INFLUENCE OF MOBILE TELEPHONY UTILIZATION ON SPATIAL ECONOMIC DEVELOPMENT OF FISHER COMMUNITIES IN LAKE VICTORIA, KISUMU WEST SUB-COUNTY, KENYA

BY

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DECLARATION

Declaration by the Student

I confirm that this research thesis is my original work and has not been presented in any other university for certification. The thesis has been complemented by referenced works duly acknowledged.

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DEDICATION

To Almighty God my creator, provider and redeemer; my greatest motivator and dad, the late Dere Omollo; my mother, Yunia Dere, for her relentless encouragement; my beloved children and greatest motivators, Trevor, Josey, Jock, Junior and Gayle.

ABSTRACT

The use of mobile telephony is one of the most striking and fastest growing Information and Communications Technology advancements in Africa in the 21st century. However, in Africa, there have been concerns over disparities in the geographical rollout of mobile phones and challenges of cellular access. Fishing, which is a key economic activity in the Lake Victoria region, involves dealing in perishable products which require time critical transactions which mobile phones are able to provide. Mobile telephony has been used to advance various economic activities in the world. However, studies that explore mobile phone use and its influence on spatial economic development of fisher communities are limited. The extent to which mobile phones are being utilized to enhance business transactions for the perishable fish products was not known despite the fact that beaches in Lake Victoria, Kisumu County suffer lack of storage facilities and poor road network. Furthermore, development plans that can make mobile phones a transformative tool for spatial economic development planning in Kenya are not clearly documented. The study therefore sought to establish the influence of mobile telephony utilization on spatial economic development of fisher communities in Lake Victoria, Kisumu West Sub-County. The specific objectives were to assess the level of mobile telephony utilization among the fisher communities in Lake Victoria; to establish the influence of mobile telephony utilization on the business transactions of fisher communities in Lake Victoria and to assess the influence of mobile telephony utilization on spatial economic development of superstructures and infrastructure of beaches in Lake Victoria, Kisumu West Sub-County, Kenya. The study used spatial economic theory and time space convergence concept to understand the relationships of the key constructs of fishing activities, mobile telephony and spatial economic development of fisher communities. Cross-sectional and longitudinal research designs were used in the study. Three hundred and nineteen fishers were sampled using stratified random sampling from a population of 699 from six major beaches namely, Usoma, Ogal, Usare, Paga, Rari and Rota. Data was collected through interviews and non-participant observation. Data was analyzed using descriptive and inferential methods which included Chi-Square, correlation and regression analysis. The findings indicate that, while ownership of mobile telephony was 92.5%, it had contributed to only 5.3% variation in business transaction and accounted for 29.4% change in spatial economic development of infrastructure and superstructures in the beaches. The study found that location of mobile banking superstructures were mostly in the periphery of the beaches. The study concludes that there is a high level of ownership of mobile telephony, and it positively influenced business transactions and spatial economic development of the beaches in Kisumu West Sub-County, Kenya. However, the potential use of mobile telephony had not been optimized despite the fact that mobile telephony was crucial for bridging the temporal gap and overcoming the transport communication challenges. ICT support hubs should be introduced within the beaches to support use of mobile telephony. Beach Management Units should create conditions that are attractive for investors and allow for development of infrastructure and super-structures within the beach boundaries to support mobile telephony use.

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LIST OF ABBREVIATIONS AND ACRONYMS

BMU	Beach Management Unit
CAK	Communications Authority of Kenya
CBD	Central Business District
CDR	Call Detail Records
CCK	Communications Commission of Kenya
CPDO	City Planning & Development Office
FDG	Focused Group Discussion
EFMIS	Electronic Fish Market Information System
ESDP	European Special Development Perspective
ESRI	Economic and Social Research Institute
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GPS	Global Positioning System
GSM	Global System for Mobile Communication
ICT	Information and Communications Technology
IS	Information System
ITU	International Telecommunications Union
INSPIRE	Infrastructure for Spatial Information in Europe
LVFO	Lake Victoria Fisheries Organization
KEMFRI	Kenya Marine and Fisheries Research Institute
Ksh	Kenya Shillings
KNBS	Kenya National Bureau of Standards

MIS	Management Information System
NCDP	Naga City Development Plan
NOFP	National Oceans and Fisheries Policy
OECD	Organization for Economic Co- operation and Development
RFSR	Regional Frame Survey Report
SITP	Strategic Information Technology Planning
SME	Small and Medium Enterprises
SMS	Short message service
TSC	Time Space Convergence
US	United States of America

OPERATIONAL DEFINITION OF TERMS

For the purpose of the material presented in this thesis, these terms should be understood as follows: -

Fisher Communities: Refers to the fishers and the beaches from where they operate. The fishers include crew members, fish processors (at the beach), boat owners, and fishmongers at the beaches.

MPESA: Refers to mobile based money transfer financing and micro finance service. M for Mobile and PESA is a Kiswahili word meaning 'money'

Spatial economic development: Refers to development of infrastructure and superstructures in the beach as a result of use of mobile telephony for economic activities of fisher.

Penetration: Refers to the spread of adoption and use of mobile telephony

Time - Space: Refers to the distance between places defined in terms of the time of crossing the space between them

Cost –distance: Refers to the distance between places defined in terms of the cost of crossing the physical distance between them.

Utilization: The act of using mobile phone for the intended purpose

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The first commercial mobile phones systems were up and running in the 1940's yet it took over 30 years to develop a mass market mobile phone system (Brown and Green, 2012). According to Katz (2008) mobile communication was arguably the most successful and certainly the most rapidly adopted technology of the 21st Century as more than one of every three people worldwide possessed a mobile phone.The use of mobile phones offers three kinds of mobility. First is the mobility of the user, second is the mobility of the device and third is the mobility of services since they can be accessed from any point. According to ITU (2018) 96 % lived within reach of a mobile cellular network. Furthermore, 90 % of the global population could access the Internet through a 3G or higher speed network.

Evidently mobile telephony had been used widely to facilitate businesses all over the world as cited by Aker and Mbiti (2008); Ratti, Frenchman, Pulselli, & Williams, (2006); Melissa, Hamidati, Saraswati, and Flor (2015);Sankarsingh (2009). Studies have also been conducted by scholars on mobile phone ownership and use by small holder farmers in Ghana and fisher folk in Nigeria as reported by Owusu, Yankson & Frimpong, S. (2018) ; Ifejika and Oladosu (2011). However, there was a call for more research on use of mobile telephones on low income populations and particularity in Africa as stated by May and Diga (2015) there were also concerns over disparities in the geographic rollout of mobile phone in Africa as cited by Sanou (2012).

The benefits of mobile telephony utilization on business transactions were cited in studies by Chhachhar and Salleh (2012);Owusu, Yankson,, and Frimpong (2018); Jensen, (2007).Donner (2004). Therefore studies conducted previously may not necessarily apply to the situation of the Beaches in Lake Victoria, Kisumu County. Furthermore, fishers would require a more time critical transaction given the perishable nature of the fish product. The studies did not highlight the use of mobile telephony in facilitation of banking services. Use of social media and Internet services was also not highlighted well in the previous studies yet they offer a myriad of opportunities for business transactions. While the mobile phone revolution presents enormous opportunity, challenges to cellular access remained. This has been observed by Varshney and Vetter, (2001); Kini and Thanarithiporn, (2004); Kim and Steinfield (2004) and Pramanik (2017). The drawbacks included affordability and lack of infrastructural support, it was important to find out the extent use of mobile telephony was influencing business transactions and if there were factors hindering the optimal use of mobile telephony for business transactions.

The study was interested in establishing whether there was development superstructures and infrastructure in the beaches as a result of utilization of mobile telephony in Kisumu West Sub County of Kenya as a result of mobile telephony utilization. From the spatial economic theory, it is believed that, as mobile telephony, which is a mobile factor of production, is utilized, there are consequent changes on the immobile factor of production, the beaches development in support of the use of mobile telephony for business transactions. Empirical studies that establish the relationship between mobile telephony use and spatial economic development of beaches in Kenya were not found. However, there were general views advanced by different writers on how spatial economic development relating with the use of mobile telephony The views included those of Blauw and Franses (2011); Kang-Rae, Eun Taek Kang (2015); Jekel, Strobl, and

Griesebner (2012); Aker and Mbiti, (2008). These studies focused on use of mobile phone for accessing population distribution and motion patterns and not spatial economic development as a result of use of mobile phone. The methodologies for the studies based on surveys and secondary data from census while the current study used cross sectional and longitudinal research designs. The study sought to find out the nature of businesses that had spawned as a result of used of mobile telephony by fisher communities and was interested on those structures that directly supported mobile telephony use. The study also intended to approve or disapprove the statement by Soludo, Ogbu, and Chang, (2004) that mobile phones have then been absorbed into, but have not transformed, economic structures in Africa.

The endowment of the East African region with rich fisheries resources presents myriad opportunities for economic and social transformation of the local people. The majority of this target population is found in rural communities who rely mainly on mobile phones to access market information (Aura, Nyamweya, Njiru, Odoli, Musa, Ogari, Abila, Okeyo, and Oketch, 2012). Kenya mobile phone ownership in 2017 was 86.15% (Ritchie and Rose, 2017). According to the LVFO (2012) report, mobile telephone network was available at 320 out of the 324 beaches in Lake Victoria Kenya while mobile phone networks increased with 93.6% in the beaches compared with the LVFO 2008 report. Given the availability of telephone network in the beaches in Lake Victoria, it was expected that the fishers in Kisumu West Sub-county were utilizing the technology to enhance their business operations. However, this status was not documented for any beaches in Kenya.

The Kisumu County Strategic Plan 2018 -2022 highlights the importance of ICT and pledges to improve connectivity across the County. The County plans to enhance use of ICT and standardization of trade licensing up to the sub-County levels using ICT. The Kisumu County

plans on ICT would have an implication on the use of mobile telephony given that it is a key medium of ICT connectivity. However, the plans are not explicit on mobile telephony infrastructure which is important for optimal functionality of mobile telephony for business transactions. It was therefore necessary to find out the influence of mobile telephony on business transactions and on spatial economic development of beaches in Kisumu West Sub County Kenya.

1.2 Statement of the Problem

In the 21st Century, approximately one of every three people possesses a mobile phone. However, in Africa, there have been concerns over disparities in the geographical rollout of mobile phones and challenges to cellular access. Fishing, which is a key economic activity in the Lake Victoria region, involves dealing in perishable products which require time critical transactions. In Kisumu County, most of the beaches are characterized by poor roads and poor storage facilities for fish products. The extent to which mobile phones are utilized to mitigate transport and storage challenges in Kisumu West Sub County was not known. This is despite that the fact that, mobile phones are a space adjusting technology which can converge the time and space to overcome the infrastructural challenges. The beaches need both virtual and physical infrastructural development to enable optimal use of the mobile phones yet little is known about the status of spatial economic development of specific facilities like mobile service provider networks, electricity for charging and mobile banking vendor shops. Various studies have examined the adoption and use of mobile telephones with more focus on the penetration of the mobile phones with little attention on how they influence spatial economic development, which was the focus of this study. Other studies have also explored the use of mobile in spatial planning with reference to its use for accessing cellular traffic and population distribution and

motion patterns. These studies are limited in content on exploring mobile phone use and spatial economic development of beaches particularly in terms of superstructures and infrastructure that supports use of mobile telephony for business transactions. The methodologies for the studies were based on surveys and secondary data while the current study used cross sectional and longitudinal research designs. The empirical literature on this relationship is limited and therefore constituted a gap in both content and methodology among the body of scholars. Policies and plans that can make mobile phones a transformative development tool in spatial planning in Kenya are not clearly documented and might have a negative influence on future planning for spatial economic development of fisher communities. The study therefore seeks to establish the influence of mobile telephony utilization on spatial economic development of fisher communities in Lake Victoria, Kisumu County, Kenya.

1.3 Aim of the Study

The main objective of this study was to establish the influence of mobile telephony utilization on spatial economic development of fisher communities in Lake Victoria, Kisumu County Kenya.

1.4 Specific Objectives

The specific objectives are to:

1. Assess the level of mobile telephony utilization amongst the fisher communities in Lake Victoria, Kisumu West Sub-County Kenya.
2. Establish the influence of mobile telephony on the business transaction of fisher communities in Lake Victoria, Kisumu West Sub-County Kenya.
3. Assess the influence of mobile telephony utilization on development of infrastructures and superstructures of beaches in Lake Victoria, Kisumu West Sub-County Kenya

1.5 Research Questions

1. To what extent do fisher communities in Lake Victoria, Kisumu West Sub County Kenya use mobile telephony?
2. How has the use of mobile telephony influenced business transactions of the fisher communities in Lake Victoria, Kisumu West Sub County, Kenya?
3. To what extent has spatial economic development of the beaches been influenced by use of mobile telephony in Lake Victoria, Kisumu West Sub County, Kenya?

1.6 Significance of the Study

Planners, policy makers and scholars need to understand the dynamics of time-space transformations that occur in places and regions as consequence of continuing advances in information and communication technologies. This study provides information on the stride of mobile telephony utilization amongst the fisher communities and provides insights for Strategic Information Technology Planning (SITP). The study sheds light on the influence of mobile telephony utilization on the business transaction of fishers in Lake Victoria beaches in Kenya. It contributes to a much-needed pool of knowledge on technological advancements at the beaches to guide in planning and management of economic activities of fisher communicates as well as infrastructure development of beaches. It provides measures for mitigating the challenges in relation to mobile telephony utilization in transacting business and vital information to the fishing industry as well as the private sector firms and civil society organizations with an interest in supporting technology initiatives among fishers. The study informs policy and practice to help the county government of Kisumu to understand the infrastructural support needs.

1.7 Scope and Limitations of the Study

The study was limited to fisher communities in Lake Victoria Kenya. It focused on six beaches in Kisumu West sub-county on the Lake Victoria shoreline. Kisumu West is the rural part of the

Kisumu County. The main beaches were those with at least 35 fishing boats and had operational beach management units. The fisher community included crew members, fish processors, at the beaches, boat owners and fishmongers. Fisher communities not found within the landing beaches were not included in the study.

Data was collected through questionnaires administered by the researcher. The questionnaires were written in English language and some respondents required translation into local language and this was time consuming. Some respondents also tended to shy away from answering questions relating to income. However, informants were assured of confidentiality and they went ahead and answered questions accordingly. Regardless of this, there was a possibility that they did not give accurate responses. There was some discomfort in answering questions relating to demographic characteristics and finances of which the participants were at liberty to answer or not and they were informed so. Distractions during interviews were experienced especially among the crew members as they had to carry on with fishing at a specified time and therefore they were on the rush. The respondents were persuaded and scheduled meetings at specific times for the interviews and this was time consuming.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviews literature on use of mobile telephony as well as literature on influence of mobile telephony utilization on business transactions. It presents literature on mobile telephony and its influence on income and profits of businesses. It also examines how the use of mobile telephony relates to spatial economic development and its implication for urban planners.

2.2 Mobile Telephony Utilization

The first commercial mobile phones systems were up and running in the 1940's yet it took over 30 years to develop a mass market mobile phone system (Brown and Green, 2012). One of the most striking characteristics of the world we live in today is the increasing use of technology for accessing information and mediating communication. Srivastava (2008) stated that the phenomenal spread of mobile and Internet technologies and applications are extraordinary in any other domain of human activity. According to Katz (2008), mobile communication was arguably the most successful and certainly the most rapidly adopted new technology in the world as more than one of every three people worldwide possessed a mobile phone.

Brown and Green (2012) descrbed mobile phones as a pivotal technological device that represents more than just a new technology because, unlike personal computers, mobile phones are small, mobile, constantly on and potentially constantly connected to the Internet. The mobile phone includes a wide range of different features and technologies which have contributed to its success. The basic features of a mobile telephone includes, sending and receiving calls, telephone book and calendar functionality, mobile short messaging text, graphics and music. The use of mobile phones offers three kinds of mobility. One is the mobility of the user, two is

the mobility of the device and three is the mobility of services since they can be accessed from any point. The study will be interested in all the three levels of mobility as a result of mobile phone utilization and how it influences business transactions of fisher communities.

According to McKiernan (2010), by the end of 2009, there were more than 4.6 billion mobile cellular subscriptions worldwide, This represented ownership rate of 67% per 1,000 inhabitants. The cell phone ownership was nearly universal in the developed world (97 %) and nearly one-half of the developing world (45%) owned cell phones by the middle of 2007. According to ITU (2018), nearly the entire world population, or 96 per cent, lived within reach of a mobile cellular network. Furthermore, 90 per cent of the global population could access the Internet through a 3G or higher speed network.According to Gray (2006), the ingredient, which mostly seemed to have made the revolution of mobile telephony possible, were the prepaid systems, which had lowered the threshold of telephone ownership; transforming millions of poor people with low incomes.Ahmed, Hil, Smith, Wiesmany, Frankenberger, Guliati , Quabili and Yohannes (2007) stated that approximately 300 million Africans are classified as poor and living on less than US$ 1 per day. 120 million were classified as ultra poor living on less than US $ 0.50 per day. The increase in mobile phone subscription was surprising considering the prevalence of poverty in sub-saharan Africa and the price of mobile phone handset and the services. This could imply that mobile telephony is considered a necessary commodity rather than a luxury.

