THE DETERMINANTS OF MOBILE PHONE TECHNOLOGY ADOPTION IN KENYA

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DECLARATION

This research project is my original work and has not been presented for a degree award in any other university or for any other award.

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DEDICATION

I dedicate this project to my wife Mercy and daughter Brianna.
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ABBREVIATIONS AND ACRONYMS

CA  Communication Authority of Kenya
GDP  Gross Domestic Product
GSM  Global system for mobile communication
GSMA  Global system for mobile communication association
ICT  Information and Communications Technologies
ITU  International Telecommunication Union
MNO  Mobile Network Operator
MTR  Mobile Termination Rate
NRA  National Regulatory Authorities
PSTN  Public Switched Telephone Network
SIM  Subscriber Identity Module
SMS  Short Message service
1G  1st Generation mobile Services
2G  2nd Generation mobile Services
3G  3rd Generation mobile services
OPERATIONAL DEFINITION OF TERMS

Adoption: A decision to make full use of an innovation as the best course of action available.

GSM (Global System for Mobile communication): is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies.

Mobile phone technology adoption: This is defined as the decision to make full use of mobile phone technology as the best course of action available.

Mobile phone technology subscriber: Refers to the subscriptions to a public mobile telephone service and provides access to Public Switched Telephone Network (PSTN) using cellular technology, including number of pre-paid SIM cards active during the past three months.

Perceived ease-of-use (PEOU): This is defined as the degree to which a person believes that using a particular system would be free from effort.

Perceived usefulness (PU): This is defined as the degree to which a person believes that using a particular system would enhance his or her job performance.

Subscriber: This refers to an entity or person that contract to receive or pay for a mobility service.

Unique mobile subscribers: Refers to the number of people who subscribe to mobile services and can actively use multiple connections.
ABSTRACT

Even though mobile phone technology has brought new possibilities to the country such as mobile money transfer services, the unique mobile subscriber penetration rate in Kenya is below 50 percent. This means that Kenya is below the global level of optimization of mobile phone technology adoption that can act as an engine for economic growth. The economic importance of mobile phone technology as a communication tool, facilitator of financial transfer and a medium for access to information cannot be over-emphasized. Indeed, timely adoption and appropriate use of easily and widely available mobile phone technology is one opportunity that may help the country in realizing the digital mobile phone platform opportunities that exist. It is against this background that this study aimed to bridge the knowledge gap by investigating the primary determinants of mobile phone technology adoption. The main objective of this study was to establish the main determinants of mobile adoption in Kenya. The specific objectives were: To determine mobile phone technology characteristics that influences its adoption in Kenya; to determine the human characteristics that drive adoption of mobile phone technology in Kenya and to determine the economic factors that drive adoption of mobile phone technology. The study was guided by non-experimental research design. Cross sectional data drawn from a randomly selected sample of 177 respondents was used in the study. The descriptive statistics show that adopters were keen on a number of technology specific characteristic, namely the ability of the mobile phone to access internet and the memory size of the mobile phone. The logit model was used to estimate the determinants of mobile phone technology adoption. The regression results of the study indicate that all economic factors i.e income level of the adopter and cost of the mobile phone device, were important determinants of mobile phone adoption, while sex was the only significant human/adopter characteristic. All technology specific factors were found not to be statistically significant.
CHAPTER ONE

INTRODUCTION

1.1 Background

1.1.1 Historical Background

Mobile phone technology adoption began on 3rd April, 1973 when a Motorola employee, Mr. Martin Cooper, using prototype Motorola DynaTAC made the first publicly recorded mobile phone call during a press conference in New York City. This innovation would later evolve into an integral component of the social and economic development of people across the globe. Soon after, production of mobile phone became commercialized in the early 80’s with the first adopters being male executives whose companies provided the phone as an office perk. These early mobile phones were not very mobile as most were car mounted. They allowed the user to talk on a telephone during dead time such as when stalled in traffic. Among the innovative businessmen who adopted the mobile phones were building contractors for whom the cell phone fitted well with their highly mobile nature of work (Gruber and Verboven, 2001).

Rather quickly, cellular telephones became very popular consumer products, with non-business use predominating. Meanwhile producers introduced digital cellular telephony while mobile operators focused on capturing the mass market in order to make the technology succeed commercially. The total number of worldwide mobile phone technology use surpassed the number of fixed telephone network in 2002. It took a century for the world to accumulate the first billion fixed telephones, but only a decade or so to do the same with mobile phones. Projections from International
Telecommunication Union (ITU) in 2003 suggested that the world would continue to add mobile lines faster than fixed lines; indeed, the next billion new phone users would use primarily mobile phones.

Rogers (2003) defines adoption as a decision to make full use of an innovation as the best course of action available and the rate of adoption as the relative speed with which an innovation is adopted by members of a social system. There has been a rapid adoption of mobile phone technology which has generated a great deal of speculation and optimism regarding its effect on economic development in the country and in the continent at large. Indeed, the rapid adoption of mobile phones in developing countries in the world has far exceeded expectations.

In 1999, for example, the Kenyan service provider Safaricom projected that the mobile phone market in Kenya would reach three million subscribers by 2020. However, Safaricom, alone, had over 19 million subscribers by the end of 2013 (Communication Authority of Kenya (CA), 2013). Mobile phone services were launched in Kenya in 1992. However, adoption of mobile phone technology in Kenya was not smooth. When mobile phones services were first introduced to the country in 1992, a single device cost about USD 3995 (Techhive, 2015). This was sufficient to guarantee that the mobile phone would remain a product for the elite. In fact, in the first seven (7) years of mobile history in Kenya, the industry only gained 15,000 subscriptions. The tipping point came in 1998 when the communications sector was liberalised through an Act of Parliament. Until then, the Kenya Posts and Telecommunication Corporation (KPTC) had dominated the communications sector. Figure 1.1 shows mobile phone subscriber growth in Kenya since 1999 to 2013.
Mobile subscriber base has grown from a mere 15,000 to a staggering 30.6 million subscribers by June 2013 (CA, 2013). Noteworthy, most subscribers in Kenya are on the pre-paid option with 99 percent of the 30.6 million subscribers or less than 450,000 on post-paid subscription. As at the end of June 2013 the number of mobile phone subscriptions in Kenya stood at 30.6 million. However, these figures potentially overestimate or underestimate the actual number of mobile phone users, because many individuals own several handsets or have multiple subscriber identity module (SIM) cards. At the same time, there could be potentially more than 30.6 million mobile phone users, as sharing mobile phones is a common practice in Africa and indeed in Kenya. Nonetheless, these figures indicate that mobile phone technology adoption has grown significantly in the country.

Despite the phenomenal growth in mobile telecommunication in African countries, there is still untapped market as evidenced by low number of unique mobile subscriber
penetration per 100 inhabitants in most countries. Figure 1.2 shows Unique Subscriber Penetration and SIM penetration rates as at June 2013.

![Unique Subscriber Penetration vs SIM Penetration](chart.png)

**Figure 1.2:** Subscriber Vs SIM Penetration rates in selected countries

*Source: GSMA Intelligence*

As at June 2013, despite the relatively high SIM penetration of over 70 percent, Kenya had a low unique subscriber penetration rate of 30.5 percent, while Nigeria and Tanzania had 28.6 and 31.0 percent penetration respectively. South Africa was the only country that recorded SIM penetration of more than 100 percent and unique subscriber penetration of more than 50 percent. The rapid adoption of mobile phones has generated a great deal of speculation and optimism regarding its effect on economic development in Africa. Policymakers, newspapers, and mobile phone companies have all touted the poverty reduction potential of mobile phones (Corbett, 2008). One way mobile phone adoption can have positive effect on poverty reduction is through improving labour productivity in day-to-day economic activities of low income earners who have not yet adopted the phone.
A study by David (1990) showed that in the US, it was only when the adoption level of ICT hit the 50 percent mark that ICT had a positive impact on national labour productivity. If it is assumed that the mobile phone component of ICT is to Kenya today what the computer was to the US in the 1970’s and 1980’s, a case can be made for increasing the level of the unique subscriber penetration from its current 30.5 percent to over 50 percent and thereby increase labour productivity in the country. This begs the question as to what factors determine mobile phone adoption in Kenya.

A number of studies to determine the determinants of mobile adoption in Kenya have been carried out and most of them have utilized the Technology Acceptance Model (TAM) as a tool of analysis (Mwasaa, 2010 and Meso, Musa and Mbarika, 2005). TAM is an information systems adoption theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably: Perceived usefulness (PU), which was defined as the degree to which a person believes that using a particular system would enhance his or her job performance, and perceived ease-of-use (PEOU) which he defined as the degree to which a person believes that using a particular system would be free from effort (Davis, 1989:1993).

Mobile phone technology is rapidly evolving both globally and in the country. Certainly, it can be observed that mobile phones in Kenya are evolving from simple communication tools into service delivery platforms. The current evolution was not envisaged by previous studies in Kenya by Mwasaa (2010) and Meso et al (2005) in their respective studies on consumer use of mobile Information and Communication Technology. A proper understanding of the determinants of mobile phone technology...
adoption is critical if Kenya is to grow its unique mobile subscriber levels of 30.5 percent (as at the end of June 2013) to at least 50 percent.

1.1.2 Technology specific factors

Technology usually has two components: a hardware aspect, consisting of the tool that embodies the technology as a material or physical object, and a software aspect, consisting of the information base for the tool (Rogers, 2003). Getting knowledge on a new technological innovation creates thoughts of its consequences in minds of potential adopters; such as if the innovation will solve an adopter’s current problem (Rogers, 2003). For the potential user of the phone, the problem to solve would be something in the lines of how to enable quicker access to Internet or how many applications are available.

Technological characteristic can be considered as a factor that can affect the mobile services adoption. Technological improvement could lead to a better user experience in using the mobile services (Hyvönen and Repo, 2004). The interest in technology has been identified as a factor that leads to the adoption of mobile services (Hyvönen and Repo, 2004). Improvement in technology contributes to reduction in cost of production (hence the steep drop in the price of cellular phone), improved service quality by the mobile handset produced and ultimately the attitude towards use.

For something to be an innovation, it doesn’t matter whether the idea is objectively new, but how the innovation is perceived. A phone may not have any truly new ideas, but if the potential adopters perceive it as new, then it can be counted as an innovation. A new product may be based on a technological advance that results in a reduced cost of production for the product leading to a lower selling price to consumers. In fact
consumers might even question whether an innovation has the same features as it was originally (Rogers, 2003). In Kenya for example as recent as 2010 the cheapest 3G enabled phone was going for KES 25,000. However, by the end of 2013 3G phones, such as Android powered Samsung’s Erica and Huawei’s U5130 models were going for KES 2,999 (Safaricom website, 2014).

