acknowledgement

I would like to express my deepest appreciation to all those who provided me the possibility and support to complete this report.

I want to acknowledge my supervisors Mr. Paul Wesonga and Dr. Titus Magomere for the guidance they have given me in the course of developing this project report.

I want to acknowledge my Employer Alliance for a Green Revolution in Africa (AGRA) for investing in my career development by partially supporting me financially in my university tuition fees.

A special gratitude I give to Mr. Paul Wesonga, whose contribution in stimulating suggestions and encouragement, helped me to coordinate my project to completion.

May God Bless You All.

Dedication

To my Family,

My Mother; Loise W. Mureithi; My Grandmother; The Late Hottensiah Wambui
Kangethe (1923-2012); My Children; Letion and Leshan Keen; My Sisters; Catherine W.
Kimani and Caroline W. Mureithi and my Brother; Paul Mureithi.

My Best Friend,

Anne K. Gichanga

Thank you for your endless love and support.

God Bless You All.

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Abstract

Recent efforts to improve smallholder access to agricultural information have seen increased application of Information Communication Technology (ICT) in developing smallholder dairy initiatives. The purpose of this study was to establish the factors that affect implementation of ICT in smallholder dairy co-operatives in Kabete, Kiambu County, Kenya. The study adopted a causal descriptive research. The target population was the smallholder dairy cooperatives in Limuru, Kikuyu, Gatundu, Nderi, Gikambura, Ndumberi and Sigona. Using purposive sampling, the study selected 41 respondents to respond to the study questionnaires which were designed for collecting data. The data was analyzed using Microsoft Excel 2007 program.

The findings indicate that the government's involvement in ICT implementation does not include controlling the cost despite the fact that it has invested in ICT infrastructures. It was established that most dairy cooperatives in Kabete, Kiambu County do not have trained and motivated employees to use modern ICT technologies hence the need for training and assessment. In addition to that, farmers have limited access to finances that could facilitate their accessing ICT from their cooperatives and there is poor infrastructure within the county that affects the cost of implementing ICT. Awareness of ICT benefits is very important as it determines the adoption of ICT.

The study recommends that the government takes an active role in controlling the cost of adopting and implementing ICT so that even the financially disabled farmers can be able to access and use it. Cooperatives should recruit well trained and motivated employees to use modern ICT innovations. Further research is recommended on the same topic on a larger scale.

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Abbreviations

ACP	African Caribbean and Pacific
AFFRI	African Farm Radio Research Initiative
AGM	Annual General Meeting
EDI	Electronic Data Interchange
EPZ	Export Processing Zone
GDP	Gross Domestic Product
GPS	Global Positioning Satellite
ICA	International Co-operative Alliance
ICT	Information Communication Technology
ICT4D	Information Communication Technology for Development
IDT	Innovation Diffusion Theory
KNBS	Kenya National Bureau of Statistics
LAN	Local Area Network
PLF	Precision Livestock Farming
SBO	Small Business Organization
SMS	Short Message Service
VSAT	Very Small Aperture Terminal

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Dairy production is a major activity in Kenya's livestock sector and an important source of livelihood for nearly a million small-scale farmers. With an average national family size of about six persons, the sector supports nearly 5 million Kenyans who rely on daily income from milk sales (USAID Kenya, 2008). The industry is one of the most developed in Kenya with estimated annual revenue close to \$2 billion, and contributes between 6-8% of GDP. The economic development and employment opportunities created by increased milk production, improved marketing channel efficiency, and greater consumer demand for affordable dairy products are enormous. Increasing effectiveness and developing an efficient dairy marketing and support system through the dairy Small Business Organizations (SBOs) for smallholder farmers is therefore crucial in achieving the twin Millennium Development Goals of reducing poverty and ending hunger in Kenya.

Information has become a critical factor of production in agriculture (Rao, 2006). The dramatic changes that have taken place in the last decade in ICT have touched almost every field of human activity, and dairy farming is not an exception (Winrock, 2003). Like in any other fields such as mining, engineering and commerce, computers and electronic based mechanisms are now used to collect, manipulate and process information automatically to control and manage agriculture production and marketing.

The use of ICT in agriculture is not a completely new phenomenon. During the 1970's, ICT was widely used in e-commerce, value creation in agricultural and food markets such as e-auctions in the cattle industry, and electronic cotton marketing (TELCOT) in the United States (Montealegre, Thompson and Eales, 2007). These trends have continued to evolve with modern advances in global positioning satellite (GPS) technology commonly used in precision agriculture in US commercial agriculture.

Equitable access to information is one of the most important necessities in the emerging global information economy. Information is now perceived as a factor of production like other factors such as labour, capital and land (Rao, 2006). Dralega (2007) argues that if information is combined with other factors of production, it will enhance agricultural production and marketing. It is a vital resource for development and empowerment, giving farmers the ability to make informed decisions pertaining to production, marketing and management of agricultural products and services.

Dairy production in Kenya, as in many ACP countries, is carried out by small-scale dairy farmers located in rural areas, often with low levels of literacy and very few technology skills and have pooled their resources and built up strong cooperative societies that collect the milk and then sell it on to bulk processors. There is, however, increasing pressure on the Kenyan dairy industry as cheap imports compete with locally produced milk. Farmers are further strained since the government stopped providing farm subsidies, leaving farmers to meet the full cost of production. For dairy cooperatives to survive they have to streamline their operations and improve their management processes

if they want to have a positive balance sheet and some surplus money to pay dividends to their members.

One way the cooperatives could increase efficiency is to increase their use of computers. Computers can remove the duplication of efforts often seen in the manual accounting systems and transaction recording. Processing payments by hand is time-consuming especially for cooperatives with many members. Paper transactions can then be difficult to trace, leading to complaints from farmers and, in some cases, a feeling of being cheated. An erosion of trust, questions of accountability and an accounting system that is open to abuse can all cause the collapse of a cooperative.

1.1.1 Definition of ICT

For the purpose of this study, information and communication technologies are defined as a range of technologies that consists of hardware, software, networks and media that facilitate the collection, storage, processing, transmission, retrieval, presentation and communication of information (voice, data, text, images) using electronic means. This definition encompasses both the new ICT such as e-commerce, websites and computers and the traditional ICT such as radio and television, as well as the various services and applications associated with them, such as, video conferencing and distance learning.

1.1.2 The Co-operative Movement in Kenya

The concept of co-operatives originated in Europe as a reaction to economic crunch caused by industrial revolution when the poor formed co-operatives to reduce poverty through mutual assistance and self-reliance, hence the value of self-help, and is

associated with Rochdale equitable Pioneer society of 1844 (USAID, 2008). Co-operatives have certain conventional values, principles and distinctive (ICA 2007). The co-operative principles include; voluntary and open membership, democratic member control, economic participation by members, autonomy and independence, education, training & information, co-operation among cooperatives, and concern for community in general. The principles form the basic foundation of current cooperative practices by ensuring that co-operatives remain focused to their core function of self-help; meeting the needs of members and clients, responding and adjusting to the rapid changes in global economic arena and contributing development of their country.

In Kenya, the co-operative movement dates back to 1904 when the first co-operative was formed by the white settlers working in the railways and mining industry to uplift their living standards. After independence (1963) the government recognized its important role and established policy for their management. By 2007, there were 11,635 registered co-operatives in Kenya with at least 7 million members. About 4,414 of these are agriculturally based, with 3,037 being agricultural marketing co-operatives, (USAID, 2008). Statistics further indicate that by 2006, there were 245 dairy co-operatives in Kenya.

1.2 Statement of Problem

Given the development scenario in Kenya's Agriculture, ICT movement is still evolving. However, all the ICT initiatives are not uniform with disparities between regions in the level and quality of telecommunications, information and the effort of individuals, public and private organizations, and differentiated nature of demand of the farmers in different

areas. As a result, there have been many successes, failures, lessons learned and experience gained, so far. While these initiatives are intended to address the needs of the farmers through ICT, their actual usage and their ability to bring significant impact on the farm productivity and socio-economic development of the intended beneficiaries is to be understood. It is relatively unknown as to whether the ultimate beneficiaries actually use the facilities provided for them meaningfully to meet their needs. The common problems in adoption of ICT in rural segments are ICT illiteracy, availability of relevant and localized contents in their own languages, easy and affordable accessibility and other issues such as awareness and willingness for adoption of new technologies among the rural peoples etc. One critical aspect in the usage of ICT's for farmers and their groups, as seen in some of the ICT driven initiatives, is the involvement of human interface at the last mile indicating that there is a human dependency in transmission of Information/Knowledge to farmers.

Thus, there is a need to understand how far the ICT initiatives are able to address the farmers need so that better solutions can be developed to address those unmet needs. The research aimed to study the past and present major ICT initiatives in agriculture in Kenya's dairy sector, the extent of their success, the factors affecting the success as well as failure of such initiatives. Based on this study, the project delved on determining factors that affect or impede adoption and implementation of ICT in smallholder dairy cooperatives in Kenya and to suggest appropriate ICT models to meet farmer's information needs for different selected scenarios considering the infrastructural and social-economic constraints with some field testing within the existing infrastructure.

1.3 Research Objectives

1.3.1 General Objective

To determine factors that affect implementation of information and communication technology in smallholder dairy co-operatives in Kabete, Kiambu County, Kenya.

1.3.2 Specific Objectives

- (i) To establish the effects of governments' involvement in implementation of ICT in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya.
- (ii) To determine the effect of ICT initiatives/opportunities in the smallholder dairy cooperatives in Kabete, Kiambu County, Kenya.
- (iii) To determine the effect of cooperative members' awareness of the benefits associated with the use of ICT in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya.
- (iv) To determine the effect of cost in adoption of ICT in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya.

1.4 Research Questions

- (i) What is the effect of governments' involvement in implementation of ICT in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya?
- (ii) What is the effect of ICT initiatives/opportunities in the success of farmers in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya?
- (iii) What is the effect of stakeholders' awareness of the benefits associated with the use of ICT in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya?