Srivastava (2008) stated that mobile communications narrowed the digital divide and had been a boon to the developing world and were more widespread than any other ICT, that is, personal computers or fixed-line telephones. Citizens had to walk a fair distance before finding a telephone to contact family members or to conduct business before the deployment of mobile phones in rural areas. Aker and Mbiti (2010) stated that mobile telephony had brought new

possibilities in the African content, across urban and rural as well as rich and poor divides by connecting individuals to information, markets and services.

Aker and Mbiti (2008) stated that in Kenya while only 47% of individuals owned a phone, 80% reported having access to a mobile phone through direct ownership or sharing. According to Aker and Mbiti (2008), one third of Kenya shared their mobile phone with friends and relatives, supporting qualitative evidence of providing and the use of mobile phones as a common property resource in Sub-Sahara Africa. Mobile phone ownership in Kenya in 2017 was 86.15% (Aker & Mbiti, 2017). Like most countries in Sub-Saharan Africa, Kenya has experienced a telecommunications revolution, particularly a mobile revolution. It has seen an increase in mobile subscriber numbers, and had innovated in ways that have affected the region and the world (Ndavula and Mdera, 2012). According to the LVFO (2012) report, mobile telephone network was available at 320 out of the 324 beaches in Lake Victoria Kenya while mobile phone networks increased with 93.6% in the beaches compared with the LVFO 2008 report. The penetration of mobile devices, wireless networks and mobile communication services has allowed the Kenyan medium and small enterprises to enjoy efficient communication, payments and marketing systems only available to the huge organizations and government corporations in the past (Wamuyu & Maharaj, 2011). Most rural areas had mobile telephone networks, which come with a number of development benefits in terms of creating employment greater, access to services and increased access to information, hence contributed significantly to economic growth (Wamuyu & Maharaj, 2011). With the growth in ownership of mobile phones and the availability of telephone network in the beaches in Lake Victoria, it was expected that the fisher groups in Kisumu West Sub-county were utilizing the technology to enhance their business operations. However, this status was not documented.

Evidently, mobile telephony had been used widely for different purposes all over the world. Such uses ranged from mapping urban areas to virtual stores. According to Aker and Mbiti (2008) an emerging trend is the development of mobile phone based services and products that go beyond basic voice calls and text messaging. Mobile phone applications provide opportunities for disseminating agricultural price information and transferring money amongst many things. Mobile phone networks have evolved from third generation (3G) to fourth generation (4G) with more sophistication and expansion of mobile application.

In Graz, Austria for instance, researchers worked with a mobile phone provider to map urban areas in the city in real time, illustrating mobile phone traffic intensity and traffic migration and traced users as they moved through the city (Ratti, Frenchman, Pulselli, & Williams, 2006). According to Melissa, Hamidati, Saraswati, and Flor (2015) 549,740 users of Facebook in Indonesia were owners of small and medium enterprises. The SMEs used social media accounts which they accessed through mobile phones and allowed their products to be showcased in virtual stores thus eliminating the need to have a physical store. In this case, social media was used not just to find friends but to conduct business. In light of the social media, the study focust on the extent of use of the social media by the fisher communities given that it offers a lot of opportunities for marketing and networking for business.

Sankarsingh (2009) stated that mobile phone ownership among fisher folk in Trinidad and Tobago was used for dual purpose as an instrument for personal safety while at sea, even in light of poor cell reception and as a tool on land allowing fisher folks to buy and sell not only fish but critical products necessary to their livelihood. In Trinidad and Tobago fishing, extension officers used Bluetooth technology in mobile phones to distribute learning content to fisher folks with literacy challenges. The mobile phone was beneficial for business as well as for safety while at

sea. Similarly, mobile phone utilization was considered in the current study on how it influenced crew members' safety at sea but the study did not focus on mobile phone use for distribution of learning content.

Studies have also been conducted by scholars on mobile phone ownership and use by small holder farmers in Ghana and fisher folk in Nigeria. Owusu, A. B., Yankson, P. W., & Frimpong, S. (2018) examined gender disparities in mobile phone adoption and use for agriculture and off-farm income generation among local smallholder farmers in Ghana. The finding was that a large percentage (87%) of the farmers owned and had access to mobile phones in their households. The findings showed that more farmers had adopted mobile phones compared Ghana Statistical Service (GSS, 2014) that found only 38 per cent of households used mobile phones in the districts. The 13% who did not own mobile phones were 9 % female farmers and 4 % male farmers. Although the study did not target fisher communities, the gender disparities and use of mobile telephony were similarly considered in the current study.

A study was done by Ifejika and Oladosu (2011) on **c**apability of fisher-folk to use mobile phone facilities for effective extension advisory services around Kainji Lake Basin, Nigeria. The findings in regards to uses of the leading ICT was that, mobile phone was owned by 100 percent of respondents followed by radio (75.0%) and radio cassette player (55.0%) whereas the least were internet and computer (0%) respectively. The rate of mobile phone ownership was attributed to access to mobile service network, cheap and available handsets supported by value and importance attached to communication and information. The study found that there was a high proportion of fisher-folk (68.5%) who were illiterate which comprised of primary and no schooling. Ifejika and Oladosu (2011) also found that illiteracy was a limiting factor to capacity of fisher-folk to use different mobile phone functions for extension communication.

Salia and Steel (2011) assessed the influence of mobile phone use on the artisanal fishing industry in the Effutu Municipality of Ghana. The approach used was 'before' and 'after' where 240 fishermen and their supply chain actors were sampled. The findings revealed four specific factors that influenced fishermen to obtain mobile phones. These included cost reduction, safety, business coordination and market expansion factors. The explained factors were more of determining the choice of phones rather than explaining the level of use of mobile phone already owned by the fishers. The current study considered the cost, safety, business coordination and market factors in regards to how mobile telephony ownership and use was influencing them.

The conclusion by Ifejika and Oladosu (2011) was that fish information was important to the fisher-folk in the Kainji lake basin because of the sedentary nature of their production. The current study was also interested in finding out the level of ownership of mobile telephone amongst fisher communities. Most of the other ICT services like radio are now features in mobile phones whose status the current study also sought to establish. Owning mobile phones has a wider range of services including radio, video as well as internet social media, and money transfers which the current study will explore. Smart phones today perform the functions of a personal computer and the study will be keen to know the level of smart phone ownership. The current study would also look at the literacy levels versus use of mobile telephony and if there was any relationship. The endowment of the East African region with rich fisheries resources presents myriad opportunities for economic and social transformation of the local people. The majority of this target population is found in rural communities and they rely mainly on mobile phones to access market information (Abila et al., 2012).

According to International Telecommunication Union (ITU) (2003) ownership of mobile phones implies that an individual has in his or her possession, the mobile phone device. Warschauer

(2004) also stated that ownership of an ICT device would be one of the ways to gauge ICT access. Alampay (2006) in support of Warschauer stated that access to a basic good is a prerequisite to use. Zheng (2007) stated that individual differences, capabilities and choices play a role in whether people make use of these goods, how they apply them, and how they are valued. The diverse arguments provided the basis to determine level of utilization of mobile telephony in terms of possession and use as well as the choices for different uses for social purpose or for business purposes.

May and Diga (2015) stated that there had been many cases and research around the usage of ICTs especially mobile phones in developed countries but few attempts have been made to measure ICTs among low income populations Leon, Rahim and Chib (2015) also stated that few studies have tried to understand cost savings and changes in business outputs among the poor as a result of using mobile phone. According to Aker and Mbiti (2008), there were no empirical studies of the impact of mobile phone use on supply chain management in Africa. Access and ownership of ICT indicators have been determined but understanding the depth of mobile phone usage has not been well understood (May and Diga 2015).Scholars have indicated the need for more research on use of mobile telephone on low income population and particularity in Africa and the depth of mobile phone usage on supply chain management of the fisher communities in Kisumu West Sub county which is in the rural part of Kisumu County of Kenya.

From the literature reviewed on the studies, not much was noted on the digital divide or on the disparities in the geographic rollout. Sanou (2012) stated that despite the significant growth of ICT over the past decade, Africa still lagged behind other regions both in terms of percentage of people with access to the full range of communications services and the amounts and manner in

which they were to be used. There had been huge disparities in the geographic rollout of mobile phone coverage, prompting concerns over and intra-African digital divide. This study was interested in confirming the status of the digital divide in terms of how many fishers had access to the full range of mobile telephony services and to what extent they were being used. The goal was to provide mitigation for the drawbacks to full utilization of mobile telephony for business transactions.

The global trend was indicative of surpassed projections on penetration rates and it was imperative to establish the level of utilization and whether it was in line with global trends. The literature review was indicative that the mobile telephony was volatile and new developments in technology coming up that went beyond the voice calls and messaging. Of particular interest was the level of Internet use, use of GPS and marketing information systems. Of essence also was to find out whether fishers were enjoying mobility, connectivity and flexibility of activities in a time and space convergent environment.

2.3 Influence of Mobile Telephony Utilization on the Business Transactions

Aker and Mbiti (2010) identified five potential mechanisms through which mobile phones can provide economic benefits to consumers and producers in Sub-Saharan Africa. The first is by improving access to, and use of information thereby reducing search cost. Secondly, economic benefits can be achieved by improving firm's productive efficiency by allowing them to better manage their supply chain. Thirdly, is by creating new jobs to address demand for mobile related services. The fourth way to achieve economic benefits is by facilitating communication among social networks in response to shocks, thereby reducing exposure to risks. Lastly, mobile phone based applications have the potential to facilitate the delivery of financial real time services. The five mechanisms form the core for business transactions and bridging the gap

between the buyers and the sellers in the fishing economic activities. In brief, they involve communication, management of business, addressing demand and the market networks. These in turn, facilitate the achievement of the desired outcome in the fishing business which is increased profit and income.

The fishing business activities would include information search including prices for fishing supplies, prices of fish in other beaches, contacts of potential buyers, information on mobile banking amongst others. Traditional search mechanisms included personal travel, letters, newspapers, television and radio. Personal travel requires transport medium and opportunity costs which can be relatively high with combination of long distance and poor roads (Aker and Mbiti, 2008). Most of the traditional search mechanisms can now be accessed through the mobile phone which provides immediate real time information as opposed to personal travel.

Fisher communities need market information and intelligence to facilitate their businesses activities and mobile telephony has the potential to provide this need. The use of mobile telephony for market information is highly iterative and continually evolves as a function of dynamic market environment. Given the volatility of mobile telephony technology and the myriad of opportunities that it poses for business transactions, it was imperative to examine the literature and studies on influence of its use on business transactions in the world.

Chhachhar and Salleh (2012) conducted a study on fishermen in Pakistan to assess how the mobile phone has improved the life of fishermen and increased their income. The findings revealed that mobile phone has given a ground to fishermen to communicate with dealer at port and deal for good price of their catches. Similarly fishermen got latest information about the weather before going to sea. By using mobile phones, fishermen had saved their time and also

their income. Mobile phones have also reduced the gap between rural and urban communities as fishermen directly sold their produce in market without dealing with local brokers. Utilization of mobile phones had provided fishermen with option to take processes to reduce the risks especially in cases of emergencies when fishermen were in sea. This study revealed positive uses of mobile phones and how it helped the fishers to get information and to circumvent the brokers who would hinder maximization of profits which should compare with the current study.

Owusu, Yankson & Frimpong, S. (2018) examined gender disparities in mobile phone adoption and use for agriculture and off-farm income generation among local smallholder farmers in Ghana. The finding on the benefits and perceived impacts of mobile phone use in relation to agriculture and related uses of mobile phones was that over 80 % of the farmers owning mobile phones also reported that ownership of mobile phones reduced their market transaction costs. The conclusion was that access to mobile phones, bridges the gap between production and consumption centres, as it eliminates communication gaps that would have persisted due to the existence of deplorable road conditions and high transport cost. The current study was also interested in finding out how use of mobile telephony influenced the transactions between fishers and their networks and whether there were any savings made as a result of use of mobile phones for business transactions.

The findings by Owusu, Yankson, and Frimpong (2018) was also that farmers contacted other farmers or traders about prevailing market prices which enabled farmers to know the prevailing market prices of agricultural commodities in various markets within the district, and thus enabled them to negotiate and sell produce at, 67.5% better competitive prices and improving income by 89%. The conclusion was that access to mobile phones, bridges the gap between production and consumption centers, as it eliminates communication gaps that would have persisted due to the

existence of deplorable road conditions and high transport cost. The extent to which mobile phones bridged the gap between the fishers communities in Kisumu West Sub-County and the main markets was of essence given that the road conditions in the current study area were also reportedly in deplorable condition and therefore mobile telephony would help them overcome the distance challenge of distance.

Jensen, (2007) examined the influence of mobile phones on fisheries sector in Kerala, India, using 300 sardine fishing units between 1996 and 2001. The results revealed that expansion of mobile phone coverage lead to a significant reduction in the dispersion of fish prices across markets as well as a decline in waste. Using standard multiple regression model, the overall estimates showed some variations in the magnitude of the influence across the regions. There were also welfare improvements for fishers whose profits increased by 8 percent. The gains were associated to diversification increase with distance, but the time required to reach one spot from another was also long. The findings also revealed that there were some hitches in the use of the mobile phones communication from one place to another. First, the design used was short of explanations of the changes that took place between the periods. The period of the study is also long and overview with the new phone features that have arisen due to new inventions. This justified the choice of the present study to clearly explain the influence of mobile phone utilization on the business transactions using a cross sectional design and longitudinal research designs.

A case study of the commercial fishing industry in Australia was carried out using a value added approach with Tasman Global Computable General Equilibrium model of economy to estimate the macroeconomic impact of spatial information in 2006 to 2007. Using a series of case studies, the findings indicated that GPS plotters had improved productivity of commercial fishing

operations by 12 percent. Allowing for levels of adoption and limiting this to the fin fishing industry was estimated to have produced a 4% improvement in total factor productivity in the fishing industry (Tasman, 2008). The case study was not clear on GPS plotters and mobile telephony. The current study was interested in use of GPS through mobile telephony and if it influenced business transactions of fisher communities.

A study was conducted in Tanzania on the influence of ICT use on small businesses using a qualitative quasi experiment over time. The study was conducted by randomly selecting groups of small businesses in two similar towns. In one town, the businesses were given free mobile handsets and airtime as well as free Internet access; the other town received none (Mascarenhas, 2014). Both towns started with similar poverty level of 55%. The finding after the implementation of the experiment was that the town with ICT intervention had poverty drop to 16% while the similar town with no ICT provision saw poverty drop to 38.9% (Mascarenhas, 2014). Use of mobile telephony in business transactions were found to lead to improved income and profit thereby causing a drop in poverty levels. Similarly, in the current study the use of mobile telephony interventions are expected to lead to improved transactions. These ultimately improve income and profits and have a multiplier effect on the development of beaches.

Donner(2004) conducted a survey in Kigali Rwanda on 277 mobile phone owners who also owned businesses. The main aim was to determine how the use of mobile phones by micro-entrepreneurs in Kigali, Rwanda led to changes to Social and Business Networks. In conclusion, the study deduced that mobile telephones had an impact on microenterprises since entrepreneurs developed new business contacts and expanded their social and business networks. Donner (2004) study focused more on the changes in social and business setting and networks as a result of mobile phone usage. It is essential to note that the study had a general target of entrepreneurs

without specific focus on which type of business. Such findings may not make much sense to the fisher's community due to diversity in businesses, and besides, social and business networks may not clearly indicate income and profit of the entrepreneurs as generalized. It was therefore pertinent to establish the influence of mobile phone utilization on business transaction among the fishers in Lake Victoria region.

Okello, Osamba and Parsitau (2015) conducted a study in Homalime and Kendu Bay Zone of Lake Victoria in Homabay County, Kenya to find out the Challenges Facing the Fishing Industry. Using cross sectional research design, the findings was 54.8% of respondents indicated that lack of banking facilities hindered them form saving money. Most banks were situated in towns such as, Homabay, Kisii and Kisumu which were far from the fishing areas. Reaching the banks meant spending money for transportation to the towns. Mobile banking using mobile phones has the potential to mitigate the banking challenge.

Mobile phones provided technological services that reduced costs; increased income and increased reach ability and mobility. In a market with a highly perishable commodity, such as fish or vegetable, lower search costs were to coincide with less wastage which was Pareto-improving (Aker & Mbiti, 2010). Mobile phones thus helped to extend social and business networks and they clearly substitute for journeys and for brokers, traders and other business intermediaries. A key factor in any business transaction is the banking avenue in whatever level and capacity which most of the studies in the literature reviewed did not highlight.