Mobile telecommunication technology generations can be distinguished by specific improvements in service capabilities. First generation (1G-analogue) mobile telecommunication technologies were introduced in the early 1980s for voice services which was relatively inefficient and unreliable. There was a relatively large number of different first generation systems (based on seven mutually incompatible national standards) installed globally

As soon as digital technology (second generation, 2G) had matured enough to present a credible alternative to analogue cellular, it was introduced gradually across the world (Dekimpe, Parker and Sarvary, 2000). Second generation mobile telecommunication technologies were introduced during the first half of the 1990s. These technologies provided capabilities for improving voice services and the capabilities of developing improved and new data services. The GSM standard was the first mobile technology to be used in a large number of countries and became the most widespread system by a substantial margin, both in terms of adopting countries and subscribers.

Second generation telephony displayed significant technological progress, with handsets becoming smaller and containing an increasing number of additional functions (Koski and Kretschmer, 2007). In addition to ongoing technological
innovations on the product side, pricing and services became increasingly sophisticated. 2G phones also had SMS functionality, which enabled users to send short text messages to each other and was a huge success among younger users age 18-24, especially in Asia and Europe (Koski and Kretschmer, 2007). Following the success of 2G, a third generation (3G) with more advanced data transmission facilities was developed and has been widely adopted in major cities in Kenya. The improvement in technology that has changed the character and usage of mobile phones has been a contributory factor to the adoption of mobile phone technology.

1.1.3 Economic factors and policies

One of the factors that have led to faster adoption of mobile phone technology adoption in Kenya is the relatively cheaper cost of rolling out mobile phone networks as compared to the cost of installing fixed networks. Whereas the telecommunications industry in the United States, Canada and Europe invested in landlines before moving to mobile phone networks, the mobile phone technology has effectively leapfrogged the landline in Africa. This might be attributed to the fact that landlines require transmission wires be installed along every road reserve and into every community, with smaller transmission lines into every household which can be economically limiting, especially in countries with poor road networks, vast distances and low population densities. Mobile phone coverage in sub-Saharan Africa, by contrast, is primarily provided via a network of specialized base stations, which can provide service to a 5-10 kilometer radius.

Over the years the rise in disposable income of the consumer population has been contrasted by the reduction in the cost of mobile handset. This could also have been a
major contributor to the adoption of mobile phone technology in Kenya. For instance, in 1999 the minimum monthly wage in the cities of Nairobi, Kisumu and Mombasa for an unskilled worker was KES 2,886 (Economic Survey, 2004) while the cost of the cheapest handset was costing over KES 300,000. Conversely, in 2013 the minimum monthly wage for an unskilled worker in the cities of Nairobi, Kisumu and Mombasa was KES 9,780.95 (Economic Survey, 2014) while the cost of a mobile phone handset was as low as KES 999 (Midcomstore, 2014). Indeed, with the current prices of mobile handset most of the Kenyan population can easily afford a phone given the prevailing minimum monthly wage rate for employees and relatively higher incomes of low income earners.

Usage remains a factor of disposable income and as mobile phone adopters from different social classes behave in different ways; their income influences their acquisition of cellular products and the level of spending on such services. Status plays an important role and adopters might acquire cellular phones to enhance their status. Madden et al., (2004) conclude that higher income and a large user base tend to promote mobile diffusion. Indeed, this study will investigate the level of income as a determinant of mobile phone technology adoption.

Economic factors include cost of technology considerations. Low cost of mobile handsets as a result of improvement in technology has also been an important factor in adoption of mobile phone technology in the country. When mobile phones services were first introduced to the country in 1992, a single device cost approximately KES 343,570 (unadjusted for inflation)-(Tech-hive, 2015). This was sufficient to guarantee that the mobile phone would remain a product for the elite. In fact, in the first seven
(7) years of mobile history in Kenya, the industry only gained 15,000 subscriptions. The first mobile phone adopters in Kenya were primarily male, educated, young, wealthy and urban populations, as the initial costs of handsets and services were relatively high. As adoption rate increased secondary adopters spanned the demographic spectrum which included more poor, elderly and rural individuals, in part facilitated by the introduction of lower-priced handsets.

Higher household income could also represent, simultaneously, greater time-saving motivations to use mobile phone services, as well as upturn opportunities for accessing updated devices, such as mobile ones (Meuter et al., 2005)

The adoption of more market friendly economic policies has been a major pillar in the mobile phone technology adoption process. One of the key factors in the development and expansion of mobile phone technology in Kenya was the liberalization of the telecommunication market that started in 1999. The process started with the splitting of the national public operator, the Kenya Post and Telecommunications Corporation (KPTC), into three different units: The Postal Corporation of Kenya, Telkom Kenya Ltd. (later privatized) and the Communications Commission of Kenya (CA), which took on the role of regulator of ICT services. This shift involved an important reorganization of the public ICT policy from emphasis being put on scale economies achieved through government monopolies to competition and the use of Private-Public Associations (PPAs) to increase the reach of existing ICTs.

Competition amongst the mobile service providers seems to have contributed to mobile phone technology adoption. Mobile services were first offered in Kenya in
1992, by the Government owned mobile operator, then KPTC. It was after the enactment of the Kenya Communication Act in 1998 (which came into effect in July 1999) that other mobile operators were allowed to enter into the market. In 2004; the monopoly of Telkom Kenya Ltd came to an end with the entrance of new private mobile operators, although it remained the sole fixed network operator in the country. In 2007, almost half of the shares of its mobile filial, Safaricom, were sold to Vodafone (the largest mobile operator in the world) becoming the largest private operator in the country. The other three mobile operators, Celtel Kenya (Now Airtel Networks Kenya Ltd), Econet Wireless Kenya (Now Essar Telecom Kenya Ltd) and Telkom’s Orange started in 2000, 2006 and 2008 respectively. Competing marketing strategies seem to have nudged some potential adopters into adoption. Figure 1.3 shows quarterly evolution of operators’ market share between December 2013 and March 2014.

![Figure 1.3: Mobile network operators market shares](image)

Data source: Communication Authority of Kenya3rd sector statistics report, 2013
A PricewaterhouseCoopers (PWC) report produced in 2012 argues that, in order to increase mobile phone penetration in the country, operators in Africa should adopt business models that can result in profitability at low average revenue per user (ARPU) through cooperation with competitors as a way of sharing infrastructure costs and overheads.

The economic environment in Kenya has also been very favourable for the expansion and penetration of mobile phone technology. Data from Kenya Economic survey shows that between 2002 and 2012, Kenyan Real Gross Domestic Product (GDP) per capita increased from $13 billion in 2002 to $37.23 billion in 2012 experiencing growth every year except for 2008, when the country experienced post-election violence. This was the same time as the international financial crisis of 2007-2009 that adversely affected the country’s economy. The high GDP per capita growth led to greater demand for goods and services (including mobile phone technology). Over this period, the Kenyan telecoms sector generally experienced impressive, albeit mixed, growth. The mobile phone sector in particular has grown considerably; with mobile phone penetration now at 75.06 percent as at June 2013. The actual number of mobile subscribers has since grown from 15,000 subscribers in 1999 to 30.6 million subscribers as at the end of June 2013. The growth in income must have contributed to increase in subscribers.

1.1.4 Human/ adopter characteristics

Legris, Ingham and Collerette (2003) suggest that factors other than technology itself affect the successful use of ICT. However, not much research effort in Kenya has delved into understanding adopter characteristics that influence adoption. Munnukka
(2007) argued that age, income and education remain good and accurate predictors of buying behaviour and indeed adoption. He argues that elements such as age, gender, social class and reference groups affect consumers' values and lifestyles which influence consumption patterns.

Mobile technology users are predominantly the educated young generation (Tan and Ouyang, 2003). For young people, adoption of mobile phone technology can be influenced by social factors which are affected by social interactions. Their adoption of the mobile services can be encouraged by a "theory of fashion" which is influenced by social environment (Ling, 2001). For this reason, it is necessary to determine the characteristics of each age group so as to get a clear indication as to the extent to which Age has impacted on the adoption of mobile phone technology in Kenya.

In both their studies in Kenya, Meso, Musa and Mbarika (2005) and Mwasaa (2010) found that cultural influences significantly influenced perceived ease of use while perceived technology reliability significantly influenced socializing use and business use of mobile phone technology.

Carlsson, Hyvönen, Puhakainen and Walden (2006), argued that enjoyment that comes with technological improvement could be a possibility that influence the adoption of mobile services. Carlsson et al., 2006 re-emphasized this point when they state that users will use the services if they find it useful or enjoyable, and argue that mobile services should be improved in everyday life in order for adoption to take place. For instance, mobile phone features such as screen sizes (visual factors) is quite important as it improves resolution and color and ultimately leads to higher adoption rate (Dunlop and Brewster, 2002).
1.1.5 Channels of Communication and other factors

The Communication channels which potential adopters in Kenya use to access information about mobile phone technology range from mass media to mass mailings, from print media to electronic media and from telephone contacts to face-to-face contacts. According to Rodgers (2003) no one channel of communication is sufficient. Sometimes the interplay among the varied channels of communication generates awareness and interest to adopters simultaneously or sequentially. Potential adopters may hear of an innovation via mass media but pursue it only after a friend or acquaintance has introduced them to it in a comfortable setting.

Communication in the context of adoption is the process by which participants create and share information with one another in order to reach a mutual understanding (Rogers 2003). A communication channel is a means by which a message moves from one individual to another. Rogers (2003) affirms that mass media channels are more effective in creating knowledge of innovations, whereas interpersonal channels are more effective in forming and changing attitudes toward a new idea, and thus in influencing the decision to adopt or reject a new idea. He adds that most individuals evaluate an innovation, not on the basis of scientific research by experts, but through the subjective evaluations of near-peers who have adopted the innovation.

Visibility of an innovation stimulates word of mouth and helps increase the adoption rate. In the Kenyan market different mobile phone models have been widely advertised and notified to potential adopters in the press thereby easing the initial presentation to the public. Word-of-mouth is in itself a very important component, as many people make decisions based on their friends’ and associates’ recommendations.
Advertising through mass media and promotional activities such as using direct sale representatives has been widely adopted by Mobile phone technology companies in Kenya. In addition, companies have invested heavily in branding and marketing of mobile phone technology services through promotional initiatives such as road shows. However it is not clear as to how these activities among other communication channels have influenced adopters’ decision to adopt mobile phone technology in Kenya.

1.2 Statement of the Problem

Even though mobile phone technology has brought new possibilities to the country, the unique mobile subscriber penetration rate in Kenya is below 50 percent. This means that Kenya is below the global optimization of mobile phone technology as an engine for economic growth. In USA, it took the adoption level of 50 percent for the ICT to have a positive impact on labour productivity (David, 1990; Economist, 2000). Kenya being a developing country, 30.5 percent level of adoption might be insufficient for the mobile phone technology to have a positive impact on the country’s labour productivity. The economic importance of mobile phone technology as a communication tool, facilitator of financial transfer and a media for access to information cannot be over-emphasized. Indeed, timely adoption and appropriate use of easily and widely available mobile phone technology is one opportunity that may help the country in realizing the digital opportunities that exist.