- (iv) What is the effect of cost implications in adoption of ICT in smallholder dairy cooperatives in Kabete, Kiambu County, Kenya?

1.5 Significance of Study

The findings of this study will help the dairy sector in Kabete, Kiambu County review their management capacity in regard to the use of ICT, its potential in terms of productivity as well as aiding the management process and the factors that affect its implementation in the dairy sector within the country.

The study will also be of benefit to stakeholders/farmers who are involved in the dairy sector and are keen to know what ICT initiatives are available to them and to the society at large.

The study will also benefit the government in its incentive programs aimed at improving smallholder dairy farmers in Kiambu County.

Scholars could also use the findings as a basis to conduct future studies on ICT absorption levels in dairy and other agricultural sectors.

1.6 Scope of Study

The main objective of this study was to determine the factors that affect implementation of ICT in smallholder of dairy cooperatives in Kenya. Focus was on smallholder cooperatives in Kabete, Kiambu County from which farmers were picked to respond to the questionnaires designed (refer to Table 3.1).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter reviews the different literatures related to the use of ICT in dairy cooperatives. The review was done according to the objectives of the study. At the end of the review the study analyses the theoretical framework that will form the basis of the study.

2.2 Governments' involvement in implementation of ICT in smallholder dairy cooperatives

ICT systems' potential of providing significant amount of useful data and information for process management and process documentation expedited its application in many fields. With technical innovations like GPS, GIS, various sensors etc., Agricultural production should be managed on a primary crude level to an elaborate and high level. Whereas, most of modern IT solutions in agriculture are non-compatible and isolated, thus the farmer must operate computers (IT unit) or manually transfer data each day, the advantage that application of the IT controlled machines can't be brought into play.

There is an element of dualism with regard to how the development community has perceived the role of ICTs. Some development practitioners have perceived ICTs primarily as opportunities to redress past failures of development, by increasing information and knowledge, enabling new modes of production and facilitating the

development of new social and economic networks. Others have been more concerned about the threat of the “digital divide”, that unequal accessibility and take-up of ICTs will increase inequality between rich and poor individuals, communities and nations (Souter, 2004).

Much has happened since the early days of discussions related to ICT for development (ICT4D). The typical example of ICT4D applications during the 1960s and 1970s involved the internal use of computers within government organizations for data processing and management information system purposes with little relevance for neither enterprises nor poverty (Heeks and Kanashiro, 2009). In the 1970s and 1980s, such uses were joined by similar applications in large enterprises. In the mid-1990s, the scope for ICTs as a tool to promote various development objectives was increasingly recognized.

The involvement of developing countries as consumers and producers of ICTs is also evolving as there is increased interest providing potential growth markets. In response, ICT producers are adjusting their goods and services as well as business and agricultural models to cater better to low-income consumers. More consideration is today paid to finding ways to reach the “bottom of the pyramid” (Prahalad, 2004). Improved mobile access – partly as a result of cheaper imports of technology – at increasingly affordable rates, and new service models are facilitating access for low income earners. This has allowed for greater involvement of enterprises in developing countries in ICT-related innovation processes (Heeks and Molla, 2009). Such involvement has enabled the adaptation of ICT systems (that were first developed outside these communities) to specific situation prevailing in low-income economies.

According to Liu and Zhang (2010), farm management information systems have steadily increased in their level of sophistication by including new technologies. The application of ICT system in Dairy industry is becoming a necessary requirement accompanying technologies and sciences development. These new functionalities will probably be leveraged by the expected reduction in the cost of sensors and by the increase at low energy expense, in the sensor's memory and processing capabilities (Alberto, Carlos, Anatonio, Andre and Pedro, 2007). Precision livestock farming (PLF) as described by Wathes, Kristensen, and Berckmans (2008) is the use of smart sensors in livestock farming for example the embryonic technology that has the potential to transform intensive livestock production by efficient utilization of nutrients, early warning of ill health, reduction in pollutant emissions and provision of useful information to skilled stock-men (Wathes, et al., 2008).

A study of Danish dairy firms indicates that a major obstacle in using IT in agriculture is that most of the IT solutions provided encompass non-compatible software (Lindstrøm and Sørensen, 2008). Thus, the farmer must operate several IT units in order to obtain the full benefits and this set-up is perceived as both time-consuming and costly. In this way, many of the management benefits that IT controlled machines offer is not utilized (Richard and Juergens, 2006). With the development of ICT, it is possible to develop a complete management tool for the different agricultural domains (e.g. arable farming, dairy farming and pig production). Developments within precision agriculture allow for collection of vast amount of data during agricultural production (Schellberg *et al.*, 2008).

For dairy production, sensors and automated machines which can detect heat, control indoor environment, monitor feed storage, access milk quality, perform the milking, mix feed and feed it to the cows etc. are currently available.

Smallholders form the bulk of agricultural producers. However, they remain the majority of the food and income poor (IFAD, 2007). Improving smallholder agriculture is therefore key to development, and ICT is critical to this effort. In the wake of growing demand for food, the sector offers opportunities for producers to sustain and improve their livelihood. Unknown to many, ICT plays important role in addressing these challenges and uplift the livelihood of the rural poor. The sector is confronted with the challenge of increasing production to feed a growing population in a situation of decreasing availability of natural resources. The role of ICT to enhance food security and support farming cannot be ignored. Its role in agriculture, which includes use of computers, Internet, geographical information systems, mobile phones, radio and television was endorsed at the 2005 World Summit on the Information Society. A number of factors influence the decision whether or not to invest in ICT and these are higher costs, lack of competition, lack of relevant skills for effective use of ICT could be inhibitors (Caseli and Coleman, 2001).

The use of mobile phones has been found to reduce information asymmetries, enabling users to access arbitrage, marketing or trade opportunities (Jensen, 2007). Studies have attributed multiple benefits to the mobile phone, for instance mobility, improved convenience, time and travel savings (Bhavnani, Won-Wai, Janakiram and Silarszky, 2008). Kenya's ICT sector has undergone a gradual evolution that has been characterized

by the governments' commitment towards its adoption. The Kenyan finance minister in his budget speech for the financial year 2009/2010 indicated the governments' commitment toward enhancing access to internet services. He mentioned that the East African Marine System Ltd (Teams) and Seacom Kenya Ltd have invested heavily in undersea fibre optic cables, whose completion and full deployment is expected to reduce significantly the cost of communication in our country (Dachi, 2010).

2.3 ICT initiatives/opportunities and the success of smallholder dairy cooperatives

As dairy farmers' cooperative societies become larger and utilize new technology and opportunities that come alongside advancement in ICT, organizing work to maximize productivity and efficiency becomes very important. Historically dairy farmer cooperatives trained and motivated their employees by demonstration, by "just doing it". Other methods of employee training are now needed. Motivating employees requires extraordinary efforts. It is impossible to motivate without organizing work, use of modern technologies in ICT industry, training, and monitoring. Conversely, organizing, training and monitoring results will not improve farm operations if employees are not motivated. (Holmes & Associates 1999).

To ensure accountability, service orientation and profitability, members must monitor the progress of their group cooperative. Successful cooperative entities employ participatory methods and procedures, by the use of ICT, to allow group members to assess management, participation, organization, planning, economic performance, technical operations, financial operations and growth. In addition, they use a range of instruments—including memoranda of understanding, protocols, contracts and franchise agreements—to

protect members from abuses of power and to discourage irresponsible groups from bringing the organizations into disrepute (Robert and Robert, 1995).

The key to the formation, development and success of any co-operative is understanding, accepting and practicing the co-operative difference and advantage and in these modern times, adopt appropriate ICT that will have consequent value addition. The Co-operative difference and advantage has six interdependent dimensions: a clear philosophy of co-operation; a governance practice that reflects and reinforces co-operation; a management practice that reflects and reinforces co-operation; an ongoing co-operative renewal program; an ongoing member education program and an ongoing member participation program. A co-operative in its formation must establish the pre-conditions for ongoing adaptation and renewal. Co-operatives will invariably change due to internal and external processes, pressures and dynamics and critical to a capacity of a co-operative to cope with and survive change as a co-operative is the capacity to maintain its co-operative identity (Ronan and Cleary, 2000).

At an international level, the dairy industry has made India proud in recent times. India, the leading producer of milk in the world has cooperatives as the backbone of Indian dairy industry. Dairy cooperatives have excelled in their areas of cooperatives fueled by in time incorporation of relevant ICT. Milk is the country's number one agricultural commodity and the reason for this success is an all-round empowerment that includes taking advantage of the opportunities that result from the developments in ICT. These cooperatives are not controlled by the government. The farmers own and manage

them based on the needs and demands of the community. The biggest strength of dairy cooperatives is their labor intensiveness (Sanjay, 2006).

In Kenya, cooperatives governance has continued to improve; more men and women of integrity are being elected in the committees and qualified people are now being employed. The Cooperative officers are now, slowly but surely, getting a better deal from their employer (Gitau, Dermott and Mbiuki, 1996). The responsiveness to consumers' needs by leading cooperative entities is a fundamental reason behind their success. Consumer satisfaction is their foremost goal and they always strive to bring our customers a variety of healthy, tasty and great value dairy product (Rop, 2009).

One of the most important reasons behind successful cooperatives is the relationship they have with their clients, thanks to ICT, and that they are able to offer clients the quality services they look for. When it comes to delivering what their customers need, they follow their own 4 'Rs' policy. The Right quality, the Right size, with the Right taste delivered at the Right time. They believe that there is always room for improvement and continually strive to seek it. Because the clients' success is their success they take every precaution to deliver outstanding products and services time after time- when their client's need them, they are there (Kedi, 2006). Leading cooperative entities take pride in their use of state-of-the art technology machinery that serves to provide consumers with superior quality dairy products. They are continuously seeking to improve themselves and to meet and surpass expectations time after time; their adoption of the latest technology is just one of the ways we seek to accomplish that goal.