Mobile phone based applications have the potential to facilitate the delivery of financial real time services In Kenya mobile money service M-Pesa was introduced in 2007 as a financial application package. The mobile phone based banking in Kenya is known as MPESA and is an

application that facilitates a variety of transactions for its users such as purchasing airtime, transferring money and paying bills (Aker and Mbiti, 2008).The emergence of M-PESA service, a text messaging (SMS) provided the solution to small businesses' banking needs for the majority of the Kenyan population, because the majority did not hold bank accounts but had the services of mobile phone. They could settle bills by building up credit on the mobile phones then send a text message to make payment (Chogi, 2006). The mobile money transfer system, M-PESA was an innovative mobile payment solution that enabled customers to complete simple financial transactions by use of mobile phone (Hughes & Lonie, 2007). Some of the uses of M-PESA included payment for trading between businesses; secure money transfer for people journeying between places; sending airtime; send money for various ad hoc reasons; save money. According to Oteri *et al*., (2015), a higher volume of mobile money transaction was recorded in Kenya indicating the increased popularity of mobile money transfer services. This study was interested in finding the extent of use of mobile banking in facilitating business transaction of fisher communities since they deal in perishable products that require time critical transactions.

Another mobile phone based applications package that was developed to support business transactions of fishers was the Electronic Fish Market Information System (EFMIS).According to Aura, Nyamweya, Njiru, Odoli, Musa, Ogari, & Oketch (2015), the Enhanced Fish Market Information Service (EFMIS) a pilot project based on mobile phones, was implemented in Kenya and Uganda. The system involved generating, packaging and disseminating essential market information from fish landing sites around the lakes and marine sources and markets in major urban areas across the participating countries. The aim of EFMIS programme was to indicate the landings in terms of species and prices at beaches and markets. This was to ensure that fishers could locate where wholesalers paid the best prices and boat crews could cut deals while at sea.

The EFMIS system consists of three broad phases: data recording, coding and transmission from landing sites and markets to the data centre; a central database for recording the information; and an automated query response system (Aura et al., 2019). Data was recorded at the landing sites and markets and relayed by phone Short Message Service (SMS) in a coded format to a data centre based at KMFRI in Kisumu County, Kenya. To obtain the information, a user had to send a query by SMS to the data centre from a mobile phone through a dedicated number (short code) and got an automatic response within 10 seconds. The system was active for 24 hours every day and could be accessed from any part of the region where there was a cellular network (Aura et al., 2019). The current study was interested in finding out the extent to which EFMIS was used by fisher communities to facilitate their business transactions in terms of getting adequate information on fish prices at different places in order to get the best prices for their fish products and hence maximize profits.

While the mobile phone revolution presents enormous opportunity, challenges to cellular access remain. Varshney and Vetter, (2001) identified network reliability as a technical requirement that needs to be in place for mobile applications to work properly. Kini and Thanarithiporn, (2004) found access speed and availability to be the two drivers for the adoption of mobile commerce, while Balasubramanian, Peterson, and Jarvenpaa (2001) and Varshney, Malloy, Jain and Ahluwalia (2002) found that coverage and reliability of networks impacted the usefulness and feasibility of mobile information systems. Kim and Steinfield (2004) found that connection quality had an impact on user satisfaction and continuing intention to use mobile services. According to Pramanik (2017), mobile phones are still expensive for those living in low and middle income countries: the median mobile phone owner in Africa spends over 13 percent of their monthly income on phone calls and texting. Mobile phone-based development projects are

often based on the assumption that mobile phones can improve communication, coordination and service delivery. The use of mobile phone technology in these contexts may however not always be Pareto-improving. According to OECD (1998) the rapid development of new technologies in the information age was a source of problems for the old socioeconomic structures until society and social institutions are able to match perfectly with them. If there is technological advancement without social advancement, there is almost automatically an increase in human misery. Adeya (2003) found that small scale businesses lacked the awareness regarding the potentials that exist in the use of mobile phone and ICTs. Availability of ICT alone is not sufficient to produce positive regional development. Other preconditions include the promotion of public awareness of the potential of the information society (European Commission, 1999). According to Aker (2009), simple and affordable mobile phones were being used as a means of promoting literacy for adults in Africa but despite the fact that text messages were one-seventh the price of voice calls in Niger, the use of text messages had been relatively limited in part due to high illiteracy rates. It was important to find out the extent to which use of mobile telephony was influencing business transactions and if there were factors hindering the optimal use of mobile telephony for business transactions.

The benefits of mobile telephony utilization included improved access to information, reduction in price dispersion particularly of fish products and increased profits. It was therefore pertinent to find out whether the same influence was evident among the fisher communities in Kisumu West Sub-County. When it comes to technology, each environment has a unique experience in adoption and use. Therefore studies conducted previously may not necessarily apply to the situation of the Beaches in Lake Victoria Kisumu County. Furthermore, the fishers would require a more time critical transaction given the perishable nature of the fish product. The

studies did not highlight the use of mobile telephony in facilitation of banking services. Use of social media and Internet services was also not highlighted well in the previous studies yet they offer a myriad of opportunities for business transactions. Mobile telephony was noted from the literature as particularly beneficial for reduction of the level of wastage of fish commodity and it was necessary to find out if that was the case for the fishers in Kisumu West Sub –County of Kenya.

2.4 Mobile Telephony and Spatial Economic Development

The ultimate objective of this study was to establish whether there was spatial economic development of Beaches in Kisumu West Sub County of Kenya as a result of mobile telephony utilization. In this section of literature review we examine literature on mobile telephony and spatial development. From the spatial economic theory, it is believed that, as mobile telephony , which is a mobile factor of production, is utilized, there are consequent changes on the immobile factor of production, the beaches development in support of the use of mobile telephony for business transactions. As transactions occur, the distance between the fishers and the market is converged as a result of mobile telephony use. There is therefore a clear connection mobile phone utilization and spatial economic development in the study as put forth by the spatial economic theory and time space convergence concept. The study therefore reviewed previous information on the interconnection of these variables in an attempt to find out what was covered among the scholars.

In the 1990s, higher income led to an early diffusion of mobile technology among developed countries, although no causal relationship was visible in the emerging and developing countries. Second, the worldwide spread of the mobile technology in the 2000s began to promote the growth of per capita GDP not only in developed countries but also in emerging and developing

countries such as African nations. Consequently, it seems reasonable to conclude that mobile technology, which prevailed only in the wealthier nations in the 1990s, has turned into a driving force of worldwide economic development in the 2000s (Shinozaki & Urakawa, 2017). It was imperative to establish in the current study how it influenced spatial economic development in Kisumu West-Sub County that is considered poor compared to other regions in Kenya.

According to Talvitie(2003)telecommunications were to in the future, organize regional and urban structures similarly to automobile traffic and that the list of factors, which would have an impact on planning because of the application of ICT, was long. It included the mix of home and work, the development of new lifestyles, 24/7 phenomenon, greater freedom in the location of activities and the growing importance of the quality of places, the virtual function, special requirements for the locations of businesses of the new economy, effects on the activities of companies of the old economy.

According to the Perspective (1999), some of the criteria and indicators of spatial development include changes in population numbers; changing nature and location of economic activities; technological changes in transport and telecommunication; changes in policies and projects; urban networks, partnerships and relationships with customers abroad. This study focused on the physical and virtual structures that had developed as a result of use of mobile telephony for business transactions. This entailed bringing the relationship between use of mobile phones for business transactions and the supporting infrastructural development which are in line with changes in location of activities and technological changes in communication. Empirical studies that reveal the relationship between mobile telephony use and spatial development of beaches were not found. However, there were general statements made by different writers on the

relationships between mobile telephony and spatial development without empirical research thereby introducing a methodological gap in the study.

Blauw and Franses (2011) conducted a study on the impact of mobile telephone use on economic development of households in Uganda adopted a simple and multiple linear regression models to model the relationship. The findings revealed that in case the proportion of users in a household increases with 50%, the development increases with 1%. The findings indicated the changes in development based on use of mobile phone use, but the nature of development that occurred was not clearly captured.

A study on using cellular network data for urban planning was carried out by Becker, Caceres, Hanson, Loh, Urbanek, Varshavsky, and Volinsky (2011). The study explored the use of anonymized Call Detail Records (CDRs) to capture city dynamics. The study captured transactions carried out by the 35 cell towers located within 5 miles of the center of Morristown, NJ, a suburban city in the greater New York City metropolitan area. The goal was to capture cellular traffic in and around the town and choosing the 5-mile radius allowed enabled covering both Morristown proper and its neighboring areas. The study collected voice and SMS traffic for 60 days at least 15 million voice CDRs and 26 million SMS CDRs for 475,000 unique phones. The study findings revealed that cellular network data enabled the city planners to determine the geographic distributions of home location of workers, capture life beat of a city and clustering of a city residents and visitors based on their cell phone usage using a novel application of an unsupervised clustering algorithm. The findings of the study indicate the mobile phone assisted in mapping the human traffic on land. However, the spatial development as a result of mobile phone use was not mentioned in the study, with regard to the economic development. However the issue of using mobile telephony to capture cellular traffic was of interest since it can provide

an indication of usage of space for business transaction and can guide future planning of the beaches.

Kang-Rae, EunTaekKang (2015) conducted a study on the changing relationship between commuting time and distance in the Seoul Metropolitan Area (SMA) by using the 1990, 1995, 2000 and 2005 two-percent sample data of the Korean Census of Population and Housing. The finding indicated that commuting time per distance unit in the SMA shortened over the 15 years of the study period, and this improvement was greater for longer journeys than for shorter trips. Time space convergence concept was used by Kang-Rae and Taek (2015) for analysis of transport in terms of commuting time while in the current study the focus was on communication time.

Jekel, Strobl, and Griesebner (2012) also explored the application of mobile phone data for exploring population distribution and motion patterns and distribution dynamics and stated that mobile phone data was a source for discovering spatial activity and motions. Global positioning system (GPS) and cellular technologies enable mobile electronic devices that are capable of measuring their position on the Earth's surface, and of modifying the information they collect and present based on that knowledge (Goodchild, 2002). Planners could use environmental sensing data to consider issues of environmental justice and setting of new industrial facilities, among others (Evans-Cowley, 2010).Massachusetts Institute of Technology (MIT) depicted urban motion dynamics when they carried out the first well-known exploration of mobile phone location pattern (Ratti *et al*., 2006). The first serious application of a mobile phone location system was carried out in 2010 supporting the disaster management efforts after the earth quake in Haiti. This study provided a basis for future exploration of use of mobile phone location information as proxy for personal location information. Global positioning system can also be

used by the fisher community while at sea for location during situations of distress and therefore can support the fisher communities in their fishing activities to enhance safety and manage disasters.

According to Aker and Mbiti, (2008) the mobile phone sector has spawned a wide variety of businesses and entrepreneurship opportunities in the information sector. Many of the employment opportunities are directly related to the specific business strategies of mobile phone companies in Africa including phone credit distribution networks created in partnerships with formal and informal sectors. Numerous small scale shops have been set up to sell, repair, and charge mobile phone handsets. The study sought to find out the nature of businesses that had spawned as a result of use of mobile telephony by fisher communities for transaction. Of specific interest were those structures and infrastructure that directly supported use of mobile telephony. The study set out to approve or disapprove the statement by Soludo, Ogbu, and Chang, (2004) that mobile phones have then been absorbed into, but have not transformed, economic structures in Africa. Soludo *et al.*, (2004) only developmental states in Africa can leverage the positive developmental potential of mobile phones and other new ICTs to achieve wider economic transformation.

In a comparative study on e-business between China and India, Raven, Huang, and Kim (2007) revealed that even though both countries had access to the information technology at about the same time, each has taken a different path, which dramatically involved both government and business contributions. The approaches were based on a number of factors including government initiatives and focus, infrastructure building, experience and understanding of business operation, and culture among others. This study was however done from literature data on existing online platforms and short reports whose source was in doubt. Though the

comparison between the two countries may appear to date, it was not clear how the development on the two countries was measured. Besides, the study dwelt more on the access to information between the two countries using information technology and not specifically mobile phones.

Buys, Dasgupta, Thomas and Wheeler (2009) found that probability of having a phone tower in a particular location was strongly and positively associated with potential demand factor, such as population density and per-capita income as well as the competitiveness of the mobile phone sector within the country. The factors associated with high costs of installation of masts included, topology and distance from the main road and urban centres and that these factors partially explained the rollout of mobile phone service provision within countries. Roller and Waverman, (2001) also found that there must be a certain level, "critical mass", of telecommunications infrastructure corresponding to a 40% mainline penetration rate to bring about maximum growth influences. So while developed countries tend to have enough infrastructure to bring about higher growth rates, developing countries have not usually achieved the critical mass and therefore grow more slowly. This contributes to divergence in economic performance. Based on these findings, they argue that convergence in telecommunications infrastructure would offset growing economic inequality. The status of both physical and virtual infrastructure that supports the use of mobile telephony in business transactions was of essence because mobile telephony can only be useful with necessary infrastructural support.

Townsend, (2004) presented a provocative perspective on emergent behavioral practices of urban residents and raises concerns that required consideration by planners and policy-makers. The concern was about the link between ICT use at individual, household and firm levels and the changing land-use patterns and trip distances within metropolitan areas. It was assumed that in principle both trends were possible because ICT gave more freedom for the location of different

activities and the outcome depends on how this freedom was applied. Mobile Telephony is a major space adjusting technology as wireless communications can allow the making of connections by fishers at any place at any time where the service is offered. In line with the spatial economic theory, this could mean freedom in the location of activities as a result of mobile factors of production which essentially include capital and labour factors. In the context of the study, some trips to the beaches and to the markets would be virtual and not physical.

According Doxiadēs, (1966) the world was to grow dynamically interconnected, in one continuous network, into one universal city, which he called ecumenical city, the city of the completely inhabited earth, or ecumenopolis. The unique city of man was to form a continuous, differentiated but also unified texture consisting of many cells in the human communities. Depending on how well these cells are interconnected into an organic whole, a successful system that will provide man with much greater horizons and give new dimensions to his life, was the prediction of Doxiadis. The spatial economic theory considers the influence of technology on the distance and space as a mobile factor of production. Time space convergence introduces the aspect of time and distance or space converging. Both the theory and concept confirm the prediction by Doxiadis of ecumenopolis, a continuous network. The study was interested in the space of the beach and distance to its main market and networks and how mobile telephony had influenced the relationship of fisher's interactions.

According to Strategy & Unit (2005) the Geneva Plan of Action paragraph 6 indicated 10 targets to be achieved by 2015 that included the impact of ICT access, especially in poor and rural communities and the promotion of ICT applications that can support sustainable development. This study will provide some incites to the extent that this had been achieved in the study area.

The Kenya government's recognition of the strategic role played by ICTs in the economy was an important aspect of the implementation of *Vision 2030*, the country's development blueprint. Vision 2030's key goal is that Kenya will be one of the top three investment destinations in Africa by 2030. This will be achieved by addressing three pillars – Economic, Social and Political. ICT is explicitly dealt with under the Economic Pillar, which is geared towards attaining prosperity for all Kenyans through an economic development programme aimed at achieving an average GDP growth rate of 10% per annum over the next 25 years (Msimang, 2011).The National Oceans and Fisheries Policy (NOFP), 2008, is the current policy document in use in Kenya. The policy provides a coordinated framework to address the challenges facing the fisheries sector and guides the sustainable development of fisheries. However, the strategy did not include the role of ICT in addressing the challenges facing the fisheries sector. The Kisumu County Strategic Plan highlights the importance of ICT and pledges to improve connectivity across the County. The County plans to enhance use of ICT and standardized trade licensing up to the Sub-County levels. The Kisumu County plans on ICT would have an implication on the use of mobile telephony given that it is a key medium of ICT connectivity.

There have been several gaps identified from the literature with regard to policies and plans relating to spatial economic development and utilization of mobile telephony. Talvitie (2003) stated that, because of the rapid development of ICT, the examination of spatial effects of ICT applications were to be a short-term exercise. This exercise, however, was necessary or else planners would be caught unawares with the rapid and sporadic developments in ICT. The general gap between research knowledge and the information needs for formulating policy recommendations is a stark admission that the urban form implications of ICT adoption remain highly uncertain (Janelle & Gillespie, 2004).

Planning consequences of mobile telephony may be treated as an urban navigational tool as this may enable researchers find answers to the question of whether mobile phones lead to creation of new mental maps, intangible information cues that had typically been the realm of Web designers. There was evidence that mobile phone usage had proliferated in a variety of sectors all over the world and the objective, target group and use in each project differed significantly. Specifically, for the current study, it was imperative to find out the influence of mobile phone use on the spatial economic development of beaches in terms of the physical and virtual structures. The development of wireless communications systems may provide new possibilities but their availability and costs were not equal in all areas such as small communities and sparsely populated areas. There was immense uncertainty about the understanding of the impact of ICT among planners and scientists and it is difficult to understand the impact of ICT on spatial development (Talvitie, 2003). If planners are not aware of how a good ICT-infrastructure and service standard may affect the development of their planning area, they can easily miss the opportunity to guide the development.

Mobile telephony had changed the meaning of spatial planning in the context of space, place, distance and time. In many cases; distance will no longer be a problem when one can transmit information via telecommunications networks. Policies and plans that can make mobile phones a transformative development tool in spatial planning in Kenya are not clearly documented. It was not known how mobile phone utilization for business transaction would affect the future land use patterns in the beaches of Kisumu West Sub-County. It was therefore necessary to establish the dynamics that use of mobile telephony imposes to enable strategic spatial planning and management of beaches in Lake Victoria Kenya. From the literature review, some scholars indicated that mobile telephony had not led to a transformed economic structure and the aim of

the study was to verify the notion that the technology had been absorbed but was not transformative to the spatial development. Literature does not provide how the virtual markets necessitated by the use of mobile telephony interns affect the spatial set up of beaches in a rural set up.