In support of regular researches in tandem with the rapid evolution of mobile phone technology, Kim and Garrison (2008) suggest that researchers should add more
constructs to the existing acceptance models related to mobile technology as this kind of technology is constantly evolving and new factors are emerging every time.

From the discussion above it is apparent that technology specific factors, economic factors, human/adopter characteristics and communication channels used among other factors are important in the decision to adopt mobile phones technology. However, the level of their significance in Kenya has yet to be established with a level of certainty.

Against this background, this study aimed to bridge the knowledge gap by investigating the primary determinants of mobile phone technology adoption taking into account the current technology specific factors, economic factors and human/adopter characteristics that potential adopters are currently relying upon.

1.3 Research questions

The research questions were:

i. What are the mobile phone technology specific characteristics that influence its adoption rate in Kenya?

ii. What human characteristics drive adoption of mobile phone technology in Kenya?

iii. What economic factors drive adoption of mobile phone technology in Kenya?
1.4 Objective of the study

The general objective of this study was to establish the determinants of mobile adoption in Kenya. The specific objectives were:

i. To determine mobile phone technology specific characteristics that influences its adoption in Kenya.

ii. To determine the human characteristics that drive adoption of mobile phone technology in Kenya.

iii. To determine economic factors that drive adoption of mobile phone technology.

1.5 Significance of the study

It is apparent that determining the level of significance of the determinants of mobile phone technology adoption is important as has been shown in studies elsewhere (Vesa, 2005; Carlsson, et al., 2006). Exposing these determinants will shed light on the adoption criteria of consumers, their perception regarding possible benefits and any possible drawbacks of mobile technology that telephony is moving to. Understanding of these determinants will also help mobile service providers and mobile phone producers design their strategies taking into consideration the findings of this study. Given the rapid evolution of innovation in mobile phone technology, it is paramount to come up with the determinants of mobile phone technology adoption that accompany this rapid evolution from time to time and thus the significance of undertaking this study.
1.6 Scope of the study

The study was carried out in Nairobi County owing to the fact that there is a good demographic representation and reflection of the various social-economic profiles in the country. It will rely on primary data collected through a questionnaire.
CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter will discuss the literature review in three parts: theoretical literature, empirical literature and overview of the literature. Theoretical literature will focus on theory specific to technology adoption models and theory specific to various variables that have been cited as determinants of mobile phone technology adoption. Empirical literature will focus on researches done by others and findings reported. The third part will give an overview of both theoretical and empirical literature.

2.2. Theoretical Literature

One of the most salient models in mobile phone technology adoption studies is the Technology Acceptance Model (TAM, henceforth) proposed by Davis (1989) and later validated by many other researchers in a variety of academic disciplines. TAM as proposed by Davis (1989) consists of two constructs; perceived usefulness (PU) and perceived ease of use (PEOU). Perceived Usefulness refers to the degree to which a person believes that using a particular system would enhance their performance, whilst perceived ease of use is defined as the degree to which a person believes that using a particular system would be free of physical and mental effort (Davis, 1989). Perceived ease of use construct plays an important role and gets more attention from researchers (Venkatesh and Davis, 1996), while the perceived usefulness is believed as equally important as ease of use and lean toward service-dependent (Venkatesh and Davis, 2000). Technology Acceptance Model (TAM) has been used as a conceptual tool to identify central issues revolving around ICT’s adoption.
Technology Acceptance Model (TAM) proposes that usefulness and ease of use are important factors in determining user attitude towards adopting a new technology (Malhotra and Galletta, 1999). Technology Acceptance model has been used in a number of studies on mobile phone technology adoption which focus on users (Amberg, 2004; Pagani, 2004; Samtani et al., 2003, Teo and Pok, 2003). Other, researchers studying adoption and use of ICT have also extended the TAM by including other external variables while measuring determinants of technology adoption. These variables include prior use and experience and gender (Venkatesh and Morris, 2000), age and education (Pijpers et al., 2001), knowledge about technology (Pijpers et al., 2001), and others.

Gender was not included in the original TAM, but empirical evidence demonstrates that males and females have different perceptions about ease of use and usefulness toward information systems and thus have different system usage behavior (Gefen and Straub, 1997). Research on gender differences indicates that men tend to be highly task-oriented (Minton and Schneider, 1980) and, therefore, performance expectancies, which focus on task accomplishment, are likely to be especially sapient to men. According to Morrow, Presll and McElroy (1986) women typically experience high levels of anxiety in using a given technology which could lead to lower level of perceived ease of use. Gefen and Straub (1997) argue that men have relative tendency to feel more at ease with computerized gadgets as compared to women. However, researchers in Kenya are yet to ascertain the significance of gender in the adoption of mobile phone technology in Kenya.
On the other hand, age was recurrently found to have moderating effect on performance expectancy (usefulness), effort expectancy (ease of use), social influence, and as a facilitating condition in many TAM-related studies. Morris and Venkatesh's study (2000) found a direct effect of age on usefulness perceptions for both short-term and long-term usage. Subsequent studies by Venkatesh and his colleagues (2003) found age effect greater for older workers in terms of weaker willingness to adopt new IT products. Morris, Venkatesh, and Ackerman (2005) used Theory of Planned Behavior to examine age as a moderator of the determinants of technology use. They found older workers influenced more by attitude toward using technology, subjective norm (social influence), and perceived behavioral control (facilitating conditions).

One of the important modifications brought to TAM is by Venkatesh and Davis (2000) who proposed the TAM 2 model. Venkatesh and Davis recognised that TAM had some limitations in explaining the reasons for which a person would perceive a given system useful, and so they proposed that additional variables could be added as antecedents to the perceived usefulness variables in TAM. They called this new model, the TAM 2.

TAM 2 model was extended to explain perceived usefulness and usage intentions in terms of social influence (subjective norms, voluntariness, image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, perceived ease of use). The extended model was tested in both voluntary and mandatory settings. The results strongly supported TAM-2 (Venkatesh and Davis 2000). Similar to TAM-1, TAM-2 posit individual (e.g., ease of use, usefulness) and organizational (e.g., social norms, facilitating conditions) antecedents to predict
behavioral intention to use (i.e., acceptance) and/or actual use of a new technology in an organization. The model proposes that usefulness and ease of use are important factors in determining user attitude towards adopting a new technology (Malhotra and Galletta, 1999). The model has indeed been used in a number of studies on adoption of mobile services which focus on users (Amberg, 2004; Pagani, 2004; Samtani et al., 2003, Teo and Pok, 2003). The constructs of the model are actually meant to be general and universal.

In 2008 Venkatesh and Bala proposed TAM 3. In TAM 3 the determinants of perceived usefulness (PU) include perceived ease of use, subjective norm, image, job relevance, output quality and result demonstrability. As in many other areas of life, an individual’s perception of IT can be colored by social influences separate from the objective characteristics of the technology being considered. In TAM 3, these social influences are represented by subjective norm and image. Subjective norm is defined as “the degree to which an individual perceives that most people who are important to him think he should or should not use the proposed IT” and image is “the degree to which an individual perceives that use of an innovation will enhance his or her status in a social system” (Venkatesh and Bala, 2008).

Another model that has been used in mobile phone technology adoption studies is the unified theory of acceptance and use of technology (UTAUT). The UTAUT model which aims to explain technology acceptance, is based on eight technology acceptance theories or models. In particular, the UTAUT draws on the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behaviour (TPB), and the model of Personal Computer
Utilization, the Innovation Diffusion Theory and the Social Cognitive Theory (Venkatesh et al., 2003). At its core, the UTAUT model uses behavioural intention as a predictor of the technology use behaviour. The included predictors of behavioural intention are based on the components the eight technology adoption models reviewed.

In the UTAUT model, performance expectancy, effort expectancy, and social factors have direct effects on behavioural intention, which along with facilitating conditions have direct effects on use behaviour. The effects of interactions of each of performance expectancy, effort expectancy and social factors with each of age and gender; interactions of experience with each of effort expectancy and social factors; and an interaction of voluntariness of use and social factors on behavioural intention are also included. Finally, there are effects of interactions of age and facilitating conditions and experience and facilitating conditions on use behaviour (Venkatesh et al., 2003).

Studies by Rahm and Huffman (1984) and Heres and Mante-Meijer (2001) have utilized utility functions to study the determinants of adoption of technology. In their work they expressed utility functions as a lexicographic ordering of elements that provide the decision maker with utility. They posit that an individual ranks the elements in the utility function by order of importance and then chooses a particular action depending upon a satisfying criterion. Each element of the utility function must be satisfied in order of rank so that the highest level of utility is achieved when the greatest number of elements has been satisfied. The construct of their models included social factors like income level, social network, age, mobility and level of education.
2.3. Empirical Literature

In Slovenia Turk (2003) studied the adoption of mobile telephony using multi-
attribute utility model. By developing a cross-section model for utility estimation, he
empirically tested determinants of mobile phone adoption with dataset about mobile
telephony usage, which was collected in nine countries in Europe. His samples
comprised; Czech Republic (389), Denmark (730), France (813) Germany (880), Italy
(675), Netherlands (596), Norway (912) Spain (675) and UK (562). Using the logit
regression his study concluded that Income levels, Social network, Age, Mobile
enjoyment and level of education were all significant factors in determining adoption
of mobile telephony.

Hyvönen and Repo (2004) in their study titled “Diffusion of Mobile services in
Finland” used Technology Acceptance Model (TAM) and modified it to include other
variables such as the elements of enjoyment and new possibilities, which are mobile
services such as ringtones, icons and logos, and games. The survey was a traditional
empirical study with random sampling. A sample of 1,000 consumers was randomly
selected from the Population Register Centre of Finland by using age, mother tongue
and residence as criteria. Their study concluded that that technology and its
continuous improvement could lead to a better user experience in using the mobile
services and subsequent adoption of mobile phone technology. Technology
Improvement was found to contribute to reduction in cost of production, improved
service quality by the mobile handset produced and ultimately the attitude towards
use.

In Kenya, Meso et al., (2005) using theories of technology acceptance and technology
transfer studied factors affecting the use of mobile information and communication
technology (mobile ICT). Using 150 samples they tested the TAM model using partial least squares (PLS) structural modeling technique, their findings indicated that cultural influences significantly influenced perceived ease of use of mobile phone technology with a t-value of 2.6485, technology reliability influenced socializing use with a t-value of 14.6031 while accessibility of mobile ICT had a significant influence on business use of mobile phone technology. However, unlike other studies carried out in other parts of the world, their study concluded that age, gender and education level had no effect on mobile ICT use. In conclusion of their study they recommended that Firms conducting business in sub-Saharan African needed to pay attention to the factors that explain individual mobile ICT use because these factors will most likely determine the market segmentation, business development and customer service strategies for leveraging m-commerce operations in the region.