2.4 Awareness of the benefits associated with the use of ICT in smallholder dairy cooperatives

ICT has a myriad benefits, for instance, it's vital in collecting accurate and complete information for all market sectors and industries including agriculture. Information promotes competition and improves market performance (Thompson and Sonka, 1997). Information may also increase the level of trust on consumers in a product or firm and leading to increased demand. Information and communication technologies offer the ability to increase the amount of information provided to all participants in the agricultural sector and to decrease the cost of disseminating the information (Kurtenbach and Thompson, 2000). ICT in the agriculture sector facilitates knowledge sharing within and among a variety of agriculture networks including researchers, exporters, extension services and farmers. ICT enables vital information flows by linking rural agricultural communities to the Internet, both in terms of accessing information and providing local content (Ibid).

ICT especially mobile telephones can speed the way farmers in rural areas of Kenya get, exchange and manipulate information. They rework the way farmers interact with markets and cities. A variety of innovations that integrate ICTs into the dissemination of agricultural information to farmers (Farmers Information Services–FIS) have been developed at local, national and regional levels. They have currently demonstrated a promising field of new research and application in e-agriculture whilst bringing new sources of information and new tools for local knowledge dissemination. They have increasingly enabled farmers to focus, search and extract useful and up to-date market

information. Because of its potential to ameliorate this old rural farming problem an evaluation of its usage among farming communities becomes necessary (ISNAR, 2002).

2.4.1 E-commerce

Recently, e-commerce has been used in agriculture by a number of companies in developing countries. It has been used successfully in the fishing and agricultural sectors in the Philippines where a trading portal, *b2bpricenow.com*, has been launched to provide price updates and market information for agriculturalists, consumers and manufacturers (Batchelor, Evangelista, Hearn, Peirce, Sugden and Webb, 2003). Processing a purchase order include paperwork, data entry, phone calls, faxes and approval requests, and this can be quite expensive when done manually. On the other hand, performing these transactions online reduces costs substantially.

2.4.2 Computerized Milk Collection

In some areas such as Gujarat (India), some farmers are now using the facilities of computerized milk collection centres to ensure that farmers get better prices from the cooperatives they sell milk to. The use of computerized milk collection centres have led to transparent buying and selling of milk, faster processing, shorter queues and immediate payment to farmers (Cecchini and Scott, 2003; Harris, 2004).

2.4.3 Record keeping

Computer operations are useful for collecting, entering and interpreting data, thereby very instrumental in making decisions (Batte, 2005). Besides, computers can be used for

crop, livestock, field and farm record keeping. Field activity records include information on field identification, tillage practices, crop progress, weather, fertilizer and lime applications, general planting information, chemical application records and general harvest information. Computers can also be used for keeping financial records, budgets, accounts and business plans.

2.5 Major barriers in adoption of ICT in smallholder dairy cooperatives

A major stumbling block to the adoption and diffusion of technology in developing countries is the set of barriers inhibiting widespread use. This section presents issues that pertain to the barriers to ICT use and the factors affecting the use of ICT in developing countries. Relevant examples from agriculture communities are given.

For the past fifteen or more years new technologies have been used in a way to improve agricultural production, reduce poverty and enhance food security. According to Ortmann (2000), commercial farmers in South Africa are now using ICT in the management of farm enterprises, since ICT have proven to be the best way of reducing costs for farmers and enhancing demand along the agricultural food supply chain.

Despite efforts by commercial farmers to apply ICT in their farming practices, the majority poor farmers in developing countries have no or limited access to modern tools thereby highlighting the digital divide that not only exists between different continents and countries, but also provinces and even between local agricultural communities within the same country (Lio and Liu, 2006). This may be because of some constraints that are inhibiting people in most developing countries from using ICT. Some of them are; Poor

technological infrastructure, Lack of ICT access, High cost of access to ICT, Lack of ICT awareness and training, Language and content limitations (Adebayo and Adesope, 2007).

2.5.1 Poor technological infrastructure

Technological infrastructure encompasses technological tools, methods and access models that are used to facilitate the efficient management and transfer of information. Lack of adequate technological infrastructure has remained a major inhibiting obstacle to the use of ICT in most developing countries. According to Guermazi and Satola (2005), the infrastructure investment needed for the uptake of ICT far exceeds the resources of most developing countries and is prohibitively expensive or not commercially viable for example Malawi and Mozambique. Wambui (2005) mentions the Sierra Leone's ICT infrastructure that is in great need of reform because of its poor shape. The country lacks communication facilities and the main efficient form of communication remains the radio.

Jorge (2002) noted that telecommunications infrastructure is limited in most developing countries and costs are exceedingly high. The limited available infrastructure is mostly found in larger urban areas, thereby neglecting and depriving the rest of the individual farmers and firms in rural areas – those in need of a steady flow and ready access to information and wider business networks. Problems of connectivity and poor network coverage have been a major setback facing most developing companies in South Africa since the early 1990s (Langmia, 2006). Infrastructure in South Africa is poorly linked and is uneven across the country, with very low penetration of ICT services in under serviced rural and isolated historically disadvantaged remote areas.

2.5.2 Lack of ICT Access

In this era where information is considered the fundamental basis of socio-economic activities of any economy, it is unfortunate that not everyone is participating fully in the information society (Kabede, 2004). This result in a digital divides which hinders those without access to ICT from playing an active role and become beneficiaries of the information society. Poor people do not have access to information, knowledge and communication. This is because access to ICT is highly dependent on telecommunications infrastructure. Therefore, without infrastructure, there is no access to ICT.

Ensuring access for all to ICT is still a great challenge to most of the developing countries. Guerhazi and Satola (2005) found that most developing countries have the lowest access to ICT resources and within these countries; there is a notable digital divide between the rural and urban areas, the rich and the poor population. The inaccessibility of ICT makes it difficult to share information across traditional barriers and to give a voice to traditionally unheard people. Though the use of computers is improving, Internet connectivity is still extremely poor, affecting the access to information and the ability to make informed decisions by farmers (Maru and Ehrle, 2003).

2.5.3 High cost of ICT

According to Jorge (2002), even when infrastructure is available, affordable access is a concern in most developing countries. Personal computers, faxes, printers and some ICT equipment are expensive and unaffordable to the majority of developing countries

inhabitants, even for middleclass families, thereby cutting down the populations who are able to use the technology (Fors and Moreno, 2002). The initial costs of ICT and the ongoing expenses of maintaining them are very high and a number of people cannot afford them. Among the main obstacles affecting ICT diffusion is the price that is charged to end- users by ICT service providers for ICT access. As a result, a lot of potential users are barred from using the Internet because of the high costs.

2.5.4 Lack of ICT awareness and training

With the greatest percentage of illiterate people in developing countries, ICT face a tremendous challenge to be effectively used by the communities. Most developing countries are in the bottom rank on literacy. According to Ifinedo (2005) all countries in Sub-Saharan Africa with the exception of South Africa and its neighbours have a poor e-readiness score. This is evidenced by the fact that, there is a general lack of community awareness about the potential benefits and capabilities of ICT (Colle and Roman, 2003). Without a high level of ICT awareness, no community can fully participate in this networked world.

2.5.5 Language and content limitations

In most developing countries, a major barrier in the use of ICT for economic development is the lack of local and community related content as well as content in local languages. According to Mutula (2005), Sub-Saharan Africa faces a problem of inadequate locally owned, published and adapted knowledge and content to satisfy the needs of its people. Most of the content on the web is not relevant to the indigenous

people of Sub-Saharan Africa. Therefore, there is need for digital information content that is relevant to the communities in Sub-Saharan Africa, to cater for the needs and requirements of different consumers and communities (Kavulya, 2007).

2.5.6 Gender inequalities

Pigato (2001) mentions gender inequalities as one of the barrier of ICT use in most developing economies. Cullen (2001) mentioned women and girls among the specific groups of people disadvantaged in the uptake of ICT. Most women are still facing discrimination in terms of access to public services such as education and politics, thus increasing levels of illiteracy in African women. The female population remains confined to the rural areas. Among other things, Jorge (2002) identifies lack of gender focus in telecommunications and ICT policy as a major barrier that a lot of women in developing countries are facing. To address these gender disparities, the International Service for National Agricultural Research (ISNAR), (2002) proposed that (i) Rural women should be enabled to use ICT to improve their livelihoods and share their views in local and national programs, and (ii) development actors are supposed to use gender sensitive approaches in their programs especially in agriculture and rural development.

2.5.7 Attitudinal barriers

In addition to all the other barriers, Cullen (2001) mentioned attitudinal barriers as a contributing factor inhibiting the use of ICT. Attitudinal barriers are mainly cultural and behavioural attitudes towards ICT pertaining its appropriateness, usefulness and relevance. These may discourage the use of ICT even if all the other facilities for ICT use

are available. An example of attitudinal barriers include beliefs in some societies such as, computers are for intelligent people or for males and the young only. Some even believe that ICT are difficult to use or they belong to the rich class or white culture. The list is endless, but these are some of the beliefs that hinder the use of technology in some societies in Africa.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This section outlines the research methodology used in conducting this project. It provides an overview of the research design process, target population, sampling design, data collection, research procedure and data analysis and presentation process.

3.2 Research Design

This constitutes the blueprint for collection, measurement and analysis of data. It entails the type, purpose, time frame, scope and environment of study (Cooper and Schindler, 2006). This study involved a causal descriptive research which allowed the researcher to study a small part of the population. It also allowed for the use of both qualitative and quantitative data analysis techniques. This method also enabled the research to obtain results about variable relationships, description of events and examine cause and effect relationships (De Vaus, 2003). The method also introduced flexibility in the data collection process and allowed the use of a questionnaire as the data collection tool.