2.5 Theoretical Framework

The study used spatial economic theory and time space convergence concept to help understand the relationships of the mobile telephony utilization which is an independent variable and business transactions and spatial economic development of beaches which are dependent variables. Spatial economic thinking was first explained in the work of nineteenth-century German economist Johann Heinrich von Thunen who is known as the father of spatial economics. Johann Heinrich von Thunen (1826) stated that distances to the market determined farming specialization even in a perfectly uniform setting. Kasper (1994) stated that Thunen laid the basic logic of how producers distribute themselves in space and that the owners of mobile production factors, such as capital and technical knowledge, have to be paid the same return whether their assets are employed in the cetre of activity or on the periphery, at a distance from the central marketplaces.

Spatial economics theory is centred on the problem of uneven distribution of factors of production and the role of distance. The factors of production can be either mobile or immobile. Economic activities are concerned with bridging the space between buyers and sellers because they are dispersed in space and overcoming the distance between them can be costly. Transport and communication are key to bridging the space between buyers and sellers and improvements in transport and communications have been among the main driving forces of economic

progress. According to Kasper (1994), spatial economic theory is an approach that considers the role of space in the functioning of society.

Thunen's principles of spatial economic theory were demonstrated at three levels of locational analysis. One level is in a city or region, real estate rents which drop as one moves away from the centre of activity. The second level is within a nation, where landowners and workers can earn high location rents if they operate in the central areas of economic activity for instance cities and towns. Mobile factors crowd in and make intensive use of land and labor, and people earn high incomes. The third level is on a global scale where mobile and immobile inputs are combined most intensively and with the highest productivity. According to Kasper (1994), the new transport and communications technologies raised the mobility of capital, human, financial, and physical entrepreneurs, and entire firms to extraordinary levels.

According to Logan (2012) the other scholars who developed Thunen's theory of spatial economics further included Alfred Weber in 1909 who developed a coherent theory of industrial location. In early 1930s Walter Christaller and August Lösch brought in an understanding of the location of service activities and the nature of urban networks. Logan (2012) added that geographers tried in the late 1950s and 1960s to develop a more systematic view of their scientific enterprise, and decided that geography should become a discipline of distances. The functional approach to social problems through the analysis of distance was fruitful. Its role in planning theory and practice was essential during the 1960s and 1970s. It allowed for the design of well-organized cities or suburbs. However, it did not prevent, the development of urban pathologies. In order to understand them, other approaches to the role of space in social life had to be developed Logan (2012).

It was in the late 1960s that geographer Donald Janelle analyzed the intuitive notion of a shrinking world and introduced the notion of time-space convergence. According to Jenelle (2001) Human geography is significantly a part and product of the effort required to overcome distance where distance refers to time distance and cost distance. As communication times between places shrink due to advancement in information technology, they may be said to move closer to each other in time-space or time distance. The communication time between two places is the amount of time needed to exchange information between two places using the communication medium available. The distances between places are not defined as metric distances but as time-distances needed to cross the physical distance between them. With these notions, it can be shown that, although the absolute metric distance between places is fixed, the time distance between many places in the world has been shrinking steadily over the past two centuries (Brey, 1998).

According to Janelle & Gillespie (2004) four interrelated general concepts were fundamental to understanding the time space adjusting technologies and the processes that alters states of regional and community organization. The concepts included time space convergence time space compression and human extensibility. Time-space convergence is analogous to the physical concept of velocity and purports to assess the earth-shrinking impact of technological investments to overcoming distance. The notion of time-distance can be used as a measure to give quantitative content to the notion of a compressed world which was attributed to the occurrence of time-space and cost-space compression processes to space-adjusting technologies. According to Janelle and Gillespie (2004), the ability of capital to shift resources to different places easily and often with impunity to the disruption of life at the local scale, suggest that time-space compression may denigrate the importance of place in human society. Human

Extensibility is a concept advanced by Janele in 1973 and refers to the ability of an individual or agency to extend their influence and presence over space and through time to distant locations via media and other means of influence over human resources. These processes permit the restructuring of human enterprise at all geographical scales and reduce, if not subvert, the usual constraints based on distance, spatial contiguity and temporal continuity. These processes also have fundamental bearing for relationships among localities, regions and centres of global capital; for the spatial structures of communities, cities, metropolitan areas and regions. According to Green (2002), mobile technologies introduce opportunities for new continuities across space and time, previously disjoined through centralization.

Prykhodko (2018) supports the theory by noting that it is possible to distinguish the difference in the country regions development by its application. The value addition of the study by Prykhodko (2018) was that the highlighted theoretical positions could also be used for further study of theories of spatial economics. The study by Prykhodko therefore provides evidence that the theory has been used in other studies but the context was not similar to that of the current study. However, Durlauf and Blume (2008) observe three main problems that remain open on the theoretical front of spatial economic theory. The first is lack of a unified general equilibrium approach to spatial economics and the often uneasy coexistence between urban systems and the new economic geography. A second challenge regards the micro foundations of trade costs. Trade costs play a fundamental role in many models but their microeconomic foundations have received only scant attention. This will probably involve looking beyond transport costs and open the black box of the multiplicity of transactions costs associated with trade between different parties. A third major challenge according to Durlauf and Blume (2008) regards the

development of a 'theory of proximity' which would provide some answers as to why direct interactions between economic agents matter and how.

The gap between spatial economic theory and the concept of time space convergence is that, the time space convergence concept introduces the time aspect of the distance. The theory looks at three levels of space city, national and global while the concept looks at one level of space which is a result of globalization brought about by the advancement of ICT. The theory, on the other hand, considers the aspects of both mobile and immobile factors of production. The current study was interested in the mobile factors of production including capital and technical knowledge which were key constructs in the spatial economic theory initially advanced by Thunen. Mobile telephony, which is a mobile factor of production, is one of the most widespread ICT, in the 21st century working in the global space. The three space levels of city, national and global in the spatial economic theory have since been absorbed intuitively into one global space.

The common factors in both the theory and concept is the distance between geographical locations and the communication between them using a space adjusting technology which is a mobile factor of production. The theory and concept guided in bringing clear connection among the variables (telephony utilization, business transactions and spatial-economic development of beaches). The connections would be in terms of how the mobile factor of production, mobile telephony was influencing the business transactions within the space of the beaches and the markets. It would also bring the connection in terms of how mobile telephony utilization affected economic activity of the fishers and ultimately how the spatial economic development was influenced by the use of mobile telephony.

2.6 Conceptual Framework

The conceptual framework was based on spatial economic theory. Spatial economics theory is centered on the problem of uneven distribution of factors of production and the role of distance. The factors of production include mobile and immobile factors. In our study, the mobile factors include fishers (labour), mobile telephony (capital). Land includes the fish and beaches. Economic activities are concerned with bridging the space between buyers and sellers because they are dispersed in space such that overcoming the distance between them can be costly. Mobile telephony as a space adjusting technology is key to bridging the space between fishers and the market and utilization of mobile telephony is a main driving force for spatial economic development.

Figure 2.1 presents a conceptualization of the components of mobile telephony utilization and how it results in Time Space Convergence (TSC) in view of spatial economic theory.

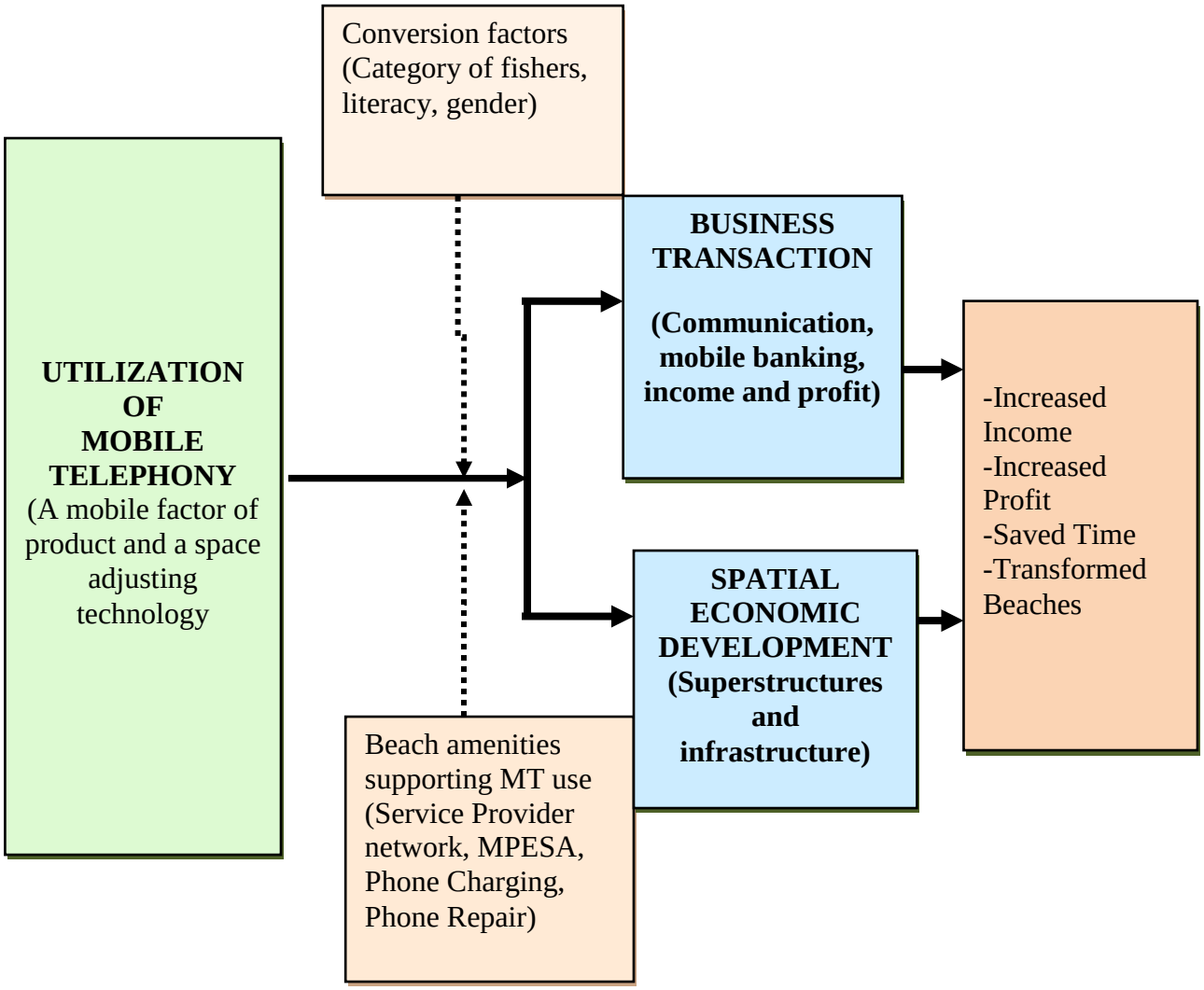

Figure 2.1: Conceptual Framework (Self Conceptualization)

The conceptual framework shows that when mobile telephony is utilized for business transaction, it leads to increased income and profit. The framework also shows that utilization of mobile telephony leads to spatial economic development of beaches with regard to the structures and amenities that support use of mobile telephony for business transactions. Mobile telephony a is mobile factor of production in the fishing economic in line with spatial economic theory and interacts with other mobile factors who are the fisher communities. The immobile factor of production is the Lake resource from which the fish product emanates. Mobile telephony is also

a space adjusting technology because its use implies time space convergence where distance is compressed and considered as time distance as opposed to metric distance. The Mobile telephone is the independent variable and the means to achieving the desired outputs.

As a means to achieving the desired output, mobile telephone characteristics are an essential part of the mobile telephony input because mobile telephony only becomes relevant in so far as their characteristics enable individuals to utilize them for the desired purpose. Its characteristics include, connectivity to service provider network ease of use, and affordability, connectivity to Internet, connectivity to applications like MPESA, EFMIS and connectivity to power, connectivity to internal features like GPS among others.

Despite the fact that mobile phones may have similar features, the level of utilization will be different due to difference in conversion factors per individual user. The differences may be personal, social or environmental including literacy, gender, culture, norms and values. According to Alampay (2006), conversion factors are considered as the capabilities which mediate the conversion of ICT characteristics and affect the rate at which individuals use them. Mobile telephony utilization for business transaction can only take place when there are certain beach amenities that support the use of mobile telephony. These amenities can be physical or virtual. They include electricity to enable charging of mobile phones, mobile banking vendors to support mobile money banking, and phone repairs from where to service phones. Virtual infrastructure include mobile phone network without which a mobile phone would not be able to perform the basic functions**.**

Time space convergence occurs as a result of utilization of mobile telephony which is a space adjusting technology. Utilization of mobile telephony therefore implies the concept of

convergence of space and time hence freedom of location. Utilization of mobile telephony implies occurrence of time critical transactions which adds value to the supply chain given the perishable nature of fish products. Other desired outputs as a result of mobile telephony utilization include increased incomes and profit as a result of effective transaction and communication between the fishers and the customers. It is expected that time would be saved with the use of mobile telephony and this is considered critical given the perishable nature of fish as a product. Ultimately, it is expected that utilization of mobile telephony would have a multiplier effect on the spatial economic development of the beach environment which includes structures and infrastructure that support use of mobile telephony such as MPESA shops, charging shops, installation of masts, electricity and phone repair shops.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter outlines details on study design and location, the target group and sampling techniques. It provides details on research validity and reliability as well as the methods of data collection. Finally, it presents the methods of data analysis and ethical consideration.

3.2 Study Area

3.2.1 Location

This study was conducted in the beaches located in Kisumu West sub-county of Kisumu County, Kenya. Kisumu West sub-county is located in the western side of Kisumu County and covers an approximated area of about 360.8 km^2 with an estimated population of about 149,831 people according to LVFO 2012. The Sub – county boarders Kisumu East to the East, Bondo to the West, Lake Victoria to the south and Vihiga to the North. Lake Victoria is Africa's largest lake with a total surface area of 68,800 km^2 of which Kenya covers 6% of the lake. The shoreline of Lake Victoria is approximately 3,450 km long of which Kenya covers 552 km, which is 16% (Kelly, Mulas, Raja, Qiang, & Williams, 2009). Lake Victoria waters support one of the world's most productive inland fisheries of commercial fish species that include nile perch, dagaa and tilapia. The contribution of the fishery to the GDP of the riparian countries is: Kenya 2.0%, Tanzania 2.8 and Uganda 3.0% (Kelly *et al.*, 2009). Lake Victoria is the second largest fresh water body in the world that is endowed with enormous fresh water fishery resource. It has a total surface area of 68870Km^2 and a total catchment area of 180950 km^2. As the largest lake in Africa, Lake Victoria is the single source of fresh water fish on the African continent and it is of great importance to the region's economy and population.

The study was conducted on the six major landing beaches of Lake Victoria Kenya shoreline in Kisumu West constituency of Kisumu County. This included Ogal, Usoma, Rota, Paga, Usare and Rari as shown in figure 3.1. The study selected the 6 landing sites in Kisumu West sub-county which had BMU office with fishers registers. According to RFSR (2015), the 6 beaches selected out of 10 in Kisumu West Sub-County had BMU office and registered fishers. The beaches selected were also located in the rural part of Kisumu County and would benefit greatly from the mobile telephony given the rural infrastructure and challenges of accessibility. According to Development (1999), in order to achieve spatial development, more attention should be paid to regions with geographical barriers to access especially remote areas. Usoma and Usare Beaches are off Kisumu - Kisian road while Paga Rari, Rota and Ogal Beaches are located off Kisian Bondo road. All the beaches are between 4 and 10 kilometers off the tarmac roads. The study targeted fishers, who included, crew, boat makers, fish traders and fish processors at the beaches. According to LVFO Regional Frame Survey Report, RFSR, (2015), there were 40,113 fishers along Kenya's Lake Victoria shore. There were 321 beaches in Kisumu County of which 2420 fishers were registered with the Beach Management Units.