In China, Park, Yang and Lehto (2007) conducted an online survey of 221 Chinese nationals and tested a conceptual framework based on the Unified Theory of Acceptance and Use of Technology (UTAUT) which was developed by Venkatesh et al., (2003) with moderating variables of users’ personal factors: gender, education, and past internet experiences. Their study used a two-step process. The first step included testing of the core attitudinal model, followed by the test of moderating effects using structural equation modeling (SEM). While social influence was the most important factor influencing mobile device use, male users tend to be influenced by performance expectation when forming their attitude toward mobile phone technology usage. The results from their analysis also indicated that gender and education level were the significant factors in the adoption of mobile phone technologies for the Chinese consumer.
A survey in 17 African countries by Chabossou, Stork, C., Stork, M and Zahonogo (2008) using data from nationally representative household surveys revealed that African countries differ in their levels of ICT adoption and usage and also in the factors that influence adoption and usage. In their study income and education was found to vastly enhance mobile adoption but gender, age and membership in social networks had little impact. Income was the main explanatory variable for usage. In terms of mobile expenditure the study found that mobile expenditure proofs to be inelastic with regard to income, i.e as income increases mobile expenditure increases to a lesser extent indicating its importance in individual budgets.

In USA, Phan and Daim (2011) utilized Analytical Hierarchical Process (AHP) and Cluster analysis to identify the factors that influence the adoption of mobile services using a sample of 15 people aged between 20 to 60 years old. The variables analysed in their study included; Service Quality, Simplicity, Innovativeness, Visual Factor, Speed, Time Efficiency, Enjoyment, Cost, Mobility, Content, Habits, Technology, Social Factors, Usefulness and Ease of Use. The result of their study showed that ease of use and usefulness are top two factors that influence the adoption of mobile services. Social Factors were found to be the least important among all other factors.

In Nigeria, Nwagwu (2012) used Roger’s innovation adoption theory to explain the penetration of mobile phone technology in Nigeria’s premier higher educational institution. Using a sample of 370 students and acquisition of a mobile phone as a proxy for adoption, he examined the determinants of mobile adoption using regression analysis. He used technology characteristics such as relative advantage, complexity, trialability and compatibility as factors that could explain adoption. His study
concluded that there was a relationship between adoption of mobile phones and characteristics of the technology, all the characteristics except observability had significant relationship with whether students would embrace the mobile phone technology or not.

In Pakistan, Kabeer and Adeel (2013) investigated the determinants likely to influence the adoption of mobile banking services, with a special focus on low-income population of Pakistan. Technology Acceptance Model (TAM) was used, with additional determinants of perceived risk and social influence. Data was collected by surveying 372 respondents from the two largest cities (Karachi and Hyderabad) of the province Sindh, in Pakistan using judgment sampling method. Their study empirically concluded that consumers’ intention to adopt mobile banking services was significantly influenced by social influence, perceived risk, perceived usefulness, and perceived ease of use. The most significant positive impact was of social influence on consumers’ intention to adopt mobile banking services.

Chitungo and Munongo (2013) used a sample of 275 individuals in rural Zimbabwe to study determinants of Mobile phone Banking Adoption using an extended Technology Acceptance Model. They used the Pearson correlation analysis to examine the bivariate relationships among variables and found that the extended TAM could predict consumer intention to use mobile banking. Specifically, perceived usefulness, perceived ease of use, relative advantages, personal innovativeness and social norms had a significant effect on user’s attitude thus influencing the intention toward mobile banking, whilst perceived risks and costs deterred the adoption of the service.
2.4. Overview of the literature

As examined in literature review, there are human/adopters characteristic, technology specific factor and economic factors that play a role in determining whether mobile phone technology is adopted. Some of these variables are included in the empirical work for this research.

Most of the previous studies have utilized the Technology Acceptance Model (TAM) to unearth determinants of technology adoption as well as the adoption of mobile phone technology. However, few studies have also used utility functions in their work. From the literature reviewed some of the variables that have been found to be significant in determining technology adoption include; Age, gender, Income level, level of education, technology specific factors, social factors among others. Most of the studies reviewed used cross-section data and estimation methods that include partial least squares (PLS) structural modeling technique, probit and logit.

Despite the fact that a number of studies on mobile phone technology adoption have been done, a major shortcoming of previous research is the use of TAM model to make conclusion about adoption despite the fact that the model was designed to measure acceptance rather than adoption. In addition, literature reveals that not much work has been done on mobile phone technology adoption especially in sub-Saharan Africa and in Kenya in particular. Further, Donner’s (2008) survey shows, very little of research on adoption has been conducted by economists, and economic studies of the subject have often focused on diffusion rather than individual adoption.

Based on the knowledge gap revealed by the literature review, this study adopted the utility maximization model of Rahm and Huffman (1984) and Heres and Mante-
Meijer (2011) and aimed to bridge the identified gap by investigating the primary determinants of mobile phone technology adoption taking into account the current technology specific factors, economic factors, human/adopter characteristics and the communication channels that potential adopters are currently relying upon in Kenya.
CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This section discusses the methodology to be adopted for the study. It includes the research design, the theoretical framework, the model specification, estimation techniques, the definition and measurement of variables, data sources, collection and analysis.

3.2. Research Design

The study used non-experimental cross-sectional research design since the variables were not be deliberately manipulated or the setting controlled. Data was collected without making changes or introducing treatments. The study will utilize regression analysis to investigate the determinants of mobile phone technology adoption.

3.3. Theoretical framework

The determinants of mobile phone technology adoption have been explored by various studies such as Carlsson et al., (2006), Park et al., (2007) and Meso et al., (2005). Most of these studies have utilized Technology Acceptance Model. However, this study adopted a utility maximization model of estimation to identify the determinants of mobile phone technology adoption as proposed by Rahm and Huffman (1984) and Heres and Mante-Meijer (2001).

Analysis of determinants of mobile phone technology adoption was based on the utility theory. Utility is defined as the (perceived) ability of something to satisfy needs or wants. Following the work of Heres and Mante-Meijer (2001) this study assumes
that where the utility of the first product is greater than the utility of the second product, the consumer chooses the first product. Similar, when consumer wants to replace an old mobile phone for a new one, he considers their utilities and he might buy a new one, if he finds:

\[ U_{\text{new mobile phone}} > U_{\text{old mobile phone}} \]

A consumer adopts new mobile phone technology when utility gained from the usage of a new phone is higher than utility emerging from the usage of the existing (old) phone. When a user doesn't own a mobile phone (he considers to buy one), he tries to get some information about it and this way he tries to estimate the utility he could gain with it. The above formula becomes

\[ U'_{\text{new mobile phone}} > U_{\text{old mobile phone}} \]

\( U'_{\text{new mobile phone}} \) is expected utility, estimated according to the user's knowledge about new mobile phone and his experiences. The consumer estimates his utility by considering different characteristics of the mobile phone technology.

\[ U_A = k_p U_p (p_A) + k_n U_n (n_A) + k_w U_w (w_A) \]

Where \( A \) is a mobile phone, \( p, n \) and \( w \) are characteristics, or attributes of \( A \), and \( k \) are weights. Weights we can express different importance of particular attributes for different people. One user may consider size of the mobile phone screen, while for another user it is more important for a mobile phone to have internet connectivity. The overall utility is a sum of partial utilities, which are derived from different attributes. Every attribute has its own utility function.
This task requires an empirical estimation of utility functions and weights, according to equation 3.1. The utility functions can be estimated for a group of users with statistical tests, while weights are different for different users. The utility functions can be estimated on the basis of samples for relatively small groups of users with specific characteristics (e.g. older persons, high educated persons).

In the proposed framework, the utility of a product or service can be observed also from the variables, which describe persons (their social status, education etc.). Model 3.1 can be further empirically explored on the level of an individual user.

In the view of the utility concept and users' decision-making, the observed response categories may reflect the actual choices made by individuals in a sample. Underlying each choice at the population level is the utility, which represents the difference between the costs and the benefits of a particular choice made by an individual decision maker (Powers and Xie, 2000).

Assume binomial dependent variable, which describes some users' decision (e.g. whether to adopt an ICT product or not) and replace the usual linear model

\[ Y_i = \beta_0 + \beta_1 x_i + \varepsilon_i \]

where \( \varepsilon_i \) is distributed normally

\[ Y_i \sim N(\beta_0 + \beta_1 x_i + \varepsilon_i, \sigma^2) \]

with a model with the Bernoulli distribution

\[ Y_i \sim BIN[1, F(\beta_0 + \beta_1 x_i + \varepsilon_i)] \]

3.2
where the function $F$ has the property that it maps $\beta_0 + \beta_1 x_i + \epsilon_i$ onto the interval $(0, 1)$. If the probability that, for example, $Y_i = 1$, given the outcome of $\beta_0 + \beta_1 x_i + \epsilon_i$

This can be written also as

$$Pr[Y_i = 1|X_i] = 1 - Pr[Y_i = 0|X_i]$$

$X_i$ collects the intercept and observed independent variables $x_i$, while $Y_i$ denotes a random variable with realization $y_i$ (1 or 0), which takes values conditional on the values of $x_i$ (Franses and Paap, 2001).

The latent variable (in our case utility) is continuous in nature. In case of a single explanatory variable we can describe it as

$$y_i^* = \beta_0 + \beta_1 x_i + \epsilon_i$$

Utility $y_i^*$ is mapped onto the binomial variable $y_i$ according to the rule

$$Y_i = 1 \text{ if } y_i^* > 0$$
$$Y_i = 0 \text{ if } y_i^* \leq 0$$

This is a "cost-benefit" approach of decision-making. Threshold value of utility is chosen as equal to zero. The user explores the expected utility gained from using a particular service; when this value is positive, the user prefers the service, and the value of observed variable $Y$ for user $i$ is set to 1.

If user $i$ is making a choice between two products (or two brands of a product), denoting the products as A and B, then his evaluation of expected utilities can be written as
The user prefers brand $A$ if the utility of $A$ exceeds that of $B$, that is

\[
Pr[Y_i = 1|X_i] = Pr[u_{A,i} > u_{B,i}|X_i]
\]

\[
= Pr[\alpha_A - \alpha_B + (\beta_A - \beta_B)x_i > \varepsilon_{A,i} - \varepsilon_{B,i}/X_i]
\]

\[
= Pr[\varepsilon_i \leq \beta_0 + \beta_1 x_i/X_i]
\]

Where $\varepsilon_i$ equals $\varepsilon_{A,i} - \varepsilon_{B,i}$, $\beta_0$ equals $\alpha_A - \alpha_B$ and $\beta_1$ is $\beta_A - \beta_B$. The individual parameters in 3.4 cannot be identified; one can only identify the differences between them. Parameters $\beta_0$ and $\beta_1$ can be seen as measurements of the effect of $x_i$ on the choice for brand $A$ relative to brand $B$, which is in accordance with the understanding of the utility concept.