Theoretical framework

The adoption of technology in businesses is strongly explained by the attitude towards the innovation conceptualized as perceived innovation characteristics. Several factors have been identified to explain the drive towards the adoption of ICT in firms. The ways in which the technologies are likely to offer opportunities to the organization, the result

of the firm's evaluation of the opportunities that ICT technologies offer for creating value and the positive attitude towards an innovation are some of the factors important in adopting ICT in organizations. However, it has been noted that firms may decide to ignore adoption of ICTs despite the opportunities presented (Van der Veen, 2005). As such this study explores the Innovation Diffusion Theory (IDT) proposed by Rogers (1995). The study believes that this theory presents the best framework that will be able to explain the findings the study gets.

Innovation Diffusion Theory (IDT)

According to Quaddus and Hofmeyer (2006), the adoption of organizational innovation occurs in two stages-the initiation stage and the implementation stage. During the initiation stage, an organization comes up with an awareness of the innovation, creates an attitude towards that innovation and evaluates it. Paul et al. (2008) notes that the actual decision to adopt ICT in organizations occurs between the initiation and the implementation phases. London (2006) observed that the changeover from knowledge of the innovation to its implementation is determined through a chronological procedure which comprises the 'innovations rate of adoption'. This means that the process of adoption may be shaped by the type of innovation decision being sort, comprising collective/organizational and authoritarian/hierarchical. Alternatively, diffusion comprises the process by which an innovation is communicated via certain channels over time among the parties of a social system (El-hadary, 2001). Quaddus and Hofmeyer (2006) considered an innovation as an idea or concept that the adopting organization considers new. Rogers (1995), in Innovation Diffusion Theory (IDT) analyzes the

process of diffusion, and draws the result of a combination of social, economic, and technical forces on the diffusion process (Braun, 2004).

Majority of scholars agree that the IDT is suitable and valid to explain the adoption of IT in organizations. In fact a study by Jeyaraj, Rottman and Lacity (2006) recognized IDT as the only theory capable to explain the adoption of IT in organizations as well as to individuals. The same sentiments were echoed by Looi (2004) based on the many theoretical reviews made on theories explaining the adoption of IT. Some of the main strengths of IDT is the fact that it attempts to explain factors influencing the adoption of an innovation in an organization as well as attempts to explain the procedures by which new innovations are disseminated through social systems over time. El-hadary (2001) concurs that the IDT has made great contribution in the innovation decision process, which (Paul et al., 2008, p.5) note “starts with one's knowledge about the existence of the innovation and ends with the confirmation of the adoption/rejection decision”. Aghaunor and Fotoh (2006) outlined the components unique with the IDT as: Relative advantage which is the degree to which an innovation is considered beneficial to the organization, for instance, the innovation's economic profitability, low initial costs, reduced discomfort, time saving, faster returns and reduced effort inputs. Gemino, Mackay and Reich (2006) found that relative advantage was the main driver towards the adoption of ICT in organizations.

Compatibility is the other component of IDT which is the extent to which an innovation is agreeable (compatible) with existing beliefs, experiences and needs of the adopting organization. A faster adoption of ICT is imminent when the adopting organization

perceives the technology highly compatible with these factors. Complexity is also a component. It is the extent to which an innovation is seen as relatively difficult to understand and apply/use. Trialability - the ability to which the innovation can be tested (tried) before being adopted. According to Rogers' (1995) "the trial ability of an innovation, as perceived by members of a social system, is positively related to its rate of adoption". Trial ability has been identified to reduce the uncertainties users may have towards certain innovations (Alam et al., 2007). The last component identified to affect innovation is the observation of the innovation. Observation is considered the extent to which the adopter perceives the results of the innovation visible to others (Aghaunor and Fotoh, 2006).

3.3 Target Population

The smallholder dairy cooperatives targeted under this study are listed in table 3.1 below. The choice of target population was influenced by the concentration of dairy farming in these regions; Central province being the second leading in milk production after Rift-Valley. Out of the targeted dairy cooperatives, the ICT departments were the main targets with specialists in ICT being the individuals comprising the population. This population was expected to offer most relevant information to the study concerning the implementation of ICT projects in dairy cooperative in Kenya. Where the ICT department was absent, the communications and PR department were targeted as the population. The estimated total number of employees in dairy cooperatives was 70- (Each cooperative was estimated to have an average of 10 employees in the ICT or communications department in the seven cooperatives).

Table 3.1: List of Dairy cooperatives

Milk shed	Cooperatives targeted under the study.	Total number
Kabete	Limuru, Kikuyu, Gatundu, Nderi, Gikambura, Ndumberi, Sigona	7
Total		7

3.4 Sampling Design

The study adopted purposive sampling which led the researcher to respective respondents with the relevant information to the study. According Cooper and Schindler (2006), purposive sampling enables a researcher sample the respondents who will meet the purpose of the study. Purposive sampling ensured that the researcher gets a size that is well informed of the ICT activities within their cooperatives.

3.5 Sample size

Using purposive sampling, the study adopted a sample size of 41 respondents by picking not less than 5 respondents from each of the seven cooperatives. This sample was 59% of the whole target population hence it would represent the views of majority of the population.

3.6 Data Collection Procedure

This involves the techniques to be adopted by the researcher in data gathering phase of the work. The researcher used a closed ended questionnaire as the instruments to collect primary data. Secondary data on the other hand was collected by reviewing of already published material. The questionnaire was preferred based on its capability to collect data from a large number of people at a lower cost when compared to other methods.

A questionnaire also allows the respondent to offer his/her responses at the time convenient to him/her. The questionnaire was administered through the drop and pick method to ensure a higher return rate.

3.7 Data Analysis and Presentation.

After the data collection exercise was complete, all the questionnaires were checked for data quality and completeness. All the data available from the field was then analyzed using descriptive statistics and then presented using tables and figures. Excel spreadsheets were used to process the data descriptively.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the collected findings, analyses the findings and discusses them in relation to the literature reviewed in chapter two. The chapter is organized according to the objectives of the study. The presentation of the findings starts with the presentation of the background information before analysis per objective.

The study targeted a sample of 42 respondents from the dairy corporative in central province. 34 questionnaires were answered well for analysis making the response rate to be 81%. Since this response rate comprised majority of the responses, the researcher went ahead with the analysis and discussion of the data. The researcher believed that these results were adequate enough to give draw conclusions.

4.2 Background information

The study investigated the background of the respondents to establish whether they adequately comprehended the questions under study. The findings were then discussed as below.

4.2.1 Age of Respondents

Respondents were questioned about their age so that from the answers the researcher can estimate the possible length of time the respondents have been exposed to IT knowledge.

The results given were as show in table 4.1

Table 4.1: Age of respondents

Age bracket (years)	Frequency	Percentage (%)
18-30	18	53
31-40	12	35
41-50	4	12
51-60	0	0
Total	34	100

The results show that 53% of the respondents were aged between 18 and 30 years while 35% were aged between 31 and 40 years. This group is characteristic of the youth who by being born in a generation highly characteristic of IT adoption highly apply the use of technology in their day-to-day activities. This population is therefore likely to be more aware of ICT usage than earlier generations.

4.2.2 Education level

Concerning the highest level of education attained by the respondents, the results in table 4.2 were collected.

Table 4.2: Highest level of education of respondents

Level of education	Frequency	Percentage (%)
O/A Level	4	12
College (Diploma)	20	59
University (Undergraduate degree)	10	29
Postgraduate	0	0
Total	34	100

A majority of 59% of the respondents agreed to have attained college (diploma) education as their highest education; 29% had degree (undergraduate) education while the remaining 12% had O/A Level education. These results show that most of the

interviewed respondents had post-secondary education thus had a higher scope of understanding the adoption of ICT in the dairy cooperatives.

4.2.3 Length of Experience

The findings concerning the amount of experience with dairy cooperative were as shown in table 4.3.

Table 4.3: Level of Experience in working in dairy cooperatives

Experience duration	Frequency	Percentage (%)
Less than 5 years	19	56
5-10 years	9	26
11-15 years	3	9
Over 16 years	3	9
Total	34	100

Most of the respondents, 56% agreed to having an experience not stretching more than 5 years in cooperative societies. Twenty six percent had between 5 and 10 years' experience. The experience of the majority shows that the responses given are done with comparison to the general ICT developments. This is based on the age groups of the majority as shown in table 4.1 that shows that the respondents were just from school/college hence filled with the theoretical view of the ICT developments thus based on the experience, it is likely the respondents will give well compared results.

4.2.4 ICT Awareness

The study endeavored to establish whether the dairy cooperatives had websites. This was aimed to establish the extent to which ICT is adopted in the cooperatives. The collected results showed that 21 (62%) of the dairy cooperatives had websites while 13 (38%) did

not have them. This shows that most of the cooperatives embraced ICT up to the level of using it to communicate to stakeholders and market their products through website.

Whether the dairy cooperatives had any goals in regard to ICT, the study found a 100% agreement from the cooperatives. The most stated goal was automating the main processes of the cooperative including automating farmers paying system as well as the accounts section, automating the milk weighing and milk rate standardizing procedures.

4.3 Governments' involvement in the Implementation of ICT in Small holder Dairy Cooperatives

The first objective of the study investigated the government's involvement and how it affects the implementation of ICT initiatives in Dairy cooperatives. The collected results were as shown in table 4.4. (All values are in percentage (%)).