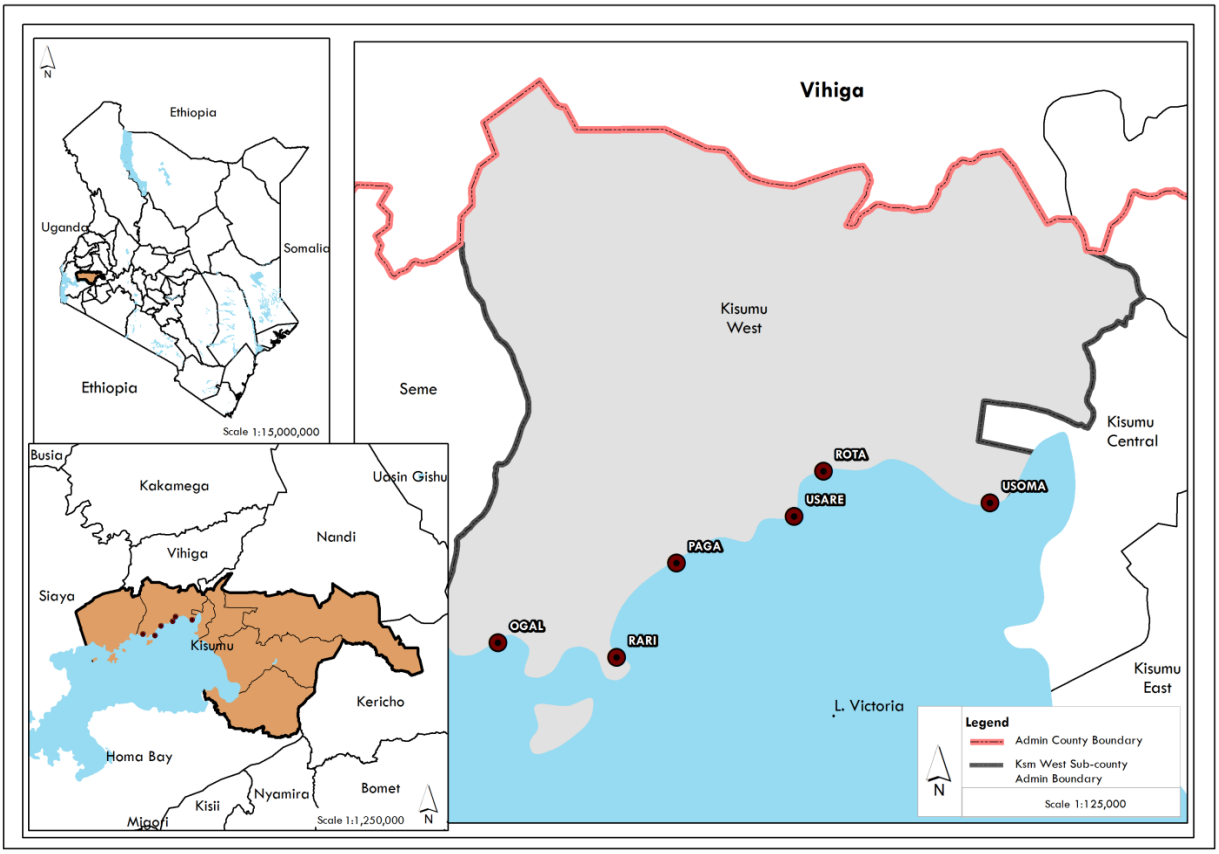

Figure 3.1: Study Area Location

3.3 Study Design

The study used cross sectional and longitudinal research designs. Cross sectional study analyzes data from a population or sample at a specific point in time. Longitudinal study was used to examine the superstructures and infrastructure supporting mobile telephony between 2008 and 2018. According to Denscombe (2007), a researcher who adopted a survey approach tends to buy in to a tradition of research, which emphasizes the quest for details of tangible things, which can be measured and recorded. The cross - sectional study was conducted using face to face and it included both questionnaires and interviews, where direct contact was made between the researcher and the respondents at the beaches in Kisumu County. Face-to-face contact allowed the researcher to select the potential respondents from the people needed to fill the necessary

categories of fishers. It also allowed for probing and clarifications. Respondents for focus group discussions and key informants identified for the study were purposively selected.

3.3.1 Study Population

The study focused on Kisumu West Sub-County which had a total of 699 fishers registered with BMU LVFO Regional Frame Survey Report, RFSR (2015).

3.3.2 Sampling Procedures

The study used stratified random method to sample fishers who provided the primary data through questionnaires. The method was used to sample the fishers from the Beach Management Unit Register in the stratum of fisher category per beach. The strata was fisher category which included crew, on shore labourers, fish traders, fish processors, boat builders and boat owners in the BMU registers. Simple random sampling was used to select the number of subjects from each stratum and the process involved identifying the respondents randomly once at the beach. Therefore, after identifying the fishers in a particular beach, the researcher approached any one of them and avoided repletion until the required sample size for that particular beach was achieved. Stratified sampling is often used when one or more of the strata in the population have a low incidence relative to the other strata. The stratum that had a low incidence relative to the other strata was that of the boat builders

3.3.3 Sampling

The sample size for the study was established as illustrated below:

Sample size formula for n is:

$$n = \frac{NZ^2pq}{E^2(N-1) + Z^2pq}$$

Where: N (population size = 699), Z (confidence level=1.96/95%), E (± error= 0.05), p (probability= 0.5), q (=0.5)

$$n = \frac{699 * 1.96^2 * 0.5 * 0.5}{0.05^2 * (699 - 1) + 1.96^2 * 0.5 * 0.5} = 248.14$$

Therefore, $n \approx 248$

Required sample size calculated was 248. However, according to Faber, and Fonseca (2014), a very small sample undermines the internal and external validity of a study. Whereas it can be argued that very large samples may transform small differences into statistically significant differences, it is more desirable in any keen study, to explore the accuracy of the sample or its precision on the representativeness to the population of the study. Therefore, the study sought a slightly larger sample from the population, amounting to 319 respondents, which was an increase of 71 respondents. These sample sizes were allocated proportionately to each beach considering the number of registered fishers. Table 3.1 below provides the proportion and sample size calculated.

Proportion was calculated using the formula

$$Proportion = \frac{N_i \times 100}{N}$$

Where $N_i$the number of registered fishers per beach and N is is the total number of the registered fishermen across all six beaches. For example, from the table, the proportion for Paga was calculated using the formula and inserting the values as shown below.

$$Proportion\ (Paga) = \frac{N_i \times 100}{N} = \frac{133 \times 100}{699} = 19.03\ \%$$

Table 3.1: Sampling Frame

Beach/Facilities	Registered Fishers	CM N(n)	FP N(n)	FM N(n)	BB N(n)	BO N(n)	P (%)	Sample
Paga	133	33(15)	31(14)	28(13)	17(8)	24(11)	19.03	61
Ogal	155	46(21)	37(17)	33(15)	15(7)	24(11)	22.17	71
Rari	80	20(9)	18(8)	15(7)	12(5)	15(7)	11.44	36
Rota	71	18(8)	13(6)	15(7)	10(4)	15(7)	10.16	32
Usare	120	33(15)	29(13)	30(14)	9(4)	19(9)	17.17	55
Usoma	140	42(19)	20(9)	47(22)	11(5)	20(9)	20.03	64
Total	699	191(87)	147(67)	171(78)	72(33)	118(54)	100	319

Key: P-Proportion, CM-crew members, FP-fish processors, BB-Boat Builders, BO-Boat owners

The last column provides the sample size calculated for that beach. The formula used included multiplying the calculated sample size, 319 and the proportion allocated in the fourth column. For example the sample size for Paga is thus calculated as:

$$Sample\ size(Paga) = \frac{P_i}{100} * n = \frac{19.03}{100} * 319 = 61$$

The calculated sample size was 319 and all questionnaires were returned.

Key informant respondents were obtained through snowballing technique. According to (Denscombe, 2007), snowballing is an effective technique for building up a reasonable sample size especially when used as part of a small scale research project as in the case of the current study. The key informant who was a boat owner at Usoma Beach and operated at most of the beaches in the Kisumu West sub-county was identified. The details of research interest were shared with the key informant and he was able to link the researcher with the BMU chairpersons who in turn mobilized members for the focused group discussions (FGD). The Beach

Management Unit (BMU) officials were purposively selected as the discussants in the FGD. The BMU officials were believed to be opinion leaders who possessed crucial information for the study.

The research also carried out observation during the field survey. Using GPS, mapping was done and photographs taken for the infrastructural development along the beaches. Photos of features were taken, including MPESA, fish stands, and shops among other spatial economic indicator features. GPS were taken and coordinates used to plot the points for the spatial distribution of the infrastructural development.

3.4 Data Collection

3.4.1 Primary Data

Primary data was collected through questionnaires, interviews and observation. Information on the level of utilization, reported influence and challenges of mobile telephony was collected through questionnaires and key informant interviews. Information on the spatial development of the beaches was also collected through interviews and observation.

3.4.1.1 Fishers Interviews

Structured and unstructured questionnaires were administered to fishers within the sampled beaches. The fishers were asked questions in line with the research objectives that included ownership and uses of mobile phones. The number of calls made as well as how mobile phones affected business transactions and profit were also considered. Research questions included open ended, closed ended and rating scales (Likert Scale) and ranking scale type of questions. Open-ended questions were coded to give numerical characteristics to ease analysis. Questionnaires provide a relatively cheap, quick and efficient way of obtaining large amounts of information from a large sample of people. Data can be collected relatively quickly because the

researcher would not need to be present when the questionnaires were completed (Jones *et al*., 2013). Therefore this study employed the questionnaire as the main method of collecting data.

3.4.1.2 Key Informant Interviews

According to Young et *al*., (2017), key informant interviews allow the researcher to focus on what is important and relevant from interviewee's perspective thereby highlighting the main issues that the interviewer might not have considered. In the present study, the key informant interviews were therefore important in getting detailed information on the key variables of the study that included mobile telephony, utilization, business transactions and support infrastructure. The interviews were conducted using the interview guide which enumerated the key thematic areas including utilization of mobile telephone, transaction and support infrastructure. Key informant interview was also held with one boat owner at the beach management offices. Data collected from the key informant interviews was used to triangulate the data from questionnaire. The key informant interview guide is attached as appendix II.

3.4.1.3 Focus Group Discussions

Focused Group Discussion (FGD) involving 2 groups of 10 participants for each of the 6 beaches were conducted. The FGDs focused on two thematic areas, the aspects of the fishing business supported by use of mobile phone and the extent to which use of mobile telephony resulted in development of superstructures and infrastructure. Structured questions for the discussions were predetermined and a moderator skilled in the area of ICT was engaged to lead through the open discussions. The FGD activity also provided the researcher an opportunity to visit the beaches and carry out data collection through observation. A consent note was developed and shared before the FGD. At the time of FGD, most participants were at ease having sensed no threat or

danger upon their business. A FGD guide with key areas for discussion was used during the discussions and is attached as appendix V.

3.4.1.4 Observation

Non-participant observation was used to get insights on the activities of fishers at the beaches and to identity the current land use and economic activities at the beaches. Observation was done on what facilities were at the beaches, what activities the fishers engaged in and what kind of superstructures and infrastructure existed at the beach. Specific attention was on the MPESA shops, electricity for charging phones, phone repair shops and masts. The observation enabled the researcher to get firsthand information and also take relevant photographs as part of data collection. Observation checklist form was used to record observations of activities and features and is attached in appendix III. In addition, the research used the geographical positioning system (GPS) coordinates to pick the points of interest in order to show the spatial distribution of the structures supporting telephone utilization.

3.4.2 Secondary Data

Secondary data was collected through review of relevant literature that included legal and policy framework documents. The documents included fisheries BMU Regulations 2007 Legal Notice 402; Fisheries Management and Development Act 2016; Agricultural sector development strategy 2010 – 2020; ICT Policy 2016; Geneva Action Plan and Kisumu County Development Plan 2018-2022. A document review guide was also used to aid in review of documents. The data sought included policies relating to fishers, mobile telephony and beaches. Data was also sought on strategic plans relating to ICT and fisheries activities. Google maps were also used to identify the features of the beaches in 2008. These were then plotted on maps and compared with the status as observed in the current study.

3.5 Data Analysis

3.5.1 Descriptive Statistics

Nominal and ordinal scale data represented as string characters were coded and converted into numerical scores before inputting into the electronic data files. Frequency tables were used for descriptive purposes to get the frequency counts and obtain percentages that were used to present the findings. Therefore, the frequency counts were useful since most of the data was coded as categorical variables. In some instances, two variables were analyzed simultaneously using cross tabulation. In the cross tabulations, the observed were obtained from the raw data while the expected were calculated. The cross tabulations show relevant (row or column) percent depending on the independent and dependent variables. Bar plots were used to present summaries of categorical variables with few categories and bar plots were selected since they were clear to interpret. Pie charts were also used to present the finding in percentages.

3.5.2 Inferential Analysis

3.5.2.1 The Chi-Square Test of Independence

The Chi-Square test was used to test how likely it was that an observed distribution was due to chance. It measured how well the observed distribution of data fitted the distribution that is expected if the variables were independent. Since most of the data was entered as categorical and the sample was random, the Chi-Square test of independence (also called Pearson Chi-Square test of association) was used for confirmatory analysis. Chi-Square test of independence tests whether there existed a statistically significant relationship between two variables. Therefore, chi square test of independence was appropriate because of the existence of the categorical and nominal variables. This could therefore help establish whether any association existed between any two selected variables whose association was important for the study. The variables included age versus expenditure on airtime, information accessibility versus reliability, mobile

line versus mobile service providers and education levels versus use of mobile phone for SMS among others. The test applies to both nominal and ordinal categorical variables. In this study, this test was applicable to two ordinal categorical variables.

In SPSS, the assumption when conducting the Chi-Square test of independence is that "the two categorical variables are entirely independent" or "there is no association between the two categorical variables".

If a contingency table is 2X2, then the Chi-Square test assumes that each cell should have at least a count of five. If the table is larger than 2X2, then all cells should have expected frequencies greater than 1, and that at least 80% of the cells should have expected frequencies of five and above.

The degree of freedom for a Chi-Square test is usually the product of the "number of categories in the first variable – 1' and the "number of categories in the second variable – 1".

In this study, the level of significance when the p-value was less than 0.05 it was assumed there was an association. The level of significance when the p-value was more than 0.05 it was assumed that there was no association.

3.5.2.2 The Correlation Analysis

Correlation analysis was done to complement the Chi-Square tests. The correlation gives the direction and strength of the relationship between two variables. The variables included age versus expenditure on airtime, information accessibility versus reliability, mobile line versus mobile service providers and education levels versus use of mobile phone for SMS among others. The variable can be both numerical and categorical. In this study, the test was conducted on categorical variables that were statistically significant from the Chi-Square tests. The

correlation analysis included two tests namely the Pearson parametric test which assumes normal distribution and Spearman which is non parametric and does not assume any distribution.

The absolute value for correlation coefficient (ρ) is interpreted as:

Weak for $0 < \rho \leq 0.3$
Moderate for $0.3 < \rho \leq 0.7$
Strong for $0.7 < \rho \leq 0.99$

Correlations that give coefficient values of 1 indicate perfect correlation and therefore there is no need of assessing the outcome. This could be due to overlapping or duplicating the variable of correlation. A negative sign indicates an inverse relationship between the two variables while a positive sign indicates the converse. Regression analysis was also utilized in both objective two and three to determine the influence of telephony utilization on business transaction and on beach development respectively. Analyzed data was presented in form of text, tables, graphs and charts.

3.5.2.3 Regression Analysis

The study adopted a simple linear regression model as stated by Tranmerand Elliot (2008).

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i$$

- Y_i - Outcome of Dependent Variable (spatial economic development or business transaction subscales) for i^{th} experimental/sampling unit
- X_i - Level of the Independent (utilization of mobile telephone subscale) variable for i^{th} sampling unit
- $\beta_0 + \beta_1 X_i$ - Linear (systematic) relation between Y_i and X_i
- β_0 - Mean of Y when X=0 (Y-intercept)
- β_1 - Change in mean of Y when X increases by 1 (slope)
- ε_i - Random error term

The model was used to determine the influence of telephone utilization on business transaction and spatial economic development of beaches as measured by spatial economic development

sub-scale, business transaction subscale and telephone utilization subscales. Regression model was appropriate for this study due to predictive outcome of spatial economic or business transaction as a result of mobile telephony utilization.

3.6 Validity and Reliability of Research Instruments

3.6.1 Validity of Research Instruments

Face validity and content validity were used in the study. The questionnaires were developed in line with the objectives of the study and focused on answering the research questions per each research objective. Piloting was done in Dunga Beach, which is in Kisumu County and was used because it was adjacent to the area where the study was conducted. Piloting involved 34 fishers and the BMU officials. The questionnaire and interview guide were piloted to confirm whether the items would solicit the required information. Pre-testing was also done to ensure that the instruments were clear and unbiased and that they were interpreted in the same way by all the subjects and whether they measured what they were supposed to measure. Content and face validities were carried out to establish validity of the instrument. This was achieved by subjecting the instrument to departmental experts who judged the instrument and recommended some changes. The research embraced the changes and aligned them to the study objectives and constructs as recommended.

3.6.2 Reliability of Research Instruments

The split Cronbach alpha tests for reliability was used where the split was made to test for consistence in questions relating to the three objectives. The acceptable Cronbach alpha value was 0.7 and above, an indicator of relatively high consistency within the data hence acceptable. In our case, we focused on the adjusted Cronbach alpha values. Thirty-four questionnaires were used for a pilot study. The data collected was tested for reliability using Cronbach alpha test for

consistency. The middle row gives the Cronbach alpha values after standardization for covariance. In this study, all the values exceeded the 0.7 level, with values of .718 for the demographic information, .799 first objectives, .745 for the second objective, and finally, .838 for the third objective, therefore they met the threshold, indicating that the data is consistent enough to be used. Socio demographic characteristics were used in the study in order to gauge the eligibility of the respondents or study area.