Equation 3.3 has two interpretations. The first interpretation is helpful if we consider different factors, which influence the decision process i.e. human/adopter and economic factors. On the other hand, the second possible interpretation can be used when there are two or more products or brands of the same product to compare technological characteristics. However, this study will only deal with the first
interpretation and in particular estimation of the utility of becoming an owner of a mobile phone, considering factors related to users.

From the description of the framework, some of the economic factors and human/adopter factors, which we can include in the equation 3.3, are derived. From the literature review the following have been identified: Income category, Cost of acquiring mobile phone, age, and sex and education level.

3.4. Model Specification

In the analysis of the determinants mobile phone technology adoption this study followed the work of Rahm and Huffman (1984) and Heres and Mante-Meijer (2001). This study used logit model to explain the determinants of mobile phone technology adoption. This study specifies the following model

\[ y_1 = \beta_0 + X_1 \beta_1 + X_2 \beta_2 + \ldots + X_n \beta_n + \varepsilon_1 \tag{3.5} \]

Where \( y_1 \) is the dependent variable (Mobile phone technology adoption), \( \beta_0 \) is the constant, \( X \)'s are the vector of the independent variables. They represent human/adopter characteristic, economic and technological factors. \( \beta_1 \) and \( \beta_2 \) are the set of parameters to be estimated and \( \varepsilon_1 \) is the stochastic error term.

Subsequently, the following equation was estimated:

\[ MT_{i,j} = \beta_0 + \beta_1 INC_{CAT} + \beta_1 COST + \beta_2 AGE + \beta_3 SEX + \beta_4 EDUC + \beta_5 TECH_{ADV} + \varepsilon_1 \tag{3.6} \]
### 3.5. Description and measurement of variables

#### Table 3.1: Definition and measurement of Variables

<table>
<thead>
<tr>
<th>Definition of the variable</th>
<th>Nature of variable</th>
<th>Measurement of variable</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phone technology adoption defined as the decision to make full use of an mobile phone technology as the best course of action available</td>
<td>Endogenous variable</td>
<td>Measured by ownership of a mobile phone</td>
<td>1-Adopter 0-Non Adopter</td>
</tr>
<tr>
<td>Income of the adopter is defined as monthly household income in Kenya Shillings.</td>
<td>Exogenous variable</td>
<td>Adopter specific characteristic</td>
<td>Absolute number</td>
</tr>
<tr>
<td>Cost of the mobile phone handset defined as the amount of money paid to acquire the mobile phone handset.</td>
<td>Exogenous variable</td>
<td>Adopter specific characteristic</td>
<td>0-0-10,000 1-10,000-30,000 2-30,000-60,000 3-60,000 +</td>
</tr>
<tr>
<td>Education level of the adopter defined as deliberate and systematic activities</td>
<td>Exogenous variable</td>
<td>Adopter specific characteristic</td>
<td>0-No education 1-Primary education</td>
</tr>
<tr>
<td>Definition of the variable</td>
<td>Nature of variable</td>
<td>Measurement of variable</td>
<td>Scale</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
<td>--------------------</td>
<td>-------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>designed to meet learning needs within the context of the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>education system in Kenya.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of the adopter-defined as the length of time in completed</td>
<td>Exogenous variable</td>
<td>Adopter specific</td>
<td>2-Secondary education</td>
</tr>
<tr>
<td>years, that a given person has been alive, measured at the</td>
<td></td>
<td>characteristic</td>
<td></td>
</tr>
<tr>
<td>beginning of birth.</td>
<td></td>
<td></td>
<td>3-Higher education</td>
</tr>
<tr>
<td>Sex-defined as biological status and is typically categorized</td>
<td>Exogenous variable</td>
<td>Adopter specific</td>
<td>0-18-24</td>
</tr>
<tr>
<td>as male or female.</td>
<td></td>
<td>characteristic</td>
<td>1-25-34</td>
</tr>
<tr>
<td>Technology specific factors defined as hardware and software</td>
<td>Exogenous variable</td>
<td>Mobile phone</td>
<td>5 Point likert scale</td>
</tr>
<tr>
<td>components of a mobile phone gadget</td>
<td></td>
<td>characteristic</td>
<td>ranging from:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measured by size of the</td>
<td>1-Strongly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>phone, screen size,</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>battery</td>
<td></td>
</tr>
<tr>
<td>Definition of the variable</td>
<td>Nature of variable</td>
<td>Measurement of variable</td>
<td>Scale</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------</td>
<td>-------------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>life, access to internet, size of memory and phone camera.</td>
<td>5-Strongly disagree</td>
</tr>
</tbody>
</table>

3.6. Study area

This study was carried out in Nairobi County, which is one of the 47 counties in the Republic of Kenya and the Capital City. The county has a total area of 696.1 Km². According to the Kenya Bureau of Statistics (2013) in 2013 the county population was projected to be 3,517,325 and was expected to rise to 3,942,054 in 2015. This study was carried out in Nairobi County since it is the county with the highest mobile network coverage compared to other parts in the country and therefore potential adopters are not likely to be constrained by lack of mobile network signals. In addition, the county also has a good demographic representation of the various social-economic profiles in the country.

3.7. Target population

The target population for this study was owners of mobile phones and potential adopters of mobile phones aged above 18 years and who live within the County of Nairobi. The choice of adopters whose age is above 18 years was arrived at based on the average age at which most of the population in Kenya complete their secondary level education and begin to actively use mobile phones.
3.8. Sampling technique

The study utilized probability-sampling method and in particular stratified sampling technique divided into 17 strata that comprise all constituencies in Nairobi. Every element in the population was assigned to only one stratum and simple random sampling was applied within each stratum.

The sample size was estimated using Watson and Chow (2001) formula of determining the sample size.

\[ n = \frac{P(1-P)}{\left( \frac{A^2}{Z^2} \right) \left( \frac{P(1-P)}{N} \right)} \]

Where:

- \( n \) = sample size required
- \( N \) = number of people in the population (3,942,054)
- \( P \) = estimated variance in population, as a decimal: (0.5 for 50-50)
- \( A \) = Precision desired, expressed as a decimal (0.1 for 10%)
- \( Z \) = Based on confidence level: 1.96 for 95% confidence,
- \( R \) = Estimated Response rate, as a decimal (0.7)

Using the above formula the sample size is estimated to be 137. However, the sample size was scaled up by 30 percent to take into consideration potential non-response.

The sample size for this study therefore was 180 divided into strata as shown in Table 3.2.
Table 3.2: Nairobi County population per constituency

<table>
<thead>
<tr>
<th>Constituency</th>
<th>Population (2015 Projections)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westlands</td>
<td>222,048</td>
<td>10</td>
</tr>
<tr>
<td>Dagoretti North</td>
<td>230,629</td>
<td>11</td>
</tr>
<tr>
<td>Dagoretti South</td>
<td>227,271</td>
<td>10</td>
</tr>
<tr>
<td>Langata</td>
<td>232,514</td>
<td>11</td>
</tr>
<tr>
<td>Kibra</td>
<td>223,940</td>
<td>10</td>
</tr>
<tr>
<td>Roysambu</td>
<td>240,779</td>
<td>11</td>
</tr>
<tr>
<td>Kasarani</td>
<td>249,875</td>
<td>11</td>
</tr>
<tr>
<td>Ruaraka</td>
<td>243,831</td>
<td>11</td>
</tr>
<tr>
<td>Embakasi South</td>
<td>252,526</td>
<td>12</td>
</tr>
<tr>
<td>Embakasi North</td>
<td>227,839</td>
<td>10</td>
</tr>
<tr>
<td>Embakasi Central</td>
<td>233,566</td>
<td>11</td>
</tr>
<tr>
<td>Embakasi East</td>
<td>205,819</td>
<td>9</td>
</tr>
<tr>
<td>Embakasi West</td>
<td>226,954</td>
<td>10</td>
</tr>
<tr>
<td>Makadara</td>
<td>201,518</td>
<td>9</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>266,279</td>
<td>12</td>
</tr>
<tr>
<td>Starehe</td>
<td>208,565</td>
<td>10</td>
</tr>
<tr>
<td>Mathare</td>
<td>242,947</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,936,900</strong></td>
<td><strong>180</strong></td>
</tr>
</tbody>
</table>


3.9. Research instrument

This study used a survey questionnaire to empirically examine the hypothesis developed based on the literature reviewed.

3.10. Pilot study

In order to ensure reliability, validity and practicability of the questionnaire a pilot test was performed on measurement items for a random sample of 20 respondents and the questionnaire was modified based on the results. The pilot questionnaire provided a space for respondents to criticize or make suggestions for improving the question items.
3.11. Data collection procedure

This study collected data by administering questionnaires. The questionnaire was attached with a brief cover letter explaining the purpose of the study and assuring respondents that confidentiality will be maintained. The questionnaires were delivered by data collectors who identified themselves, discussed the purpose of the study and requested cooperation with the respondent. Finally, follow up with non-respondents was done with another copy of the questionnaire.

3.12. Data entry and cleaning

The collected data was entered into Stata. The data was edited to check for errors and omissions after which codes were assigned. Code cleaning was done to check that only the codes assigned to the answer choices for each question appear in the data file. Contingency cleaning to check that only those cases that should have data on a particular variable do in fact have such data was done. To conclude, proof reading was done to identify and correct errors and inconsistency.

3.13. Data analysis

This study utilized the logit model to estimate the determinant of mobile phone technology adoption. Stata data analysis and statistical software was used to run the regression model.

3.14. Multicollinearity test

A multicollinearity test was carried out to determine the level of correlation between the eleven independent variables in the logit model. This was done to avoid the presence of serious multicollinearity that could undermine the effectiveness of the logit model in the regression analysis.
3.15. Diagnostic Tests

The following diagnostic tests were carried out.