Table 4.4: Government's involvement in ICT in smallholder dairy cooperatives

Government involvement	Strongly Disagree	Disagree	Somehow Agree (Agree to a very small extent)	Agree	Strongly Agree
Controls the cost of ICT adoption and implementation	20	32	21	12	15
Initiates researches into ICT effective agricultural extension systems to dairy farmers	18	6	47	20	9
Has invested in ICT infrastructure that boosts ICT implementation	21	9	50	14	6
Shows commitment towards adoption of ICT in Kenya	9	9	56	20	6
Ensures governance and integrity relevant to ensure that qualified people are elected to the cooperatives and dairy institutions	18	14	36	26	6
Develops fair policies for growth	6	12	52	24	6
Government performance in regards to implementing ICT is satisfactory.	12	50	29	9	0

According to table 4.4 above, majority of respondents, 52%, disagreed, 21% agreed somehow while 27% agreed that one of the ways through the government's involvement affect the implementation of ICT in dairy farming was by controlling the cost of ICT adoption and implementation. This indicates that the cost of adopting and implementing ICT in dairy cooperatives is not controlled. This is likely to create room where business people can influence the cost of ICT tools to their benefit at the expense of farmers hence making the adoption and access to ICT a 'who is who' game.

A majority of 47% of the respondents agreed to a small extent, 20% agreed while 9% strongly agreed that the government affects the implementation of ICT through initiating researches into ICT effective agricultural extension systems to dairy farmers. Only 24% disagreed with this statement. This means that the government is trying to ensure researches into the use of ICT in dairy farming to come up with effective agricultural extension system though to a small extent. IFAD (2007) noted that effective agricultural research and extension systems are critical to cope with challenges facing farmers. The fact that the government has taken into consideration investing in researches into ICT in dairy farming shows that the government is interested in ensuring the dairy farming sector possess fewer challenges to farmer's hence higher performance.

A total of 70% of respondents agreed that the government had invested in ICT infrastructure to boost ICT implementation across dairy cooperatives. The remaining 30% disagreed with the opinion. The opinion of the majority concurs with Dachi's (2010) explanation that the minister for finance agreed to a heavy financial investment in ICT infrastructure. This results thus confirm that the government was doing the much it could to ensure that ICT infrastructure was elaborate for use in dairy farming.

Another majority of 82% of respondents attested to the fact that the government had shown commitment towards adoption of ICT in Kenya. This concurs with Dachi's (2010) argument that the government had invested heavily in enhancing internet services by facilitating the laying of the undersea fibre optic cable. This therefore shows that the government had committed towards ensuring that ICT is widely adopted in Kenya for use in deferent corporations and organizations.

Sixty eight percent of the respondents, who comprised majority, agreed that the government had facilitated the availability of governance and integrity relevant to ensure that qualified people are elected to the cooperatives and dairy institutions. This concurs with the observation made by Gitau, Dermott and Mbiuki (1996) governance has continued to improve through such things like the 2004 Cooperatives Act made which has made it hard for criminals to continue serving in the committees or boards; the Cooperative Tribunal that has speeded up justice in the cooperative's sector and fair elections being held regularly. They say this has ensured that more men and women of integrity are being elected in the committees and qualified people are now being employed in Dairy cooperatives. This is also another instance where the government shows its involvement in enhancing the implementation of ICT in dairy cooperatives.

Eighty two percent of the respondents also agreed that the government has developed fair policies for growth of the ICT sector in the dairy sector. Policies are known to regulate a sector for sustainability hence encourages growth of the sector. This finding concur with the opinion that policy implications are drawn for up-scaling and making the ICT sector more affordable for the end users (ISNAR, 2002).

Concerning whether the government performance in regards to implementing ICT is satisfactory, 62% of the respondents disagreed while 38% agreed. This shows that as much as the government was reported to show commitment towards ensuring the implementation of ICT, it did not offer satisfactory performance towards implementing ICT in dairy cooperatives. This may be due to lack of much locally published content on ICT adoption in dairy cooperatives just as Mutula (2005:125) had asserted: Sub-Saharan

Africa faces a problem of inadequate locally owned, published and adapted knowledge and content to satisfy the needs of its people.

4.4 ICT initiatives/opportunities in Dairy Cooperatives in Kenya

The second objective of this study was to investigate the effect of ICT initiatives/opportunities in the success of farmers in smallholder dairy cooperatives. The collected results were presented in the figure 4.1.

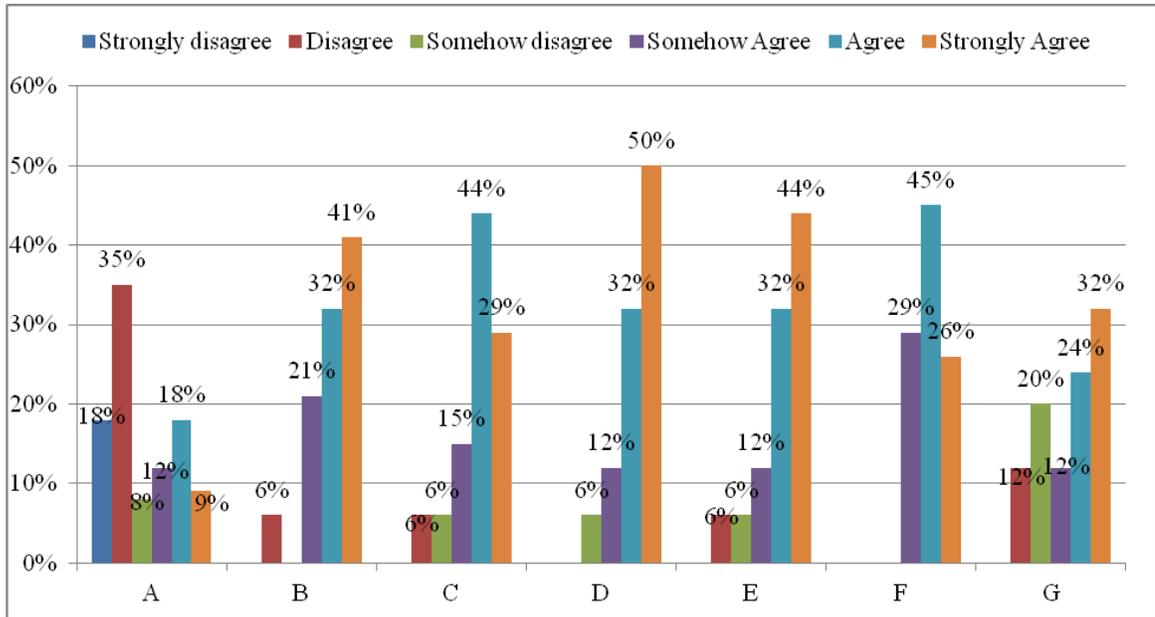


Figure 4.1: Effects of ICT initiatives and opportunities

Key:

- A Cooperatives consist of trained and motivated employees to use modern ICT technologies.
- B ICT development opportunities that enable farmers improve their service delivery.

- C ICT developments is one of the ways cooperatives respond to consumer needs.
- D ICT implementation that requires continuous training and assessment that ensures employees' constant improvement.
- E ICT has introduced e-agriculture that brings new sources of information concerning dairy farming.
- F Through ICT, farmers have been enabled to focus, search and extract useful up-to-date market information about dairy farming.
- G Through ICT, cooperative members can monitor with ease the progress of their cooperatives by use of participatory methods and procedures.

Based on figure 4.1, 61% of the respondents disagreed where 18% out of the 61% strongly disagreed that cooperatives consist of trained and motivated employees to use modern ICT technologies. This shows that most of the dairy cooperatives in Kenya do not have well trained and qualified personnel to use modern ICTs. This finding is in line with the findings by Gelb and Parker (2005) that there is critical need for ICT training for end users to cater for the ever-changing information and Internet characteristics, which can be provided by extension officers, scientists and consultants.

Concerning whether ICT development opportunities enabled farmers improve their service delivery hence enhancing the implementation of ICT in dairy cooperatives, the study found 73% of the respondents to agree and only 6% disagreed. The opinion of the majority may be attributed to the fact that ICT enhanced communication as well as

operations thus leading to improved service delivery. The findings are in agreement with the observation that the rising demand for information is an emerging new paradigm for agricultural development that challenges the old ways of delivering important services to the agricultural communities in developing countries (Adebayo and Adesope, 2007:2). The findings also concur with Cecchini and Scott (2003:74); Harris (2004:20) that the use of computerized milk collection centres have led to transparent buying and selling of milk, faster processing, shorter queues and immediate payment to farmers.

Majority of 73% also agreed that ICT developments are one of the ways through which cooperatives respond to consumer needs; 12% disagreed while 15% somehow agreed with that finding. Since ICT come with benefits like offering innovative products and faster services, it creates room for cooperatives to come up with better services customized to meet consumer needs at hand. This finding concurs with the findings presented by Rop (2009) that cooperatives having ICT aim to provide products and services that meet the consumers' needs and satisfaction.

Ninety four percent of the respondents agreed while only 6% disagreed to a small extent that ICT implementation that requires continuous training and assessment ensures employees' constant improvement. This may be informed by the fact that since the ICT sector is in constant change due to new innovations being discovered, employees need to be trained according to the respective changes. This equips the employees with newer skills every time they are trained hence improving their skills. This result is similar to the finding by Ronan and Cleary (2000) that one of the key functions of the Human Resource department in cooperatives is the assessment, identification and provision of the required

ICT training programs for all dairy staff, thereby ensuring each employee's constant improvement.

Whether ICT has introduced e-agriculture that brings new sources of information concerning dairy farming, 88% of the respondents agreed while 12% disagreed. This result may be attributed to the fact that ICT has made it easier for people to access both intensive and extensive information concerning dairy farming from different areas of the world over the internet. This results tally the argument in ISNAR (2002) that ICT gadgets like mobile phones speed up the way farmers in get, exchange and manipulate information. ISNAR (2002) further added that the ICTs have currently demonstrated a promising field of new research and application in e-agriculture whilst bringing new sources of information and new tools for local knowledge dissemination.

All the respondents, 100%, agreed that through ICT, farmers have been enabled to focus, search and extract useful up-to-date market information about dairy farming. This is based on the specific features available on the internet to bring you the exact information searched for without reading through a large document. These findings concur with the explanation by ISNAR (2002) that ICTs have increasingly enabled farmers to focus, search and extract useful and up to- date market information.