3.7 Ethical Considerations

The researcher considered several ethical issues in order to respect and protect participants and research sites. Participation was voluntary and participants had the option to participate or withdraw at any time. The researcher protected the physical and psychological anonymity of the respondents by not requiring them to indicate their names on the questionnaires. This was to identity of respondents anonymous. The data collected from the participants was not intended for use in any other study other than this study. The researcher sought the consent of the participants in order to participate in the study voluntarily. No information that reveals identity of any study participants was released or published without consent. The consent of participants whose photographs were used was also sought and the anonymity of the subjects were protected in the photographs by camouflaging their pictures to conceal their identity. The questionnaire had both open and closed ended type of questions, which enabled the participants to either express opinions freely or to choose from a given multiple choice questions. Each questionnaire took approximately 10 to 15 minutes to complete. Completed questionnaires remained in the custody of the principal researcher and would be destroyed after the full completion of the research project. Some photographs of the beaches were taken and where participants were involved, their consent was sought.

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter provides the findings of the research and discusses the results of the study in four areas. First, it presents the social-demographic information of the respondents. It then gives findings and discussions on the level of mobile telephony utilization and its influence on the business transactions of fisher communities. Finally, the findings and discussions on mobile telephony utilization and the spatial economic development of the beaches are presented. The data analyzed was collected between 2016 and 2018.

4.2 Social-Demographic Profile of Respondents

This section provides the social demographic profile of the respondents. It includes the category of the fishers, gender, age and education as well as experience in fishing business and working hours.

4.2.1 Category of Fishers per Beach

Figure 4.1 presents the analysis on the six categories of fishers in the study beaches.

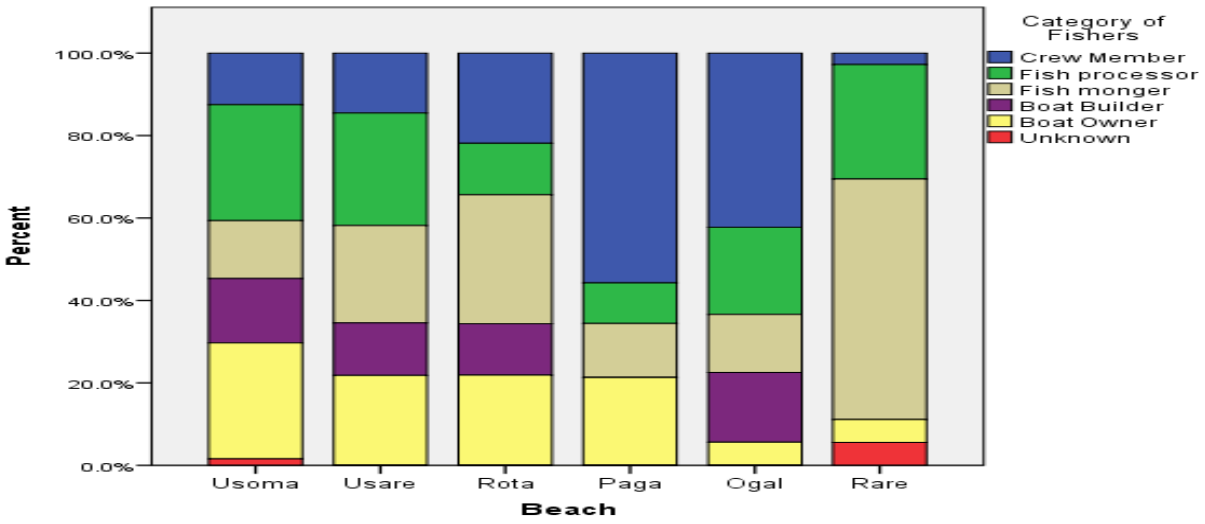

Figure 4.1: Category of Fishers per Beach
Source: Field Data, 2016

The respondents constituted crew members (27.6%), fish mongers (22.3%), fish processors (21.3%), boat owners (17.6%) and boat builders (10.3%). Crew members dominated in Paga and Ogal beaches while fish mongers dominated in Rare as shown in Figure 4.1: above

4.2.2 Gender and Age of Respondents

The gender representation of respondents per beach is given in Figure 4.2. The percentage values presented are out of the entire number of respondents (319).

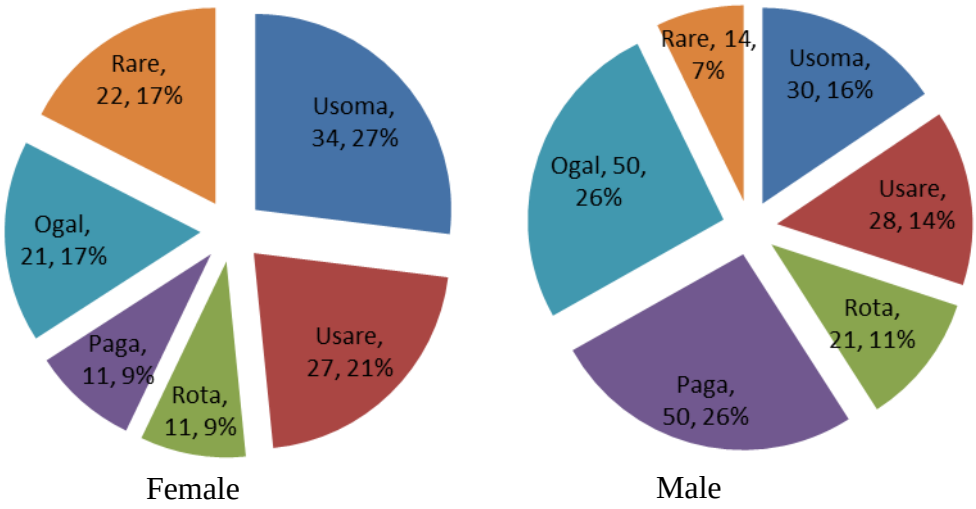

Figure 4.2: Gender of Respondents per Beach

Source: Field Data, 2016

Figure 4.2 indicates that Usoma beach had the highest percentage of female fishers, 34(27%) as compared to male fishers, 30(16%) while Ogal and Paga beaches had the highest number of male fishers, 50(26%) as compared to female fishers, 21(17%) and 11(9%) respectively. Overall, the proportion of males sampled was 60.5% while the proportion of females sampled was 39.5 percent.

The categories of fishers were also classified according to the beaches and the findings were that the different fisher's categories were present in all the beaches although in different proportions as shown in Figure 4.3 below:

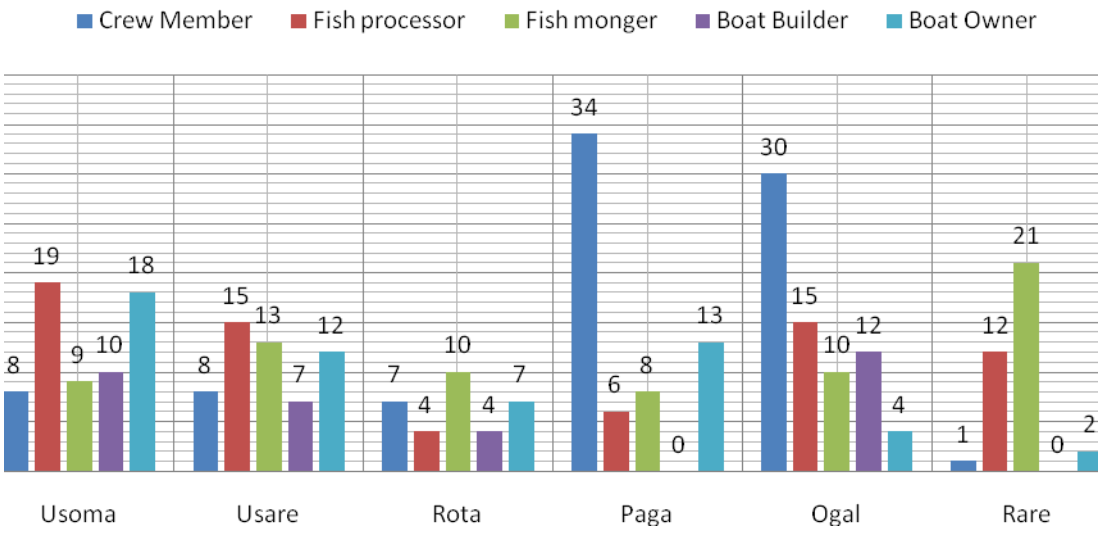

Figure 4.3: Category of Fishers per Beach

The findings show that majority (19) of the fishers in Usoma beach were fish processors while the minority were crew members. In Usare beach, majority (15) of the fishers were fish processors while the fewest (7) were crew members. However, in Rota beach, majority (10) of the fishers were fish mongers while the fewest (4) were crew members and fish processors. The findings also indicate that in Paga beach, majority of the fishers (34) were crew members while the minority (6) were fish processors. Ogal beach also had the highest number of crew members (30) while Rare beach had fish mongers (21) as the majority.

Table 4.1: **Overall Gender Distribution**

		Category of Fishers					Total
		Crew Member	Fish processor	Fish monger	Boat Builder	Boat Owner	
Gender	Male	87.5%	23.9%	45.1%	84.8%	69.6%	60.5%
	Female	12.5%	76.1%	54.9%	15.2%	30.4%	39.5%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

When gender was considered, most of the male respondents were crew members (87.5%) while most of the female respondents were fish processors (76.1%). The fewest of male respondents, 23%, were fish processors. For the female respondents, the fewest, 15.2% were boat builders. The findings showed a fair representation as the respondents of the fisher community consisted of both male and female at a ratio of 3:2 male to female. According to Breuil and Grima, (2014), women are mostly engaged in fish processing and marketing activities. The women participate in fishing activities. Of only 6 of the 31 recorded operational fisheries which translated to a ratio of about 5:1 male to female ratios.

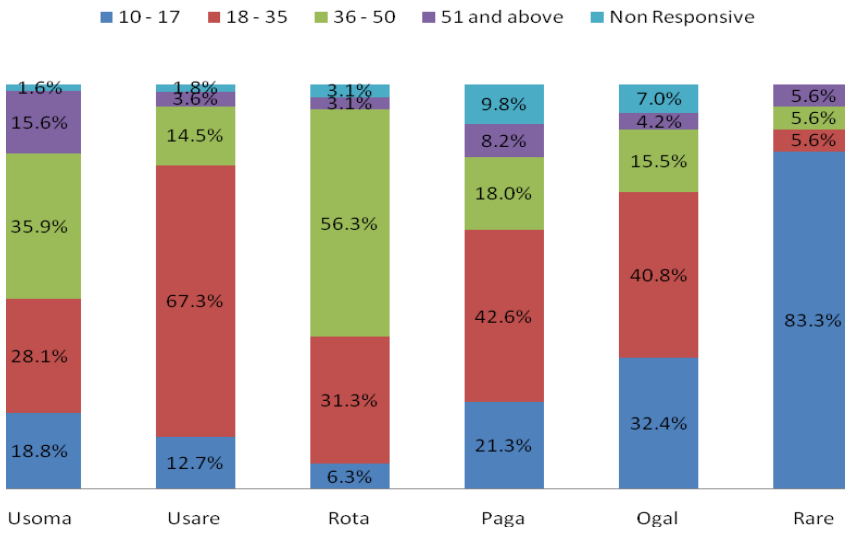

Figure 4.4: Age of Respondents per Beach
Source: Field Data, 2016

Usoma beach had majority of their respondents aged 36-50 years followed by those aged 18-35 years. The least, 15.6%, were aged 51 years and above while 16% were non responsive. Usare beach, majority (67.3%) of the respondents were aged 18-35 years while the least 3.6% were aged 51 years and above. Majority, 56.3% of the respondents in Rota beach were aged 36-50 years followed by those aged 18-35 years, (31.3%) while the least (3.1%)were aged 51 years and above. In Paga beach, majority, 42.6% of the respondents were aged 18-35 years and closely followed by those aged 10-17 years, 21.3%) and those aged 36-50 years, 18.0%. The findings also indicate that majority (40.8%) of the fishers in Ogal beach were aged 18-35 years while majority (83.3%) in Rare beach were aged 10-17 years. The findings of Rare beach indicates that majority of the fishers are young people who could still be learning how to fish. It is worth noting that 83.3% of the fishers in Rare beach were in the school going age yet they had opted to be in the fishing industry despite the existence of free primary and secondary education in Kenya. Therefore, school fees was not the main factor hindering them from studying

4.2.3 Education Levels of Respondents

The overall schooling levels are summarized in Figure 4.5: Education of Respondents across the Beaches entailed 5 categories starting from 'no school at all' to university level.

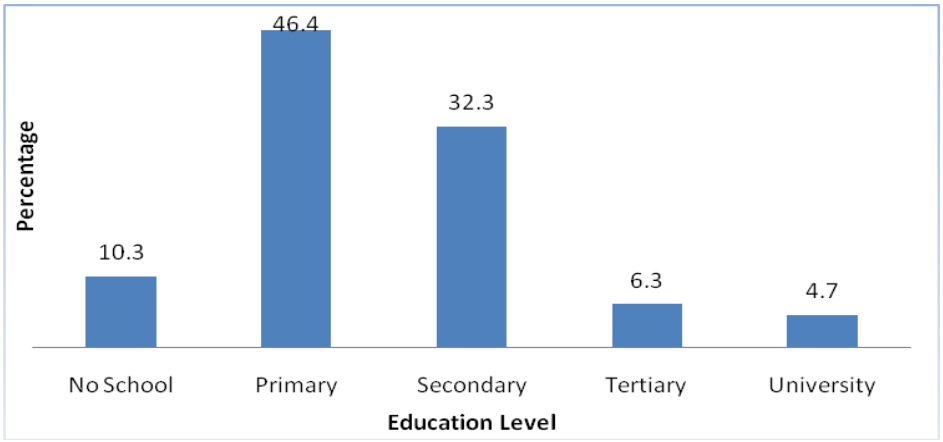

Figure 4.5: Education of Respondents across the Beaches
Source: Field Data, 2016

The chart in Figure 4.5 indicates that majority, 46.4% had attained a primary level of education, 32.3% had attained a secondary level of education while 6.3% and 4.7% had attained tertiary and university level of education respectively. A few of the fishers, 10.3% had not gone to school at all. . Muyanga, Olwande, Mueni, & Wambugu (2010) stated that there still existed constraints hindering children from poorer households transiting to secondary school go beyond the inability to pay school fees.

Table 4.2: **Level of Education across the Beaches and School per Gender**

		Education Levels					**Total**
		No School	**Primary**	**Secondary**	**Tertiary**	**University**	
Beach	Usoma	21.9%	26.6%	37.5%	6.2%	7.8%	100.0%
	Usare	9.1%	49.1%	30.9%	5.5%	5.5%	100.0%
	Rota	0.0%	21.9%	37.5%	25.0%	15.6%	100.0%
	Paga	14.8%	65.6%	14.8%	3.3%	1.6%	100.0%
	Ogal	5.6%	56.3%	32.4%	4.2%	1.4%	100.0%
	Rare	2.8%	47.2%	50.0%			100.0%
Total		10.3%	46.4%	32.3%	6.3%	4.7%	100.0%
		Education Levels					**Total**
		No School	**Primary**	**Secondary**	**Tertiary**	**University**	
Gender	Male	10.4%	59.6%	19.2%	5.2%	5.7%	100.0%
	Female	10.3%	26.2%	52.4%	7.9%	3.2%	100.0%
Total		10.3%	46.4%	32.3%	6.3%	4.7%	100.0%

The proportions of respondents with secondary education in Usoma, Rota and Rari were 37.5%, 37.5% and 50% respectively. On the other hand, majority of the respondents in Usare (49.1%), Paga (65.6%) and Ogal (56.3%) beaches had achieved only primary education.. In Rota, 40.6% of the respondents had tertiary or university education. It can thus be deduced from these findings that fishing activities were not a preserve of the illiterate but attracted even those with secondary education as well as a college degree.

The findings in Table 4.2 indicate that majority of the male fishers, 59.6% had primary level of education while majority of the female fishers, 52.4% had secondary level of education. However, the proportion of male fishers with university education was higher than that of female

fishers, 5.7% and 3.25 respectively contrary to those who had tertiary education. These findings are therefore in line with those of Lugonzo, Chege, & Wawire, (2017), who conducted a case study in Nyangoma Division in Siaya County on the factors contributing to high school dropout rate among girls in secondary schools and found that there was a significant relationship between fishing and high dropout rate of girls in secondary school. Most of the fishers were primary school dropouts and this corroborates the findings of other studies that school dropout rate was still high despite the free existence of primary and secondary education in Kenya.