3.14.1 Goodness of fit test

After a logistic regression model was fitted, the adequacy of the model was examined by overall goodness of fit test. The purpose of this test was to determine whether the fitted model adequately described the observed outcome experience in the data (Hosmer and Lemeshow, 2000). A model fits if the differences between the observed and fitted values are small and if there is no systematic contribution of the differences to the error structure of the model. Hosmer-Lemeshow goodness of fit test is based on dividing the sample up according to their predicted probabilities. In particular, based on the estimated parameter values $\hat{\beta}_0, \hat{\beta}_1, \ldots, \hat{\beta}_p$ for each observation in the sample the probability that $Y=1$ is calculated, based on each observation's covariate values:

$$\hat{f} = \frac{\exp(\hat{\beta}_0 + \hat{\beta}_1 x_1 + \cdots + \hat{\beta}_p x_p)}{1 - \exp(\hat{\beta}_0 + \hat{\beta}_1 x_1 + \cdots + \hat{\beta}_p x_p)}$$

3.14.2 Overall evaluation of the model using likelihood ratio test

A logistic model is said to provide a better fit to the data if it demonstrates an improvement over the intercept-only model (also called the null model). Likelihood ratio test is based on the difference in deviance without any predictor in the model minus the deviance with all predictors in the model. An intercept-only model serves as a good baseline because it contains no predictors (Penget al., 2002). In this study, all observations were predicted to belong in the largest outcome category. An improvement over this baseline was examined by using the likelihood ratio inferential statistical tests.
CHAPTER FOUR

EMPIRICAL FINDINGS

4.1. Introduction

This chapter analyses the results of the data obtained from 177 completed questionnaires received for this study. The chapter discusses the questionnaire response rate and the various determinants of mobile phone telephony adoption i.e human/adopter characteristic, economic and technology specific characteristics which are of interest to the study.

4.2. Response Rate

A total of 180 questionnaires were issued in 17 constituencies in Nairobi against a target of 137 samples in order to ensure that the response rate was as close as possible to the target for this study. The data collectors were adequately briefed on the study objectives and the structure of the questionnaire in order to ensure that the respondents were well apprised before filling up the questionnaire. Out of the 180 questionnaires issued out, a total of 177 were returned translating to a response rate of 98 percent. According to Mugenda and Mugenda (2003), a response rate of 50 percent can be considered adequate for analysis and reporting, 60 percent can be considered as good, while a response rate of 70 percent and over can be considered as excellent for analysis. Thus for this study, the response rate was considered as excellent for analysis and reporting.

4.3. Descriptive statistics

This section present data collected from 17 strataims that represent all constituencies in Nairobi County. The data is presented based on the various human adopter
characteristics, economic characteristics and technical specific characteristics guided by the objective of this study.

4.3.1. Human/adopter characteristics

Table 4.1: Sex of the Respondents

<table>
<thead>
<tr>
<th>Sex of Respondents</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>98</td>
<td>55.4</td>
</tr>
<tr>
<td>Female</td>
<td>79</td>
<td>44.6</td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Survey data

As per Table 4.1, the majority of the respondents were male accounting for 55.4 percent while female accounted for 44.6 percent of the sample.

Table 4.2: Age bracket of the Respondent

<table>
<thead>
<tr>
<th>Age bracket of Respondents</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 18-24 years</td>
<td>53</td>
<td>29.9</td>
</tr>
<tr>
<td>Between 25-34 years</td>
<td>34</td>
<td>19.2</td>
</tr>
<tr>
<td>Between 35-44 years</td>
<td>39</td>
<td>22.0</td>
</tr>
<tr>
<td>Between 45-54 years</td>
<td>30</td>
<td>16.9</td>
</tr>
<tr>
<td>More than 55 years</td>
<td>21</td>
<td>11.9</td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Survey data

Table 4.2 shows the age bracket of the respondents. Out of 177 respondents, 29.9 percent indicated their age was between 18-24 years, 19.2 percent aged between 25-34 years, 22.0 percent aged between 35-44 years, 16.9 percent aged between 45-54 years and respondents whose age was more than 55 years accounted for 11.9 percent.
Table 4.3: Education level

<table>
<thead>
<tr>
<th>Education level of Respondent</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>7</td>
<td>4.0</td>
</tr>
<tr>
<td>Primary Level</td>
<td>29</td>
<td>16.4</td>
</tr>
<tr>
<td>Secondary Level</td>
<td>60</td>
<td>33.9</td>
</tr>
<tr>
<td>University Level</td>
<td>57</td>
<td>32.2</td>
</tr>
<tr>
<td>Post graduate</td>
<td>24</td>
<td>13.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>177</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Survey data

As per Table 4.3, 96 percent of the respondents sampled had primary level education and above implying that most could read and write.

4.3.2. Economic factors

Table 4.4: Level of income

<table>
<thead>
<tr>
<th>Income level of Respondent</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than Kshs 10,000</td>
<td>7</td>
<td>4.0</td>
</tr>
<tr>
<td>Between Kshs 10,000-50,000</td>
<td>66</td>
<td>37.3</td>
</tr>
<tr>
<td>Between Kshs 50,000-100,000</td>
<td>61</td>
<td>34.5</td>
</tr>
<tr>
<td>Between Kshs 100,000-300,000</td>
<td>38</td>
<td>21.5</td>
</tr>
<tr>
<td>More than Kshs 300,000</td>
<td>5</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>177</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Survey data

Table 4.4 shows five different income levels of the respondents. Majority of the respondents reported to be earning income of between Kshs 10,000-50,000, followed by 34.5 percent who reported they earned income between Kshs 50,000-100,000. 21.5 percent of the respondents indicated they earned between Kshs 100,000-300,000.
Table 4.5: Period acquired current phone

<table>
<thead>
<tr>
<th>Duration of phone ownership/use</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>90</td>
<td>50.8</td>
</tr>
<tr>
<td>Between 1-2 years</td>
<td>65</td>
<td>36.7</td>
</tr>
<tr>
<td>More than 3 years ago</td>
<td>22</td>
<td>12.4</td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Survey data

As per Table 4.5, the study established that majority (50.8 percent) of the respondents had bought their current phones less than a year ago followed by 36.7 per cent who bought theirs between one and two years ago. The high number of respondents who bought their phones less than a year ago can be attributed to the decrease in prices of mobile phone gadgets in the market.

Table 4.6: Purchaser of the Phone

<table>
<thead>
<tr>
<th>Adopter</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner</td>
<td>132</td>
<td>74.6</td>
</tr>
<tr>
<td>Someone else</td>
<td>45</td>
<td>25.4</td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Survey data

As per Table 4.6, majority (74.6 percent) of the respondents indicated that they are the ones who purchased their mobile phones while 25.4 percent indicated that someone else had bought the phones for them. This can be construed to imply that majority of the respondents were responsible for the acquisition decision.
Table 4.7: Cost of the current phone

<table>
<thead>
<tr>
<th>Cost of current phone</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than Kshs 10,000</td>
<td>56</td>
<td>31.6</td>
</tr>
<tr>
<td>Between Kshs 10,000-30,000</td>
<td>89</td>
<td>50.3</td>
</tr>
<tr>
<td>Between Kshs 30,000-60,000</td>
<td>29</td>
<td>16.4</td>
</tr>
<tr>
<td>More than Kshs 60,000</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>177</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: Survey data

From Table 4.7, half (50.1 percent) of the respondents owned phones that cost between Kshs 10,000-30,000 (middle-range mobile phones), while 31.6 percent of the respondents indicated that their phones cost less than Kshs 10,000. 16.4 percent of the respondents had mobile phones that cost between Kshs 30,000-60,000 and a meager 1.7 percent owned top-of-the-range mobile phones that cost more than Kshs 60,000.

Table 4.8: Cross-tabulation of income level and current phone cost

<table>
<thead>
<tr>
<th>Cost of the current phone</th>
<th>Less than Kshs 10,000</th>
<th>Between Kshs 10,000-30,000</th>
<th>Between Kshs 30,000-60,000</th>
<th>More than Kshs 60,000</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than Kshs 10,000</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Between Kshs 10,000-50,000</td>
<td>25</td>
<td>32</td>
<td>8</td>
<td>1</td>
<td>66</td>
</tr>
<tr>
<td>Between Kshs 50,000-100,000</td>
<td>19</td>
<td>30</td>
<td>10</td>
<td>2</td>
<td>61</td>
</tr>
<tr>
<td>Between Kshs 100,000-300,000</td>
<td>10</td>
<td>21</td>
<td>7</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>More than Kshs 300,000</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>59</strong></td>
<td><strong>89</strong></td>
<td><strong>26</strong></td>
<td><strong>3</strong></td>
<td><strong>177</strong></td>
</tr>
</tbody>
</table>

Source: Survey data

Table 4.8 shows cross tabulation to determine how income level affects the purchase of mobile phones. Out of the 177 respondents, 30 respondents (16.9 percent), who earned income between Kshs 50,000-100,000, owned mobile phones worth between
4.3.3 Technology Specific factors

Table 4.10: Preference of mobile phone size

<table>
<thead>
<tr>
<th>Perceived preference of phone size</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large size- &gt; 5 inches</td>
<td>69</td>
<td>39.0</td>
</tr>
<tr>
<td>Medium size ~4.7 inches</td>
<td>75</td>
<td>42.4</td>
</tr>
<tr>
<td>Small size-&lt; 4.7 inches</td>
<td>21</td>
<td>11.9</td>
</tr>
<tr>
<td>Any size</td>
<td>12</td>
<td>6.8</td>
</tr>
<tr>
<td>Total</td>
<td>177</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Survey data

Table 4.10 shows preference of different mobile phone sizes by respondents. As per the table, 42.4 percent of the respondents indicated that they preferred medium sized phones (~4.7 inches); while 39 percent indicated that they preferred large mobile phone size (> 5 inches). 11.9 percent of the respondents indicated that they preferred Small size (< 4.7 inches).

Table 4.11: Technical Specifications Considerations

<table>
<thead>
<tr>
<th>Perceived “preference” of technical specification</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phones with large screen sizes are more preferable</td>
<td>2.2712</td>
<td>.83592</td>
</tr>
<tr>
<td>Touch screen mobile phones are better than qwerty keyboard phones</td>
<td>2.2655</td>
<td>.83435</td>
</tr>
<tr>
<td>Mobile phone battery life as an important factor before buying.</td>
<td>2.2542</td>
<td>.87762</td>
</tr>
<tr>
<td>Considers ability to access internet as an important feature of the mobile phone</td>
<td>2.1186</td>
<td>.84109</td>
</tr>
<tr>
<td>Size of the memory of a phone an most important factor in a mobile phone</td>
<td>1.8701</td>
<td>.64847</td>
</tr>
<tr>
<td>Camera is not an important feature in a mobile phone</td>
<td>2.2316</td>
<td>.95198</td>
</tr>
</tbody>
</table>

Source: Survey data

Table 4.11 shows the average and standard deviation of the various technical specifications consideration by adopters. The study used a five point Likert scale system to gauge the key technology specific factors that consumers considered before making a decision to acquire a mobile phone gadget. The key ranging between 1 and
5 was used to measure the extent to which respondents agreed with various technology specific statements in the questionnaire. From the analysis of the responses received, majority of the respondents agreed with the various statements, as the mean obtained was less than 2.3.