Sixty eight percent agreed while 32% disagreed that through ICT, cooperative members can monitor with ease the progress of their cooperatives by use of participatory methods and procedures. The choice of the majority may be because through ICT tracking progress reports and information is easy thus offering the chance to monitor progress by way of participating. The findings concur with those of Robert and Robert (1995) that

successful cooperatives use ICT to provide participatory methods and procedures to allow group members to assess management, participation, organization, planning, economic performance, technical operations, financial operations and growth.

4.5 Stakeholders' awareness of the benefits of implementing ICT

The third objective of the study investigated how stakeholders' awareness of the benefits of implementation of ICT affected the implementation of ICT in smallholder dairy co-operatives in Kenya. The collected results were tabulated and presented in table 4.5 (Figures are in percentage).

According to table 4.5, a majority of 82% of respondents agreed while 18% disagreed that ICT has enhanced the relationship between cooperatives and other stakeholders. Because ICT enhances communication and sharing of information, it is likely that it removes the many barriers that originally existed between cooperatives and its stakeholders thus enhancing the relationships between the two hence the result given by the majority. This finding concurs with the argument of Kedi (2006) that one of the most important reasons behind successful cooperatives is the relationship they have with their clients, thanks to ICT.

A majority of 91% of respondents also agreed that enhanced relationship improves business practices while building trust among stakeholders. This is to mean that with the relationships enhanced by use of ICT, trust between cooperatives and their stakeholders were enhanced thus increased business activities. This concurs the argument advanced by Kedi (2006) that cooperatives take pride in being able to respond to stakeholders' and

customers' different needs quickly and effectively, hence, improving their business practice while winning their trust in them. Another majority of 100% agreed that ICT is vital in collecting accurate and complete information for markets improving performance. This may be facilitated by the fact that ICT like mobile phone has enhanced the speed of communication thus reducing second and third party messengers which translates to accurate and original message being communicated. The findings here advance the assertion by Thompson and Sonka (1997) that ICT has a myriad benefits, like it is vital in collecting accurate and complete information for all market sectors and industries including agriculture.

ICT was also found to facilitate information sharing within and without dairy sector based on the support of 100% agreeing responses it received. Since the internet, as part of the ICT is everywhere, information on the internet can be shared both within and without given boundaries. This tallies the observation pointed out in the review that ICT in the agriculture sector facilitates knowledge sharing within and among a variety of agriculture networks including researchers, exporters, extension services and farmers (Kurtenbach and Thompson, 2000). Another majority of 94% emphasized the importance of ICT by asserting that ICT enables vital information flow by linking cooperatives in different regions in terms of accessing information and providing local content. This also concurs with Kurtenbach and Thompson (2000) discussion that ICT enables vital information flows by linking rural agricultural communities to the Internet. Another majority of 94% of respondents agreed that ICT especially mobile phones can speed the way farmers in rural areas of Kenya get, exchange and manipulate information. This is based on the convenience of accessing mobile phones in rural areas as well as the speed with which

mobile phones offer communication. This is in line with the argument that mobile technology is playing an important role of reducing the digital divide and improving ICT access in rural areas where only wireless systems are being used due to lack of communication infrastructure (Department of Trade and Industry, 2004:10; Cullen, 2001:313).

On the last variable under this objective, the study found out that 91% agreeing and the remaining disagreeing that ICT had led to transparent buying and selling of milk, shorter queues and immediate payment to farmers through computerization. This may be because ICT brings in equipment's and technologies that will offer faster collection and weighing of milk and keeps a record of what is done hence speeding the process as well as providing transparency. This analysis is in line with the argument that the use of computerized milk collection centres have led to transparent buying and selling of milk, faster processing, shorter queues and immediate payment to farmers (Cecchini and Scott, 2003).

Table 4.5: Stakeholders' awareness of the benefits of implementing ICT

	Strongly Disagree	Disagree	Somehow Agree (Agree to a small extent)	Agree	Strongly Agree
The relationship between cooperatives and other stakeholders is enhanced through ICT	9	9	21	26	35
Enhanced relationship improves business practices while building trust among stakeholders	-	9	29	38	24
ICT is vital in collecting accurate and complete information for markets improving performance	-	-	18	26	56
ICT facilitates information sharing within and without dairy sector	-	-	29	24	47
ICT enables vital information flow by linking cooperatives in different regions In terms of accessing information and providing local content	-	6	27	29	38
ICT especially mobile phones can speed the way farmers in rural areas of Kenya get, exchange and manipulate information	-	6	18	29	47
ICT has led to transparent buying and selling of milk, shorter queues and immediate payment to farmers through computerization.	9	0	35	26	30

4.6 Effect of cost implications in the implementation of ICT

The last objective the study investigated how cost implications during the adoption of ICT affect the implementation of ICT in smallholder dairy cooperatives in Kenya. The collected results were as presented in the figures below.

4.6.1 Limited access to finances hence limited access technological tools

The study investigated whether majority of small scale farmers had no or limited access to finances that could enable them access technological tools from their cooperatives. The collected results were presented in figure 4.2 below.

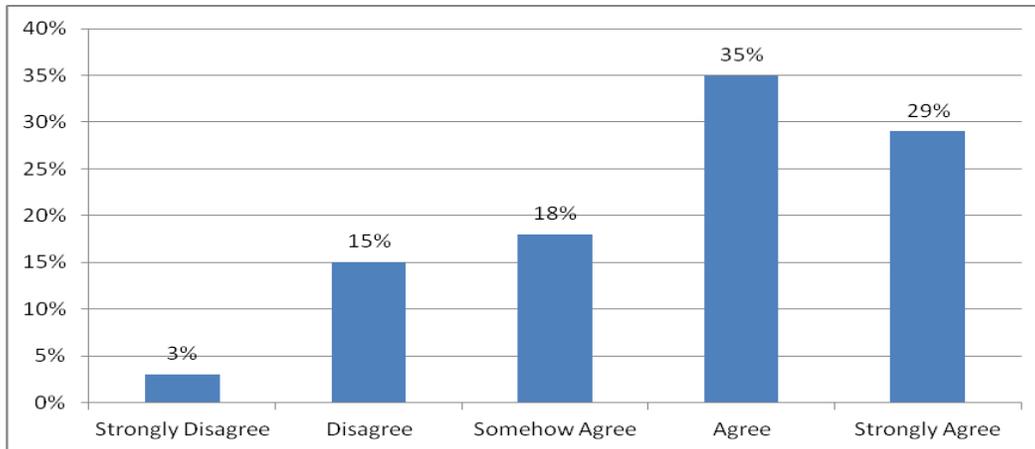


Figure 4.2: Limited access to finances that affects access to technological tools

Thirty five percent agreed, 29% strongly agreed and 18% somehow agreed that farmers had no or limited access to finances that could facilitate their accessing of technological tools from their cooperatives while 15% disagreed with the same response. Lack of adequate finances can be such a challenge towards implementation of ICT since farmers will not be able to acquire the different ICT tools. This therefore compromises the quality and service of dairy farming and suppliers delivered to cooperatives. This finding is similar to the findings by Lio and Liu (2006) that majority poor farmers in developing countries have no or limited access to modern tools thereby highlighting the digital divide that not only exists.

4.6.2 High cost due to poor technological infrastructure

Concerning whether there is poor technological infrastructure within the country that could affect the cost of implementing ICT in dairy cooperatives, the researcher collected the results in figure 4.3.

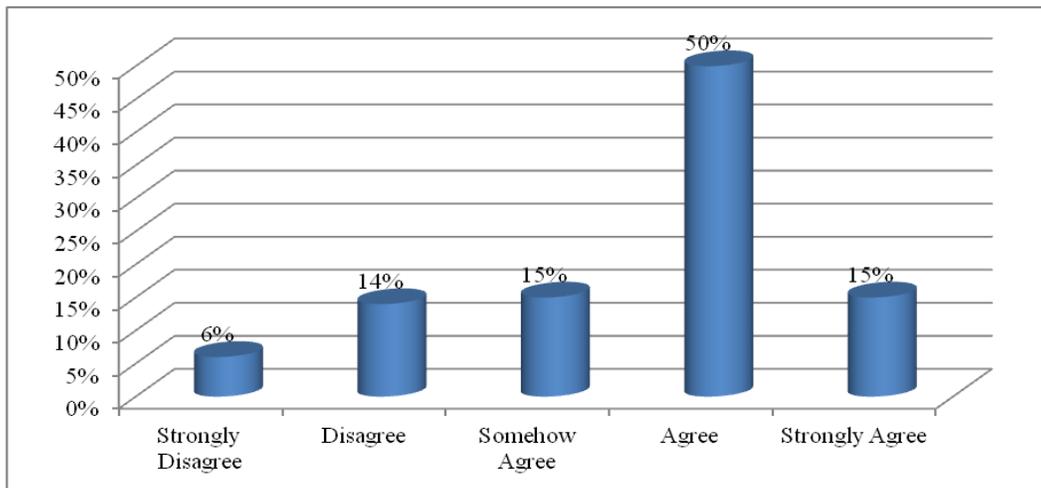


Figure 4.3: Poor technological infrastructure increases the cost of implementing ICT

Majority of 80% of respondents agreed that there was poor infrastructure within the country that affected the cost of implementing ICT. Availability of elaborate infrastructure is associated with easier and cheaper access to internet and generally ICT services hence likely to boost dairy farming services. This result does not deviate from Adebayo and Adesope's (2007) discussion that poor technological infrastructure was one of the factors constraining the implementation of ICT in dairy cooperatives.

4.6.3 High cost of adopting and accessing ICT

The study investigated whether the high cost of adopting and accessing ICT had an effect on the implementation of ICT in dairy cooperatives. The collected results were presented as in figure 4.4.