Table 4.3: Education across the Category of Fishers (Column wise)

		Education Levels					Total
		No School	Primary	Secondary	Tertiary	University	
Category of Fishers	Crew Member	8.0%	67.0%	21.6%	2.3%	1.1%	100.0%
	Fish processor	10.3%	26.5%	51.5%	4.4%	7.4%	100.0%
	Fish monger	5.6%	49.3%	36.6%	8.5%		100.0%
	Boat Builder	15.2%	45.5%	21.2%	9.1%	9.1%	100.0%
	Boat Owner	16.9%	35.6%	27.1%	10.2%	10.2%	100.0%
Total		10.3%	46.4%	32.3%	6.3%	4.7%	100.0%

Majority of crew members (67%), fish mongers (49.3%), boat builders (45.5%) and boat owners (35.6%) had a maximum of primary education, whereas majority (51.5%) of the fish processors had a maximum of secondary education.

Table 4.4: Education across the Category of Fishers (Row wise)

		Education Levels					Total
		No School	Primary	Secondary	Tertiary	University	
Category of Fishers	Crew Member	21.2%	39.9%	18.4%	10.0%	6.7%	27.6%
	Fish processor	21.2%	12.2%	34.0%	15.0%	33.3%	21.3%
	Fish monger	12.1%	23.6%	25.2%	30.0%		22.3%
	Boat Builder	15.2%	10.1%	6.8%	15.0%	20.0%	10.3%
	Boat Owner	30.3%	14.2%	15.5%	30.0%	40.0%	18.5%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

When education level is considered against category of fishers row wise as indicated in Table 4.4, it was found that 30.3% of respondents with no schooling owned boats. The respondents with a maximum of primary education mostly crew members at 39.9% while 34.3% with a secondary education were fish processors. The respondents with tertiary level of education were

mostly boat owners and fish mongers both at 30.0%. Majority of respondents with university level education were boat owners at 40.0%. These findings indicate that boat ownership cut across all levels of schooling and was not a subject of level of education.

4.2.4 Experience in Fishing Business

The study also sought the respondents' experience in years in the fishing business activity across the beaches. This is presented as shown in Table 4.5.

Table 4.5: Experience across the Beaches

		Experience in the Fishing Industry					Total
		1-5	6-10	11-15	16 and above	Non Responsive	
Beach	Usoma	17.2%	28.1%	28.1%	18.8%	7.8%	100.0%
	Usare	21.8%	45.5%	16.4%	14.5%	1.8%	100.0%
	Rota	31.2%	28.1%	37.5%	3.1%		100.0%
	Paga	19.7%	47.5%	13.1%	13.1%	6.6%	100.0%
	Ogal	18.3%	36.6%	40.8%	2.8%	1.4%	100.0%
	Rare	88.9%	5.6%	5.6%			100.0%
Total		28.2%	34.2%	24.5%	9.7%	3.4%	100.0%

The findings in Table 4.5 indicate that Rari beach had majority (88.9%) of the respondents with few years' experience in the fishing business. Ogal beach, on the other hand, had 40.8% of respondents having been in business for between 11 and 15 years. Overall, 34.2% of the respondents had been involved in the industry for between 6-10 years, 28.2% of them had been in the business for less than five years while 24.5% had been in the business for 11-15 years. Only 9.7% of them had been in the business for 16 years or more. Rari beach seemed to have been attracting new fishers as compared to other beaches.

Table 4.6: Gender across Fishing Experience

		Experience in the Fishing Industry					Total
		1-5	6-10	11-15	16 and above	Non Responsive	
Gender	Male	19.7%	42.5%	24.9%	9.3%	3.6%	100.0%
	Female	41.3%	21.4%	23.8%	10.3%	3.2%	100.0%
Total		28.2%	34.2%	24.5%	9.7%	3.4%	100.0%

The findings in Table 4.6 indicate that majority of the male respondents, 42.5% had a fishing experience of 6-10 years while the fewest, 9.3%, had a fishing experience of 16 years and above. For the females, the findings show that majority, 41.3% had experience of 1-5 years followed by 23.8% who had fishing experience of 11-15 years while the fewest, 10.3% had a fishing experience of 16 years and above. The findings show that more female than male had joined the fishing business in the last 5 years.

Table 4.7: Experience across Fishers Categories

		Experience in the Fishing Industry					Total
		1-5	6-10	11-15	16 and above	Non Responsive	
Category of Fishers	Crew Member	19.3%	45.5%	29.5%	2.3%	3.4%	100.0%
	Fish processor	30.9%	25.0%	32.4%	10.3%	1.5%	100.0%
	Fish monger	66.2%	19.7%	8.5%	5.6%		100.0%
	Boat Builder		57.6%	24.2%	12.1%	6.1%	100.0%
	Boat Owner	8.5%	32.2%	27.1%	23.7%	8.5%	100.0%
Total		28.2%	34.2%	24.5%	9.7%	3.4%	100.0%

From the findings in Table 4.7, almost half of the crew members (45.5%) had been in the business for 6 – 10 years and majority of fish processors (32.4%) had been practicing it for 11-15 years. The youngest lot were the fishmongers of whom 66.2% of them had experience of not more than five years while majority of boat owners (32.2%) and boat builders (57.6%) had been in the business for a period of 6-15 years. From these findings, it can be deduced that boat building economic activity was not attracting new entrants and no one had experience ranging between 1-5 years.

4.2.5 Working Hours

The findings in Figure 4.6 indicate the working hours of the fishers according to categories of fishing.

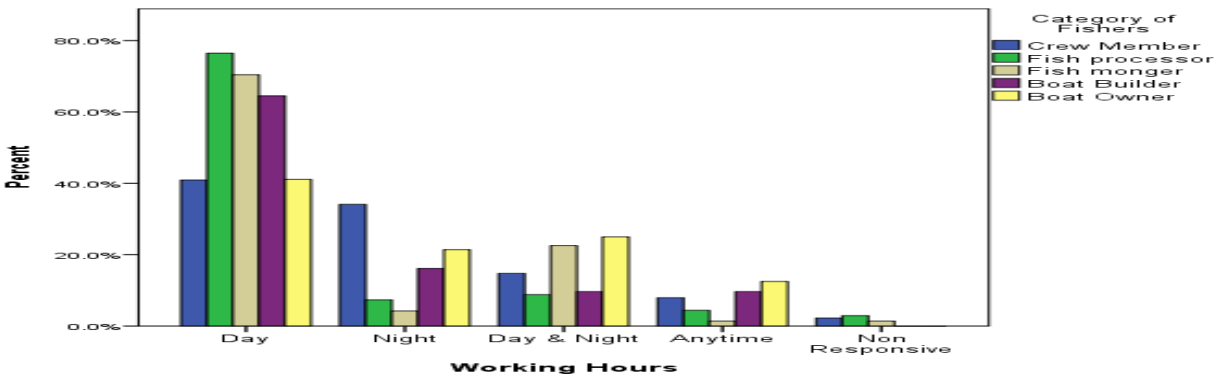

Figure 4.6: Working times per fisher Category
Source: Field Data, 2016

Slightly more than half (56.7 %) of the respondents worked during the day while 17.2% worked at night and a further 17.2% worked both day and night. shows that irrespective of the fisher category, most worked during the day.

most fishers from all the beaches worked during the day. However, majority of fishers from Usoma (34.4%) worked both day and night. Two thirds of the female respondents worked only during daytime. For the male respondents, there were 22.5% who worked strictly at night and a further 20.9% who worked both day and night. The 24/7 phenomenon cited by Talvitie (2003) was evident from the findings and therefore , greater freedom in the location of activities and the growing importance of the quality of places, and the virtual function of businesses of the new economy.

4.2.6 Residence of Respondents and Distance to the Main Market

It was important to understand the residence of the respondents in order to find out the geographic spread with regard to their station of fishing activities.

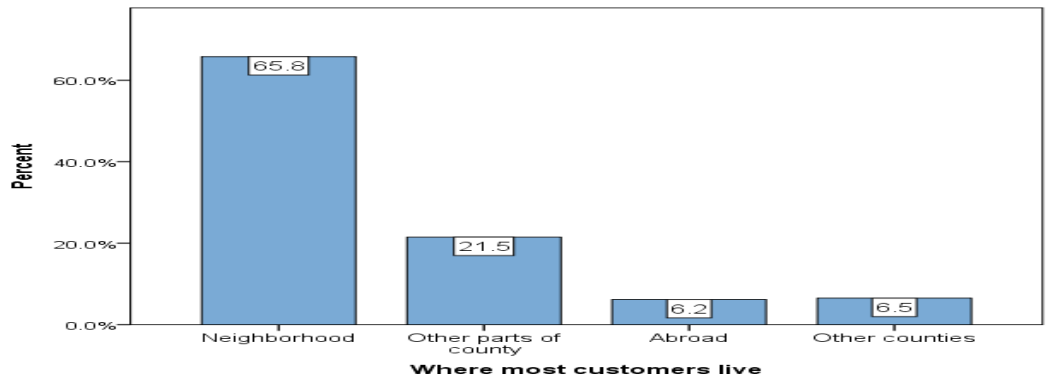

Figure 4.7: Residence of Respondents
Source: Field Data, 2016

Two out of three (65.8%) lived in the neighborhood of the beach, and 21.5% lived in the same county but not in the neighborhood. Another 6.2% and 6.5% lived abroad and in other counties respectively as shown in Figure 4.7.

Most respondents resided within the neighbourhood of the beach where they work as shown in Figure 4.11, only 12.7% of the respondents lived out of Kisumu County of Kenya as 65.8% lived in the neighborhood. Living close to the beach meant that they could communicate with their customers on a face-to-face basis more often. Eight in ten respondents used mobile phones as the most common means of communication with their customers.

On average, the respondents agreed that mobile phones helped increase efficiency by reducing the daily movements and reducing the amount of time spent travelling. Because levels of investment in infrastructure were not uniform, beaches had different trends and levels of distance

time and space convergence.

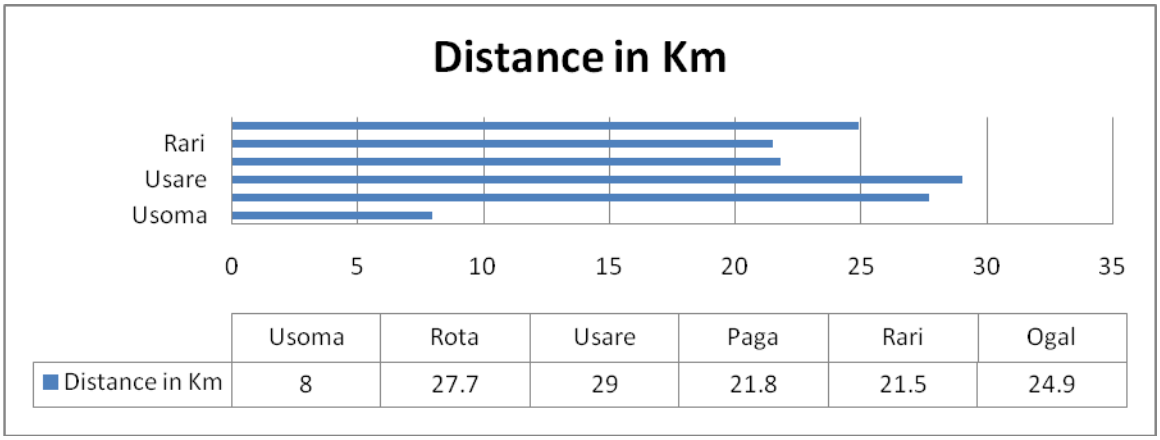

Figure 4.8: Distance between Beaches and Kisumu City

Kisumu City was established as the main market through FGDs and the distance from the beaches to Kisumu City was measured from the field travels. The findings on social demographic profiles of the fishers and the beaches were useful in discussions of findings on the level of mobile telephony; the use of mobile telephony for business transactions and the spatial economic development.

The study also sought to establish the facilities at the beaches as part of the beach characteristics. Facilities were mainly sought in terms of boats, fish, BMU office, MPESA shop, cold room, fish store and electricity. The findings are presented as shown in Table 4.8.

Table 4.8: Facilities at the Beaches

Beach/Facilities	Boats	Fish stand	BMU office	Road access	MPESA shop	Cold room	Fish store	Electricity
Paga	42	✓	✓	✓	✓	✗	✗	✓
Ogal	50	✓	✓	✓	✓	✓	✓	✓
Rari	45	✓	✓	✓	✗	✗	✗	✓
Rota	42	✓	✓	✓	✗	✗	✗	✗
Usare	40	✗	✗	✗	✗	✗	✗	✗
Usoma	50	✓	✓	✓	✗	✗	✗	✓

Source: Field Data, 2016

All beaches except Rari had BMU office structures within the beach where officials sat to manage the affairs of the beach including registration of fishers. BMUs are the backbone of

fisheries co-management in Kenya, led by the Fisheries Department. The Fisheries (BMUs) Regulation, 2007 (Legal Notice 402) provides the necessary legal framework for the BMUs to operate. The regulations outline the objectives of the BMUs, their administrative structure, area of jurisdiction and co-management mandate. They promote co-operation amongst fishermen and their participation in the overall management of fisheries resources and landing areas, as is provided for in the Fisheries Act CAP 378, 1991 and its subsidiary legislations. Fishermen are given co-management rights, which must be approved by the director of fisheries. During the focus group discussions, respondents indicated that BMUs did not use mobile telephony in an organized system to collect data on fishing crafts, fishers, licenses as had been witnessed in other regions.

All the six beaches were accessible through all-weather marram roads. However, it was noted that the roads could be inaccessible during rainy weather as there were signs of damaged roads with gullies and potholes. According to LVFO (2014) 41% of beaches in Kenya were accessible by all-weather roads. Buscher and Giles (2011) stated that information products are the tools with which cities can mine the surplus capacity in the city's infrastructure and unlock citizen's creativity to make cities more livable. Despite the poor state of the road networks, the beaches could still be livable with mobile telephony in such a way that digital infrastructure mitigates the shortfalls of physical infrastructure.

4.3 The Level of Mobile Telephony Utilization among the Fisher Communities

In assessing the level of mobile phone utilization, data was collected through questionnaires administered to fishers, key informant interviews and focused group discussions. The information sought included mobile phone ownership, duration of ownership, Internet access, expenditure, various use of mobile phones and its usefulness. The data is analyzed using both

descriptive and inferential analysis including frequency tables, cross tabulations, chi-square, correlation and regression analysis.

4.3.1 Ownership of Mobile Phones

Mobile Phone Ownership is shown in Figure 4.9: Mobile Phone Ownership which gives the proportion of the fishers who owned phones.

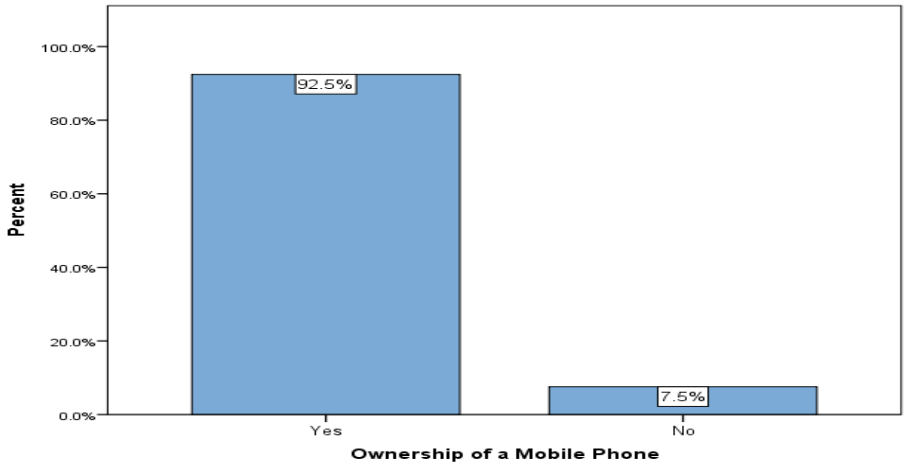

Figure 4.9: Mobile Phone Ownership
Source: Field Data, 2016

Figure 4.9 shows that 92.5 % of respondents owned mobile phone ownership. This is in line with the reports on mobile phone penetration in Kenya. Oteri, Kibet, and Ndung'u (2015) report for the period between January and March 2016 on the mobile telephony sector in Kenya, mobile penetration in Kenya was 89.2% with 38.3 million subscribers up from the previous 87.7% with 37.7million in the previous quarter. This was a growth of 1.5 percent. Less than two respondents in every ten owned a smart phone. The number of phone subscriptions per 100 people constitutes the subscription penetration rate. Since there are sometimes more active mobile phone numbers and SIM (subscriber identity module) cards than people with mobile phones, this meant that a figure above 100% was possible. James and Versteeg (2007) stated that, in terms of access, 97% of people in Tanzania have access to a mobile phone; that is, they live under the footprint of a

mobile phone. Given the capital cost implied in buying a mobile, there were more mobile phone subscribers than there were phones in Africa. This is because sometimes people buy SIM cards which they then use in other people's phones. In Botswana, over 60% of phone owners share phones with their family members, 44% with friends and 20% with neighbors, but only 2% of people charge for this service (James & Versteeg, 2007). The finding of 92.5% ownership was close to that of Tanzania of 97% having access in 2007 but not necessarily owning a mobile phone. Abhik (2017) stated that in India, every 10 percent increase in mobile penetration had seen a 1.2 percent increase in national GDP.

Smart phones have more functionality than ordinary phones. However, only 16% of the respondents with phones had smart phones as shown in Figure 4.10.