4.4. The regression analysis

4.4.1. Multicollinearity test

Multicollinearity occurs when two or more independent variables in the model are approximately determined by a linear combination of other independent variables in the model. A multicollinearity test was carried out on the study’s logistic model to determine the level of correlation between the study’s eleven variables. The study used pairwise matrix correlation test to determine the degree of correlation between the independent variables. Table 4.12 shows the results of the pairwise matrix test.
### Table 4.12: Pairwise matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender</th>
<th>Age</th>
<th>Edu</th>
<th>Inc</th>
<th>Cost</th>
<th>Screen</th>
<th>t_screen</th>
<th>Battlife</th>
<th>Interacc</th>
<th>Mernsize</th>
<th>Carn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.0296</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edu</td>
<td>0.0417</td>
<td>-0.0869</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inc</td>
<td>-0.1712</td>
<td>-0.2136</td>
<td>0.0568</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>-0.0177</td>
<td>0.0605</td>
<td>0.0458</td>
<td>0.0209</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen</td>
<td>-0.0351</td>
<td>-0.0126</td>
<td>0.0714</td>
<td>-0.2499</td>
<td>-0.1040</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t_screen</td>
<td>0.0705</td>
<td>0.0209</td>
<td>-0.1179</td>
<td>-0.0884</td>
<td>0.0948</td>
<td>-0.1097</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battlife</td>
<td>-0.0862</td>
<td>0.0206</td>
<td>0.0159</td>
<td>0.0137</td>
<td>-0.1064</td>
<td>-0.1161</td>
<td>-0.1086</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interacc</td>
<td>0.1871</td>
<td>-0.0989</td>
<td>0.0735</td>
<td>0.0343</td>
<td>0.1195</td>
<td>-0.1304</td>
<td>0.1325</td>
<td>-0.1469</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mernsize</td>
<td>-0.0187</td>
<td>-0.0598</td>
<td>-0.0719</td>
<td>0.0491</td>
<td>-0.0251</td>
<td>-0.0964</td>
<td>0.1880</td>
<td>-0.1019</td>
<td>-0.1443</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>Cam</td>
<td>-0.0918</td>
<td>-0.1571</td>
<td>0.0446</td>
<td>0.1835</td>
<td>-0.0064</td>
<td>0.0036</td>
<td>0.0434</td>
<td>-0.0008</td>
<td>-0.0436</td>
<td>0.1502</td>
<td>1.0000</td>
</tr>
<tr>
<td>_cons</td>
<td>-0.3795</td>
<td>-0.2279</td>
<td>-0.4143</td>
<td>-0.0259</td>
<td>-0.1916</td>
<td>-0.1318</td>
<td>-0.3981</td>
<td>-0.1145</td>
<td>-0.2769</td>
<td>-0.3518</td>
<td>-0.3313</td>
</tr>
</tbody>
</table>

Source: Survey data

From Table 4.12 on the analysis of pairwise correlation matrix, multicollinearity was low and therefore unlikely to affect the result of the study significantly. The highest correlation, of 0.2499, was between level of adopter's income and preference for larger mobile phone screen size. This was followed by correlation between income and age with 0.2136. The rest of the variables had a low correlation of 0.1 (rounded off) and below.

### 4.4.2. The regression Results

The logit regression analysis was carried out in two steps. The first step was to get the estimates of log of odd ratios of the eleven explanatory variables. Table 4.13 shows the first regression estimates of log of odd ratios of the explanatory variables in the logit model.
| Adopt  | Coef.       | Std. Err | Z      | P>|Z|   | [95% Conf. Interval] |
|--------|-------------|----------|--------|-------|---------------------|
| Sex    | -.8533179   | .4329492 | -1.97  | 0.049 | -1.701883 -0.047531 |
| Age    | .0041246    | .016902  | 0.24   | 0.807 | -.0290028 .037252   |
| Edu    | .2637217    | .2024888 | 1.30   | 0.193 | -.1331489 .6605924  |
| Inc    | 8.31e-06    | 3.67e-06 | 2.27   | 0.023 | 1.13e-06 .0000155   |
| Cost   | .0000943    | .0000236 | 3.99   | 0.000 | .000048 .0001406    |
| Screen | -.2576509   | .2396752 | -1.08  | 0.282 | -.7274056 .2121037  |
| t_screen | -.1174049 | .2582786 | -0.45  | 0.649 | -.6236216 .3888119  |
| Battlife | -.0708616 | .2299036 | -0.31  | 0.758 | -.5214645 .3797412  |
| Interac | .0769106   | .2972614 | 0.26   | 0.796 | -.505711 .6595321   |
| Memsize | -.1141469  | .3301342 | -0.35  | 0.730 | -.761198 .5329042   |
| Cam    | .1429755    | .2185667 | 0.65   | 0.513 | -.2854074 .5713584  |
| _cons  | .0735742    | 1.559713 | 0.05   | 0.962 | -.2983407 3.130555  |

Source: Survey data

Number of observations=177; LR chi² (11)=40.94; Prob> Chi² =0.0000; Pseudo R²=0.2086; Log likelihood =-77.665613

From Table 4.13 Pseudo R²=0.2086, indicates that only 21 percent of the changes in adoption factors were correctly predicted. Other factors not included in the model explained the balance of 79 percent of changes. However, the model estimates from a logistic regression are maximum likelihood estimates arrived at through an iterative process. They are not calculated to minimize variance, so the OLS approach to goodness-of-fit and interpreting R² does not apply.

In addition, estimates for log of odd ratios of explanatory variables cannot be interpreted because they are not marginal effects the study set out to interpret. Stage two regression was thus undertaken to derive the marginal effects.
Table 4.14: Marginal effect results

| Adopt  | dy/dx   | Std. Err | Z     | P>|Z| | [95% Conf. Interval] |
|--------|---------|----------|-------|-------|----------------------|
| Sex    | -.1139539** | .05877    | -1.94 | 0.052 | -.229132 -.001224    |
| Age    | .0005508   | .00225    | 0.24  | 0.807 | -.003868 .00497     |
| Edu    | .035218    | 0.2703    | 1.30  | 0.193 | -.017765 .088201    |
| Inc    | 1.11e-06** | 0.000000  | 2.30  | 0.021 | 1.7e-07 2.1e-06     |
| Cost   | .0000126***| 0.000000  | 5.03  | 0.000 | 7.7e-06 .000017     |
| Screen | -.0344073  | .03169    | -1.09 | 0.278 | -.096519 .027704    |
| t_screen | -.0156785  | .03464    | -0.45 | 0.651 | -.083574 .052217    |
| Battlife | -.009463  | .03066    | -0.31 | 0.758 | -.06955 .050624     |
| Interacc | .0102708  | .03965    | 0.26  | 0.796 | -.067438 .087979    |
| Memsize | -.0152434  | .04408    | -0.35 | 0.730 | -.101648 .071161    |
| Cam    | .0190933   | .02931    | 0.65  | 0.515 | -.038359 .076546    |

Source: Survey data

***significant at 1 percent    **significant at 5 percent    *significant at 10 percent

Table 4.14 shows the marginal effect results. From the Table, three variables i.e sex, income level and cost of the mobile phone handset -were found to be significant.

4.5. Results interpretation

4.5.1. Technology specific characteristic

The first objective of this study was to determine mobile phone technology specific characteristics that influence its adoption in Kenya. From the results of our analysis, none of the technology specific factors was found to be statistically significant. This contradicts conclusions by Hyvönen and Repo (2004) that technology leads to adoption of mobile services. However, despite the low significance, we cannot rule out the possibility that improvement in technology might have contributed to
reduction in cost of production (hence the steep drop in the price of cellular phone), improved service quality by the mobile handset produced and ultimately the adoption of mobile phone technology.

Moreover, from descriptive analysis captured under Table 4.11, most of the respondents seemed to agree with the various technology specific statements. In particular, there was a strong agreement that it was important to have a mobile phone that is able to access internet and one that has a large memory size.

4.5.2 Human/adopter characteristics

The second objective of this study was to determine the human/adopter characteristics that drive adoption of mobile phone technology in Kenya. Table 4.15 shows result of the analysis of human/adopter characteristics.

| Adopt | dy/dx | Std. Err | Z     | P>|Z| | [95% Conf. Interval] |
|-------|-------|----------|-------|-------|----------------------|
| Sex   | -.1139539** | .05877 | -1.94 | 0.052 | -.229132 | -.001224 |
| Age   | .0005508 | .00225 | 0.24  | 0.807 | -.003868 | .00497 |
| Edu   | .035218 | 0.2703 | 1.30  | 0.193 | -.017765 | .088201 |

Source: Survey data

Table 4.15 shows that, apart from sex, all other human adopter characteristics were not significant at all levels of significance i.e 1 percent, 5 percent and 10 percent. Sex was found to be significant at 5 percent level of significance. These results validate conclusion by Park, Yang and Lehto (2007) who found that gender was a significant factor in the adoption of mobile technologies for the Chinese consumer. However, the
results contrast the conclusion by Meso et. al (2005) that gender had no effect on adoption of mobile ICT in Kenya and Munnukka (2007) who argued that age, income and education remain good and accurate predictors of buying behaviour and indeed adoption.

4.5.3 Economic factors

The third and final objective of this study was to determine economic factors that drive adoption of mobile phone technology. Table 4.16 shows the result of the analysis of the economic factors (income of the adopter and cost of mobile phone) considered by the study.

Table 4.16: Analysis of economic factors

| Adopt | $\frac{dy}{dx}$ | Std. Err | Z | P>|Z| | [95% Conf. Interval] |
|-------|----------------|-----------|---|-------|-------------------|
| Inc   | 1.11e-06**     | .000000   | 2.30 | 0.021 | 1.7e-07          | 2.1e-06 |
| Cost  | .0000126***    | .000000   | 5.03 | 0.000 | 7.7e-06          | .000017 |

Source: Survey data

In Table 4.16, both variables in the economic specific characteristics i.e. income of the adopter and the cost of acquiring mobile phone were found to be significant. Income was significant at 5 percent level while cost was significant at 1 percent level. From the analysis, a unit change in income of the adopter and cost of the mobile phone, will lead to a 0.0000111 and 0.0000126 unit change in mobile phone adoption respectively.

These conclusions are in line with the findings of Meuter et al., 2005 that higher household income could also represent, simultaneously, greater timesaving
motivations to use mobile phone services, as well as upturn opportunities for accessing updated devices, such as mobile ones.

4.6. Diagonistic Test of the logit model

4.6.1. Goodness of Fit test

The goodness of fit test was carried on the logit model to test its adequacy. The test outcome for this study was whether the adopter will acquire a mobile phone or otherwise. The Hosmer-Lemeshow (H-L) test was used to test the null hypothesis that the logit model provided a good fit to the data, against an alternative hypothesis that the logit model is not a good fit for the data. Table 4.17 shows the results of the H-L test of goodness of fit of the study’s logit model.