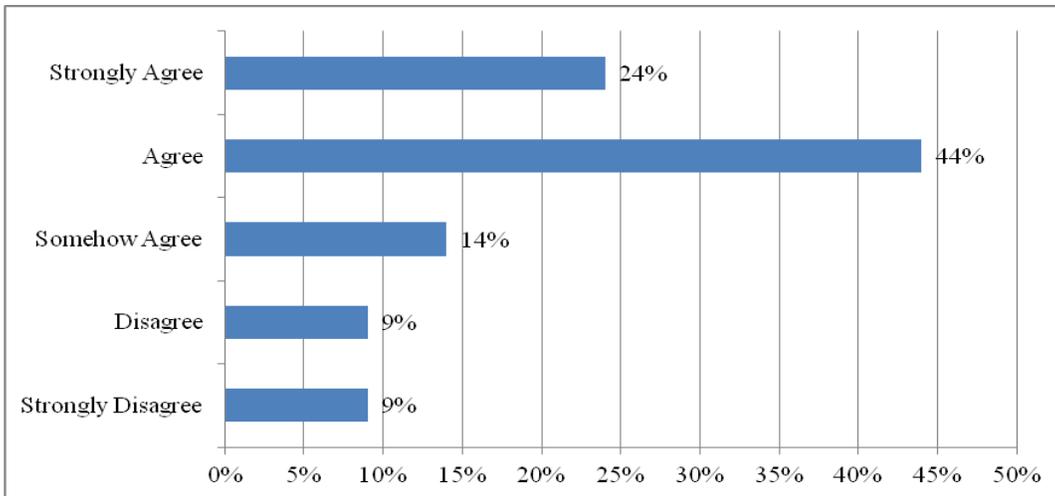


Figure 4.4: High cost of adopting and accessing ICT

Figure 4.4 shows that a majority of 82% agreed that the cost of accessing and adopting ICT is very high to cooperatives. This may be attributed to the fact that ICT infrastructure is poor as well as there is inadequate financing as already established in 4.6.2 and 4.6.1 respectively. The high cost may also arise from the high prices on ICT equipment's yet the buyers have low financial accessibility. This result testifies the findings of Fors and Moreno (2002) that personal computers, faxes, printers and some ICT equipment are expensive and unaffordable to the majority of developing countries inhabitants, even for middleclass families, thereby cutting down the populations who are able to use the technology.

4.6.4 Lack of ICT awareness among small scale dairy farmers

The results in figure 4.5 show the responses given when the study enquired whether there was lack of ICT awareness and training among small scale farmers due to low financial investment in it.

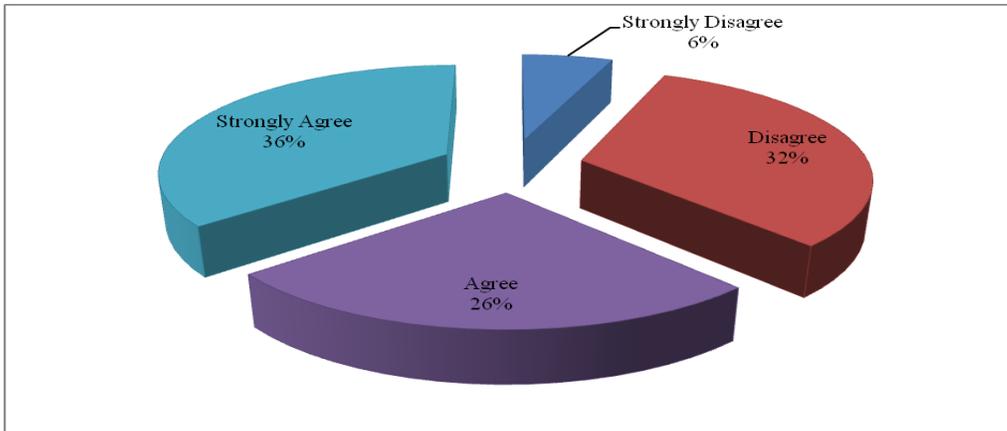


Figure 4.5: Lack of ICT awareness among farmers due to low finances

Respondents who agreed there being lack of ICT awareness and training among small holder farmers were 62% while the remainder disagreed. This shows that less effort was put in place to ensure dairy farmers and stakeholders had the motivation to adopt and use ICT facilities. The results concur with the argument by Ifinedo (2005) that Sub-Saharan Africa countries (with the exception of South Africa and its neighbours) have a poor e-readiness score for ICT awareness. The study also confirms that Colle and Roman (2003) evidence that there is a general lack of community awareness about the potential benefits and capabilities of ICT across developing nations.

4.6.5 Language differences in ICT implementations

The study also investigated the effect of language differences on the implementation of ICT and the collected results shown in figure 4.6.

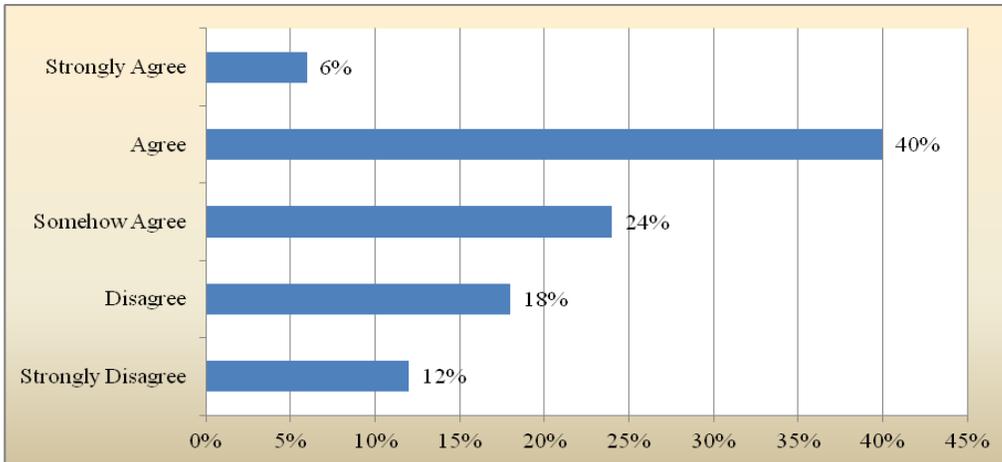


Figure 4.6: ICT implementation poses language and content limitations

The results show that 70% of the respondents agreed while 30% disagreed that the implementation of ICT poses language and content limitations as barriers. This may be based on the fact that rural farmers are only accustomed to their vernacular languages while ICT communication gadgets are programmed in major national languages. Local content or content customized to meet local needs is also deficient and challenging. It is therefore a challenge to introduce gadgets that can only be manipulated with people who are conversant in certain languages. This creates a problem in content compiling and use among the smallholder farmers. This finding concurs the observation made by Mutula (2005) that Sub-Saharan Africa faces a problem of inadequate locally owned, published and adapted knowledge and content to satisfy the needs of its people. Most of the content on the web is not relevant to the indigenous people of Sub-Saharan Africa.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the research findings. In addition to that, it gives the conclusions of the study and recommendations made after doing the analysis and conclusions drawn.

5.2 Summary of Findings

This study investigated the factors that affect implementation of information and communication technology in smallholder dairy co-operatives in Kabete-Kikuyu. The findings showed that majority of respondents, 52% disagreed that one of the ways through which the government's involvement affect the implementation of ICT in dairy farming was by controlling the cost of ICT adoption and implementation. A majority of 76% of the respondents agreed that the government affects the implementation of ICT through initiating researches into ICT effective agricultural extension systems to dairy farmers while 70% of respondents agreed that the government had invested in ICT infrastructure to boost ICT implementation across dairy cooperatives. Majority of 82% agreed that the government had shown commitment towards adoption of ICT in Kenya; 68% agreed that the government had facilitated the availability of governance and integrity relevant to ensure that qualified people are elected to the cooperatives and dairy institutions. Eighty two percent respondents also agreed that the government had developed fair policies for growth of the ICT sector in the dairy sector in Kenya. The

overall government performance towards the implementation of ICT was found to be less satisfactory by a majority of 62% respondents.

The findings for the second objectives showed that 61% of the respondents disagreed that cooperatives consist of trained and motivated employees to use modern ICT technologies; 73% agreed that ICT development opportunities enabled farmers improve their service delivery hence enhancing the implementation of ICT in dairy cooperatives while another 73% agreed that ICT developments are one of the ways through which cooperatives respond to consumer needs. Ninety four percent of the respondents agreed that ICT implementation that requires continuous training and assessment that will ensure employees' constant improvement; 88% agreed that ICT had introduced e-agriculture that brings new sources of information concerning dairy farming, while 100% respondents agreed that through ICT, farmers have been enabled to focus, search and extract useful up-to-date market information about dairy farming and finally 68% agreed that through ICT, cooperative members could monitor with ease the progress of their cooperatives by use of participatory methods and procedures.

The third objective of the study investigated how stakeholders' awareness of the benefits of implementation of ICT affected the implementation of ICT in smallholder dairy cooperatives in Kenya and the findings were that 82% of respondents agreed that ICT has enhanced the relationship between cooperatives and other stakeholders; 91% of respondents agreed that enhanced relationship improves business practices while building trust among stakeholders; 100% agreed that ICT is vital in collecting accurate and complete information for markets improving performance; another 100% of respondents

agreed that ICT facilitated information sharing within and without dairy sector; 94% respondents agreed that ICT enables vital information flow by linking cooperatives in different regions in terms of accessing information and providing local content while another 94% of respondents agreed that ICT, especially mobile phones, can speed the way farmers in rural areas of Kenya get, exchange and manipulate information. Ninety one percent respondents agreed that ICT had led to transparency in the buying and selling of milk, shorter queues and immediate payment to farmers through computerization.