Table 4.17: Goodness of fit test results

<table>
<thead>
<tr>
<th>Group</th>
<th>Prob</th>
<th>Obs_1</th>
<th>Exp_1</th>
<th>Obs_0</th>
<th>Exp_0</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.4784</td>
<td>4</td>
<td>6.5</td>
<td>14</td>
<td>11.5</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>0.5715</td>
<td>9</td>
<td>9.5</td>
<td>9</td>
<td>8.5</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>0.6510</td>
<td>11</td>
<td>11.0</td>
<td>7</td>
<td>7.0</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>0.7243</td>
<td>13</td>
<td>11.8</td>
<td>4</td>
<td>5.2</td>
<td>17</td>
</tr>
<tr>
<td>5</td>
<td>0.8055</td>
<td>15</td>
<td>13.9</td>
<td>3</td>
<td>4.1</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>0.8656</td>
<td>15</td>
<td>15.1</td>
<td>3</td>
<td>2.9</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>0.9138</td>
<td>17</td>
<td>15.2</td>
<td>0</td>
<td>1.8</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>0.9458</td>
<td>18</td>
<td>16.7</td>
<td>0</td>
<td>1.3</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>0.9820</td>
<td>16</td>
<td>17.5</td>
<td>2</td>
<td>0.5</td>
<td>18</td>
</tr>
<tr>
<td>10</td>
<td>0.9977</td>
<td>16</td>
<td>16.9</td>
<td>1</td>
<td>0.1</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: Survey data

Number of observations=177; number of groups =10 ; Hosmer–lemeshow chi2 (10)=15.17; Prob> chi2 =0.0560
Table 4.17 shows that the H-L test on the study's data yielded a chi-square of 15.17 with ten degrees of freedom. The p-value for the H-L test was 0.056, which was not significant at either 1 percent or 5 percent levels. Therefore the null hypothesis was not rejected which implies that the logit model was a good fit to the data of the study.

**4.6.2. Overall evaluation of the model using the likelihood ratio test**

The effectiveness of the model is assessed using the likelihood ratio test, which is commonly used to evaluate the difference between two nested models that share the same dependent variable. The test is done by estimating the log likelihoods of two models; one which is without the predictor variables and is restricted to the intercept only, and the other, an unrestricted model, with all the eleven predictor variables. A comparison is then made of their log of likelihood estimates (Peng *et al.*, 2002).

For this study, the null hypothesis of the test was that the intercept-only model was a better fit to the data, against the alternative hypothesis of the model with all the predict variables. This was done by nesting and estimating the log likelihoods of the two models i.e log likelihood of M1 (Intercept only model), which was equal to -98.13636 and log likelihood for M2 (with all eleven predictor variables) which was equal to -77.66561. Table 4.18 shows the likelihood-ratio test results obtained from the analysis.
Table 4.18: Likelihood-ratio test results

<table>
<thead>
<tr>
<th>Model</th>
<th>Obs</th>
<th>11(model)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>177</td>
<td>-98.13636</td>
</tr>
<tr>
<td>M2</td>
<td>177</td>
<td>-77.66561</td>
</tr>
</tbody>
</table>

Assumption: M2 nested in M1
LR chi2 (10) = 40.94
Prob> chi2 = 0.0000

Source: Survey data

From Table 4.18, the likelihood ratio test gives a chi-square value of 40.94, with 10 degrees of freedom and associated p-value of 0.0000, which is statistically significant at 1 percent level. These results indicate that if the 11-predictor variables model is added to the intercept only model (M1), there will be a statistically significant improvement in the models fit. Since the intercept only model was inferior to the model with all predictor variables, the likelihood ratio test demonstrated that the study logistic model provided a good fit to the data set of the study.
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the summary of the findings, conclusion of the study, the study’s contribution to knowledge, policy implications, study limitations and recommendation on areas for further studies.

5.2. Summary

The study sought to uncover the determinants of mobile phone telephony adoption in Kenya using Nairobi County as the population for the study. The key determinants of interest to the study included mobile phone technology specific characteristics, human characteristics and economic factors as informed by a review of previous studies.

Using a sample of 177 respondents, the study adopted a utility maximization model adopted by Rahm and Huffman (1984) and Heres and Mante-Meijer (2001) to analyze the key determinants of mobile phone adoption in Kenya. In addition to the factors used in previous studies i.e gender, age, level of education, Income levels and economic factors, this study also captured the various technology specific characteristics aspects of mobile phones that affect its adoption.

The study established that all the economic factors play an influential role when it comes to making the decision of whether to adopt mobile phone technology or otherwise while Sex was the only human/adopter characteristic that was found to be key factor in the adoption of mobile phone technology. On the technology specific factors, all the factors i.e preference for touch screen mobile phones, battery life, presence of a camera, memory size, the size of the mobile phone and the ability to
access to access internet were found not to be significant determinants of adoption of mobile phone technology.

The findings of this study supported those of Park, Yang and Lehto (2007) who concluded in their study that gender was a significant factor in the adoption of mobile technologies for the Chinese consumer. The study findings also supported those of Chabossou, Stork, Stork, and Zahonogo (2008) who concluded that income vastly enhanced mobile adoption. Indeed, we can conclude in our study that usage remains a factor of disposable income and as mobile phone adopters from different social classes behave in different ways; their income influences their acquisition and usage of mobile phone technology. However, the study findings contradicted those of Meso et al., (2005) who concluded that gender had no effect on mobile ICT use in Kenya.

5.3. Conclusions

In conclusion, this study has established that among the human/adopter characteristics, its only sex which is a key determinant in mobile phone technology adoption in Kenya. On economic factors, both the cost of the mobile phone and the income of the adopter were found to be significant determinants of the mobile phone technology adoption. On the technology specific factors, a wide range of factors was considered in this study. In particular, the study considered preference for touch screen mobile phones, battery life and presence of a camera, memory size, the size of the mobile phone and the phones ability to access internet. All the technology specific factors considered in this study were not found to be significant determinants of mobile phone technology adoption. However, despite the low significance, we cannot rule out the possibility that improvement in technology might have contributed to reduction in cost of production (hence the steep drop in the price of cellular phone),
improved service quality by the mobile handset produced and ultimately the adoption of mobile phone technology.

5.4. Policy Implications

Arising from the first study objective, although the study did not find technology specific factors to be statistically significant, the results of descriptive statistics can be of great use to mobile phone manufactures and service providers. They can take into consideration the importance adopters attach to the ability of the mobile phone to access internet and the size of the memory of the mobile phone as they design future mobile phone devices.

In addition to the policy implication derived from the first objective, and arising from the second objective, mobile phone manufactures and service providers can also design their manufacturing and marketing strategies based on the study finding of high importance of sex, a human/adopter characteristic, on mobile phone adoption. It may be useful to segment their markets and design mobile phone devices and marketing strategies that appeal to different sexes.

On the third and final objective of this study, the Kenyan government, through Communications Authority of Kenya, is mandated with the responsibility of ensuring that Kenyan residents have access to affordable communications services. By taking into consideration the findings of this study on importance of cost of mobile phone devices and income of the adopter as determinants for mobile phone adoption, the government can formulate policies that are aimed at reducing the cost of acquiring mobile phone devices. These policies may include waiving of import tariffs charged on mobile phone imports, giving subsidies to low cost mobile phone products or creating an environment that facilitates local assembling of cheap mobile phones.
5.5. Contribution to Knowledge

Mobile phone technology is dynamic and therefore there was need to carry out this study to see whether the determinants of mobile telephony adoption which were at play in 2005 when Meso et al., (2005) carried out a similar study in Kenya were still valid. This study used more variables than what previous studies have used especially with regards to technology specific factors. Finally, uncovering the significance of the various determinants of mobile phone technology adoption has shed light on the adoption criteria that consumers are currently considering before adopting mobile phone technology.

5.6. Limitation of the study

This study was carried out in Nairobi based on the assumption that Nairobi was the best representation of the country’s social-economic profile. However, there is a possibility that if the study is carried out in other parts of the country, different conclusions might be arrived at and therefore it might not be ideal to generalize the findings of this study to the whole country.

This study did not also take into account the fact that some adopters might have chosen a particular mobile phone device due to ‘brand loyalty’ or other factors not considered by this study. The questionnaire used was not detailed enough to describe reasoning behind choosing between different brands of mobile phone.

5.7. Suggestions for further research

While this study found some similarities and contrast with previous studies conducted on the mobile phone technology adoption, other studies should be carried out in the country utilizing other models with ability to describe reasoning behind choosing between different mobile phone devices. The studies should use a larger sample size
in order increase the reliability of the results. Finally, similar studies should be carried out in the rest of 46 counties in Kenya to establish if the same results would be achieved.
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Appendix 1

Questionnaire

Mobile Phone technology adoption questionnaire:

Introduction

This questionnaire asks you about the mobile phone gadget that you use and the reason for your choice. It also has some demographic questions about you. All the information you provide was treated as strictly confidential and your responses will not be associated with you personally. Your participation is voluntary. Questions or concerns about this questionnaire can be directed:

Lukas Musembi e-mail: lukas.musembi@gmail.com
Tel: +254723448555

Instructions

1. Please answer the questions below as accurately as you can.
2. If you wish to comment on any questions or qualify your answers, please feel free to use the space in the margin
3. Certain questions employ 1-5 scale, with answers ranging from “strongly agree” to “strongly disagree”. Please cross(X) the box next to the number that best matches your opinion

Section 1: About you

1. Are you ☐ Male ☐ Female
2. What is your age (years)?
   ☐ 18-24
   ☐ 25-34
   ☐ 35-44
   ☐ 45-54
   ☐ 55+
3. What is your education level?
   □ No education
   □ Primary education
   □ Secondary education
   □ Undergraduate
   □ Postgraduate Level

4. What is your level of income in Kenya Shillings?
   □ 0-10,000
   □ 10,000-50,000
   □ 50,000-100,000
   □ 100,000-300,000
   □ 300,000 and above

Section 2: About your phone

5. When did you acquire your current phone?
   □ Less than 1 year
   □ 1-2 years
   □ 3 years and above

6. I am the one who bought it?
   Yes □ No □

7. If the answer in 6 is yes, how much did it cost you to acquire your current phone?
   □ 0-10,000
   □ 10,000-30,000
   □ 30,000-60,000
   □ 60,000 and above

8. What size of mobile phone do you prefer?
Large size >5 inches
Medium size ~4.7
Small Size <4.7
Any

Please indicate the extent to which you agree with the following statements

9. Mobile phones with large screen sizes are more preferable

10. Touch screen mobile phones are better than qwerty keyboard phones

11. I will consider mobile phone battery life as an important factor before buying.

12. I consider ability to access internet as an important feature of the mobile phone

13. I consider the size of the memory of a phone an most important factor in a mobile phone

14. To me a camera is not an important feature in a mobile phone