On the last objective the study found 82% agreeing that farmers had no or limited access to finances that could facilitate their accessing of technological tools from their cooperatives; 80% agreed that there was poor infrastructure within the country that affected the cost of implementing ICT; 82% agreed that the cost of accessing and adopting ICT is very high to cooperatives; 62% agreed that there was lack of ICT awareness and training among small holder farmers and a majority of 70% agreed that the implementation of ICT poses language and content limitations as barriers.

5.3 Conclusion

The study concludes that the Kenyan government involvement in ICT implementation does not include controlling the cost of ICT adoption and implementation and initiating researches into ICT effective agricultural extension systems to dairy farmers. However, the study concluded that the government has invested in ICT infrastructure to boost ICT implementation across dairy cooperatives. The government was also concluded to have shown commitment towards adoption of ICT in Kenya by such things like facilitating the

availability of governance and integrity relevant to ensure that qualified people were elected to the cooperatives and dairy institutions and developing fair policies for growth of the ICT sector in the dairy sector. The study also concluded that the government did not have satisfactory performance in regards to implementing ICT in dairy cooperatives.

On the second objective, the study concluded that most dairy cooperatives in Kenya do not have trained and motivated employees to use modern ICT technologies. It was also concluded that ICT development opportunities enabled farmers improve their service delivery hence the implementation of ICT in dairy cooperatives. ICT developments are one of the ways through which cooperatives respond to consumer needs while ICT implementation that requires continuous training and assessment offers constant development to employees. It was also concluded that ICT development and implementation has introduced e-agriculture that brings new sources of information concerning dairy farming. Through ICT, farmers have been enabled to focus, search and extract useful up-to-date market information about dairy farming as well as cooperative members can monitor with ease the progress of their cooperatives by use of participatory methods and procedures.

The third objective of found how stakeholders' awareness of the benefits of implementation of ICT affected the implementation of ICT in smallholder dairy cooperatives in Kenya. The study concluded that indeed ICT has enhanced the relationship between cooperatives and their stakeholders and this relationship improves business practices while building trust among stakeholders. The study also concluded that ICT is vital in collecting accurate and complete information for markets improving performance.

ICT also facilitated information sharing within and without dairy sector; ICT enabled vital information flow by linking cooperatives in different regions in terms of accessing information and providing local content as well as speeded the way farmers in rural areas of Kenya got, exchanged and manipulated information. ICT has also led to transparent buying and selling of milk, shorter queues and immediate payment to farmers through computerization.

In the last objective the study concluded that Kenyan dairy farmers have no or limited access to finances that could facilitate their accessing of technological tools from their cooperatives. There is poor infrastructure within the country that affects the cost of implementing ICT. The cost of accessing and adopting ICT is very high to dairy cooperatives in Kenya. It was also concluded that there is lack of ICT awareness and training among small holder dairy farmers in Kenya. It was also conclusive that the implementation of ICT poses language and content limitations as barriers to the implementation of ICT in dairy cooperatives in Kenya.

5.4 Recommendations

5.4.1 Recommendations for Policy Change

The study recommends that the government through the ICT sector takes active role in controlling the cost of adopting and implementing ICT so that even the financially disabled farmers can be able to access and use it. The government through relevant organs should also initiate researches into the use of ICT in agricultural extension systems to dairy farmers so that better methods of implementing ICT to match dairy farming is born. The government should also monitor the qualified and trained personnel

offering ICT services in dairy cooperatives to ensure that they implement ICT in dairy cooperatives as expected and for the good of dairy farming business. The government should also take an active role in the implementation of ICT in dairy cooperatives so that its performance is satisfactory to all stakeholders.

On the second objective, the study recommends that dairy cooperatives in Kenya recruit well trained and motivated employees to use modern ICT technologies so that they can reap the most out of implementing ICT in dairy cooperatives. More ICT development opportunities should be provided in dairy cooperatives since they enabled farmers improve their service delivery hence the implementation of ICT. More employees should be encouraged to get involved in ICT implementations so that through the continued trainings available with new technologies, they will end up being more knowledgeable than before. The developing and implementation of ICT opportunities should be enhanced so that it can create even more opportunities in e-agriculture concerning dairy farming. Dairy farmers should be informed of the importance of ICT in terms of bringing up-to-date information concerning better dairy farming tactics and how it can be used to monitor the progress of their cooperatives through their participatory so that with the knowledge they can embrace the need to enhance the implementation of ICT projects in their businesses.

The third objective of the study investigated how stakeholders' awareness of the benefits of implementation of ICT affected the implementation of ICT in smallholder dairy cooperatives in Kenya. On this objective the study recommends that the adoption and implementation of ICT in dairy cooperatives be enhanced since it builds relationships and

trustworthiness between the cooperative and stakeholders hence creating a better competitive advantage for the cooperative. Dairy cooperatives and farmers also need to put a lot of consideration in adopting and implementing ICT projects to maximum since it will enable them get relevant adequate information that is likely to position them better in the dairy farming business. The implementation will also aid the cooperatives and farmers in networking and sharing ideas of value even from rural areas. The study also recommends the adoption and implementation of ICT to any cooperative aiming to have transparency and efficiency in its milk collection and payment processes.

On the last objective the study recommends that adequate financing to be availed to Kenyan dairy farmers to enable them be able to access technological tools from their cooperatives. The government and relevant authorities should ensure that ICT infrastructure is evenly distributed across the country, particularly rural areas so as to reduce the cost of adopting and accessing ICT. Adequate ICT awareness and training among small holder dairy farmers in Kenya should also be provided by the concerned authorities to enhance the participation in the ICT implementation process. Research on local dairy sector should be enhanced to ensure adequate availability of local content in local languages concerning successful implementation of ICT in dairy sector.

5.4.2 Recommendations for Further Study

The study has established that the use of ICT in effective agricultural extension systems is very beneficial to dairy farmers even though the study found out that extension system was not practiced among the dairy farmers despite the advantages. This study therefore proposes a larger study to establish if the case covers major dairy zones in the country.

The study also recommends a study to investigate why the government has not proposed the system to Kenyan dairy farmers.

The study has also established that the implementation of ICT leads to cooperatives attending to consumer needs well. However the study does not elaborate on this because it is beyond its scope. The study therefore proposes a study that will elaborate on how the implementation ICT in dairy cooperatives helps them respond and attend to consumer needs adequately.

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APPENDICES

Appendix I: Questionnaire

Introduction

This questionnaire seeks information to establish key factors contributing to success or failure of implementation of ICT in smallholder dairy cooperatives in Kenya.

Please spare a few minutes to fill to the best of your ability using either a tick or filling the spaces where appropriate. Respond to all the questions as honestly and accurately as possible since the information you will give will be treated confidentially and will only be used for research purposes.

Please indicate the appropriate answer (s) by use of a tick () , in the provided box (es). Where appropriate, fill the spaces provided with your response.

Section A: Personal Information

1. Department:.....Position.....

2. What is your age bracket in years?

18-30 () 31-40 ()

41-50 () 51-60 ()

3. Kindly state your highest qualification attained.

i. O level/A level ()

ii. College ()

iii. University ()

iv. Others(Kindly indicate) ()

4. For how long have you worked in the organization?

Less than five years ()

Between six to ten years ()

Between eleven to fifteen years ()

Over sixteen years ()

6. Does the cooperative have a website? If yes, indicate

YES ()

NO ()

7. Does the cooperative have any goals in regards to ICT?

YES ()

NO ()

8. If yes, state them

(i).....

(ii).....

(iii).....

SECTION B: FACTORS AFFECTING ICT IMPLEMENTATION

Factors that affect implementation of ICT in smallholder dairy cooperatives in Kenya cover a wide range. Below are some of the factors pertaining government involvement in the implementation, ICT initiatives and opportunities, stakeholders’ awareness of ICT benefits and the cost implications of ICT adoption. Please indicate the extent to which you agree with the provided factors in regard to ICT implementation in your cooperative.

1=Strongly Disagree 2=Disagree 3=Somehow Disagree 4=Somehow Agree 5= Agree
6=Strongly Agree

Government involvement	1	2	3	4	5	6
Controls the cost of ICT adoption and implementation						
Initiates researches into ICT effective agricultural extension systems to dairy farmers						
Has invested in ICT infrastructure that boosts ICT implementation						
Shows commitment towards adoption of ICT in Kenya						

Ensures governance and integrity relevant to ensure that qualified people are elected to the cooperatives and dairy institutions						
Develops fair policies for growth						
Government performance in regards to implementing ICT is satisfactory						

ICT initiatives	1	2	3	4	5	6
Cooperatives consist of trained and motivated employees to use modern ICT technologies						
ICT development opportunities that enable farmers improve their service delivery						
ICT developments is one of the ways cooperatives respond to consumer needs						
ICT implementation that requires continuous training and assessment that ensures employees' constant improvement						
ICT has introduced e-agriculture that brings new sources of information concerning dairy farming						
Through ICT, farmers have been enabled to focus, search and extract useful up-to-date market information about dairy farming						
Through ICT, cooperative members can monitor with ease the progress of their cooperatives by use of participatory methods and procedures						

Stakeholder Awareness	1	2	3	4	5	6
The relationship between cooperatives and other stakeholders is enhanced through ICT						
Enhanced relationship improves business practices while building trust among stakeholders						
ICT is vital in collecting accurate and complete information for markets improving performance						
ICT facilitates information sharing within and without dairy sector						
ICT enables vital information flow by linking cooperatives in different regions In terms of accessing information and providing local content						
ICT especially mobile phones can speed the way farmers in rural areas of Kenya get, exchange and manipulate information						
ICT has led to transparent buying and selling of milk, shorter queues and immediate payment to farmers through computerization						

Cost implications	1	2	3	4	5	6
Majority small farmers have no or limited access to technological tools						
There is poor technological infrastructure within the country generally						
The cost of adopting and accessing ICT is high						
There is lack of ICT awareness and training among the small farmer						
ICT implementation poses language and content limitations as barriers						

THANK YOU!