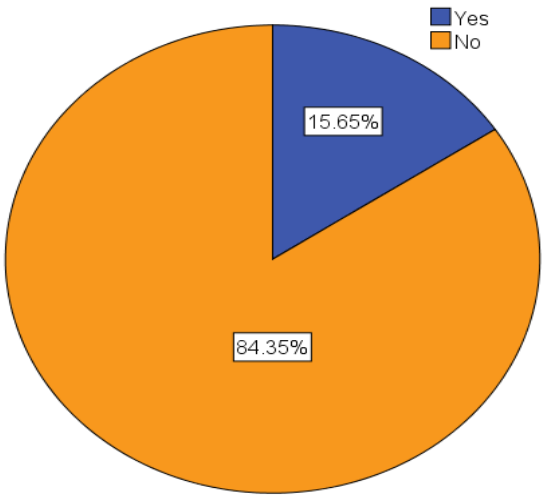

Figure 4.10: Smart Phone Ownership

According to Kitukutha & Oláh (2018), smart phones in Kenya are largely used to access games, music, news and social media sites. However, they are an increasingly essential tool to access financial products and a huge variety of useful services. Smart phones accounted for 97 per cent of all phones sold (three per cent feature phones), with 68 per cent of sales taking place in Nairobi. Presently, smart phones with 3G internet connectivity are being sold for as low as

Ksh3, 500. The smart phone ownership among the respondents was generally low compared to the high percentage reportedly sold according to a market report by Kitukutha & Oláh, (2018).

4.3.2 Duration of Owning a Mobile Phone

The study considered the duration of time the fishers who owned phones owned them. This is summarized in Figure 4.11: Duration of using Mobile Phoneselow:

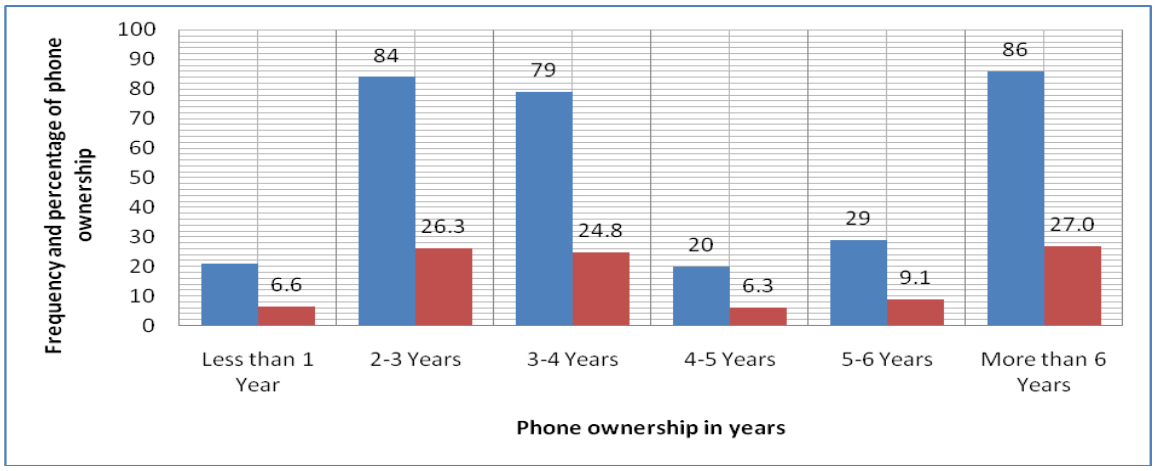

Figure 4.11: Duration of using Mobile Phones in Years
Source: Field Data 2016

From the findings in Figure 4.11, the respondents who had used mobile phones for more than six years were 27 percent. Those that had owned a phone for 2-3 years were 26.3% while those that had owned a phone for a period of 3-4 years were 24.8%. The least of the respondents, 6.6%, had owned a phone for a period of less than one year. A comparison was made between the level of schooling and duration in years of using mobile phone as shown in Figure 4.12: Duration in years of using Mobile Phones categorized by The findings produce the proportions in years of owning mobile phone by level of education.

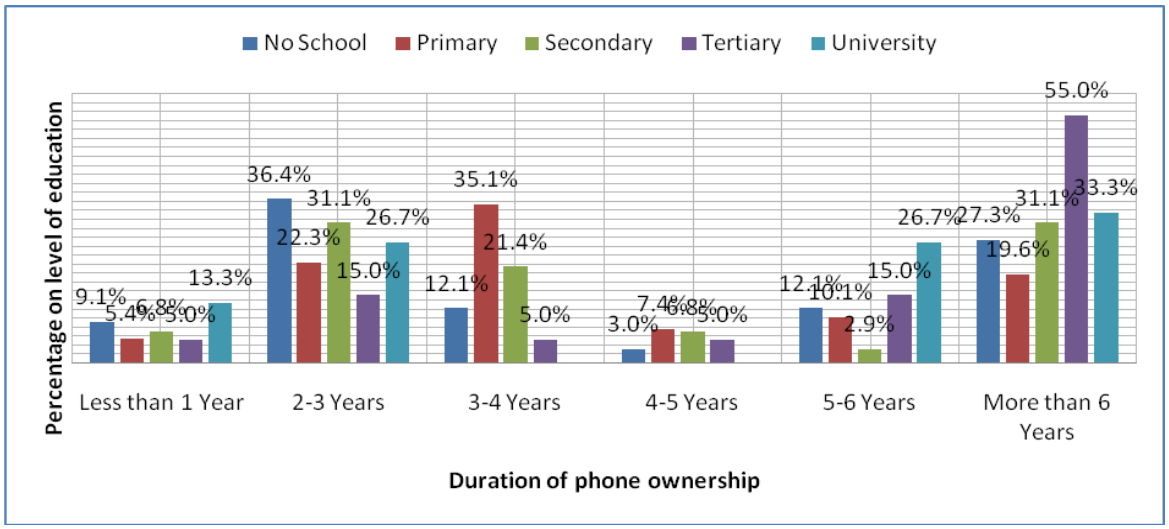

Figure 4.12: Duration in years of using Mobile Phones categorized by level of schooling
Source: Field Data 2016

The findings in Figure 4.12 indicate that majority of the fishers that had university level of education had owned a phone for over 6 years. Majority, 55.0% of those in tertiary level had owned a phone for over 6 years while majority, 31.4% of those in secondary level had owned a phone for a period of 2-3 years or over 6 years. However, for those who had attained primary level of education, majority had owned a phone for a period of 3-4 years while those who had not schooled had owned phones for a period of 2-3 years. Given that phone ownership reflects the usage, it can be deduced that majority of the users had university, tertiary and secondary level of education.

4.3.3 Phone Internet Access

The study also sought to establish the number of smart phone users as well as the level of internet access across the beaches. The findings are presented in Table 4.9.

Table 4.9: Beach versus Internet Access

		Mobile Phone has Internet Access		Total
		Yes	**No**	
Own smart phone	Yes	87.2%	12.8%	100.0%
	No	78.3%	21.7%	100.0%
Total		79.6%	20.4%	100.0%

Beach verses Internet Feature Cross-tabulation

		Mobile Phone has Internet Access		Total
		Yes	No	
Beach	Usoma	93.8%	6.2%	100.0%
	Usare	90.9%	9.1%	100.0%
	Rota	43.8%	56.2%	100.0%
	Paga	52.5%	47.5%	100.0%
	Ogal	88.7%	11.3%	100.0%
	Rare	97.2%	2.8%	100.0%
Total		79.6%	20.4%	100.0%

The findings in Table 4.9 indicate that eight out of ten (78.3%) of non-smart phone users had internet access while 87.2% of the smart phones had internet access. There were 20.4% of all phones users who could not access internet. When considering the beaches, a good proportion of respondents from Rota (56.2%) and Paga (47.5%) did not have internet access. However, majority of the fishers, 93.8% from Usoma beach, and 90.9% from Usare beach had internet access. In Kenya, the uptake of data internet services continued to display an upward trend with 34.2 per cent of the population accessing the internet mainly via the mobile phone (Oteri *et al*., 2015). The finding was that nearly 80% could access the internet through mobile phones and this number surpassed the 34.2 % mentioned by Oteri, (2015). According to Kitukutha and Oláh, (2018), Kenya was leading globally in the share of internet traffic coming from mobile phones overtaking Nigeria, which was at the top in 2017. At 83 per cent, Kenya was at the top in telephone usage, with Nigeria coming in second at 81 per cent. Kenya's high percentage was attributed to the country's high level of presentation of smart phones.

4.3.4 Expenditure on Phones per Day

The study further considered the expenditure of airtime on phones per day as summarized in Table 4.10.

Table 4.10: Average Airtime Expenditure per Day

Expenditure	Frequency	Percentage
20 ksh and less	92	28.9
>20-50 ksh	57	18
>50 to100 ksh	44	13.8
>100-250 ksh	81	25.4
250+ ksh	44	13.8
Total	319	100

Source: Field Data, 2016

Table 4.10 indicates the amount of average airtime expenditure of the fishers per day. It emerged that majority, 92, which is 28.9% of them, spent Ksh 20 or less per day. However, the second in category, 81, which is 25.4% spent between 100 and 250 Ksh per day. Overall expenditure for all the fishers was more than Ksh 50 per day

Table 4.11: Cross tabulation of Expenditure on Airtime Versus Category of Fishers

Expenditure on Airtime (Ksh)	Crew Member	Fish processor	Fish monger	Boat Builder	Boat Owner
	%	%	%	%	%
≤ 20	36.3	17.6	56.3	6.1	7.1
> 20 ≤ 50	15.9	30.9	11.3	24.2	8.9
> 50 ≤ 100	20.5	11.8	7.0	15.2	12.5
> 100 ≤ 250	20.5	25.0	15.5	36.3	37.5
250+	5.7	11.8	9.9	12.1	28.6
Nonresponsive	1.1	2.9	0.0	6.1	5.4
Total	100	100	100	100	100

Source: Field Data, 2016

Majority of crew members (36.3%), fish processors (30.9%) and fish mongers (56.3%) spent between Ksh 20 and Ksh 50 on phones daily. On the other hand, most boat builders (36.3%) and boat owners (37.5%) spent between Ksh 100 and Ksh 250 daily on phone related expenses. This was understandable so for boat owners because they could be having access to more money since they are entitled to a good percentage of the proceeds from the fish caught.

Table 4.12: **Airtime Expenditure and Smart phone use Cross Tabulation**

Expenditure on Airtime * Smartphone Cross tabulation

			Own smart phone		Total
			Yes	No	
Expenditure on Airtime	20 Ksh and below	Count	3	87	90
		% within Own smart phone	6.4%	32.0%	28.2%
	More than 20 Ksh to 50 Ksh	Count	3	53	56
		% within Own smart phone	6.4%	19.5%	17.6%
	More than 50 Ksh to 100 Ksh	Count	6	37	43
		% within Own smart phone	12.8%	13.6%	13.5%
	More than 100 Ksh to 250 Ksh	Count	28	51	79
		% within Own smart phone	59.6%	18.8%	24.8%
	Above 250 Ksh	Count	6	37	43
		% within Own smart phone	12.8%	13.6%	13.5%
	Non responsive	Count	1	7	8
		% within Own smart phone	2.1%	2.6%	2.5%
Total		Count	47	272	319
		% within Own smart phone	100.0%	100.0%	100.0%

From the results in Table 4.12, among the 47 smart phone owners, 59.6% of them used airtime ranging between more than Ksh 100 to Ksh250 daily and this can imply that they spend more money on airtime for Internet use. In Kenya, the uptake of data internet services continued to display an upward trend with 34.2 per cent of the population accessing the internet mainly via the mobile phone (Oteri *et al*., 2015). Out of the 272 respondents who did not own smart phones, 28.2% used Ksh 20 and below of airtime daily, 24.8% used between more than Ksh 100 to Ksh 250 daily and 13.5% spent more than Ksh 250 daily on airtime. Nearly 30% of the respondents used a maximum of 100 Kenyan Shillings (Ksh) per day on airtime. This translates to approximately a minimum of 3000 Kenya Shillings per month. This could imply that at least some fishers live above the poverty line of a dollar per day because it was assumed that, if they

spent about one dollar a day on phone calls, then they could be making more than a dollar a day from the fishing businesses.

Table 4.13: Cross Tabulation between Airtime Expenditure across the Beaches

		Expenditure on Airtime						Total
		20 Ksh and below	More than 20 Ksh to 50 Ksh	More than 50 Ksh to 100 Ksh	More than 100 Ksh to 250 Ksh	Above 250 Ksh	Non responsive	
Beach	Usoma	4.7%	9.4%	7.8%	31.2%	35.9%	10.9%	100.0%
	Usare	10.9%	10.9%	10.9%	56.4%	10.9%		100.0%
	Rota	9.4%	25.0%	9.4%	37.5%	15.6%	3.1%	100.0%
	Paga	26.2%	26.2%	32.8%	9.8%	4.9%		100.0%
	Ogal	57.7%	14.1%	12.7%	11.3%	4.2%		100.0%
	Rare	58.3%	27.8%		5.6%	8.3%		100.0%
Total		28.2%	17.6%	13.5%	24.8%	13.5%	2.5%	100.0%

Eight in ten respondents from Paga (85.2%), Ogal (84.5%) and Rari (86.1%) spent up to Ksh 100 daily on airtime. On the other hand, most fishers from Usoma (67.2%), Usare (67.3%) and Rota (53.1%) spent Ksh 250 and above.

Table 4.14: **Airtime Expenditure versus Age**

Age * Expenditure Airtime Cross tabulation

		Expenditure on Airtime						Total
		20 Ksh and below	More than 20 Ksh to 50 Ksh	More than 50 Ksh to 100 Ksh	More than 100 Ksh to 250 Ksh	Above 250 Ksh	Non responsive	
Age	10 – 17	54.0%	27.6%	5.7%	8.0%	3.4%	1.1%	100.0%
	18 – 35	20.5%	17.2%	22.1%	29.5%	10.7%		100.0%
	36 – 50	16.4%	8.2%	8.2%	35.6%	24.7%	6.8%	100.0%
	51 and above		13.0%	8.7%	34.8%	34.8%	8.7%	100.0%
	Non Responsive	42.9%	14.3%	21.4%	14.3%	7.1%		100.0%
Total		28.2%	17.6%	13.5%	24.8%	13.5%	2.5%	100.0%

Age played a role in determining the amount of money used on airtime daily as half of the respondents aged between 10 – 17 spent Ksh 20 and below on airtime daily. This proportion decreased with increase in age. Two thirds of respondents aged between 18 to above 51 spent more than Ksh 100 daily on airtime

4.15 and 4.16 give tests for association and correlation analysis between the amount of money spent on airtime and the age of the respondent.

Table 4.15: Chi-Square Tests for Age and Daily Expenditure on Airtime

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	107.555[a]	20	.000
Likelihood Ratio	113.440	20	.000
Linear-by-Linear Association	40.714	1	.000
N of Valid Cases	319		

a. 13 cells (43.3%) have expected count less than 5. The minimum expected count is .35.

Table 4.16: Correlation Tests for Age and Daily Expenditure on Airtime

			Value	Asymp. Error[a]	Std.	Approx. T[b]	Approx. Sig.
Interval by Interval		Pearson's R	.358	.055		6.822	.000[c]
Ordinal by Ordinal		Spearman Correlation	.422	.051		8.283	.000[c]
N of Valid Cases			319				

Based on normal approximation.

Both outputs have a p-value of less than 0.05. We therefore conclude that there is some association between the age and the amount of airtime spent on telephone. The Pearson's correlation is statistically significant at the alpha level of 0.05, positive but weak (0.358). This means that older respondents tend to spend more on airtime daily than the youth.

Those who spent money on airtime could still have been able to use their mobile phone by using "beeping" or "flashing" to get called back by the recipients. In South Africa, survey respondents spent an average of 10–15% of their income on mobile phones (Samuel, Shah, & Hadingham, 2005).According to Pramanik (2017), mobile phones were still extremely for those living in low and middle income countries: the median mobile phone owner in Africa spends over 13 percent of their monthly income on phone calls and texting. There were several options available for the respondents to purchase airtime. In the study the respondents in this study stated that they could

purchase directly through cards and the mobile monies platform like MPESA as well as through the options provided by service providers. Options available for loading airtime in Kenya included borrowing through options like "okoajahazi" while others used would redeem their saved loyalty points for airtime. Some respondents mentioned that they would receive airtime from their friends through options like "sambaza". Most of the respondents (68.7%) loaded airtime to their phones through purchase of scratch cards. There were 19.7% and 8.2% of the total respondents who purchased airtime only 1.9% borrowed airtime while 11% said that their friends would send them airtime. Out of the 319 respondents, 9.4% said they use any two options available to purchase airtime (Pramanik, 2017). The study also sought to establish the facilities at the beaches as part of the beach characteristics.

4.3.5 Uses of Mobile Phones

The study sought to establish the uses of mobile telephony among the fishers and the overall use for all the beaches is shown in Table 4.17.

Table 4.17: Extent of Utilization of Mobile Phones

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	Means
Voice Calls	154(48.3)	102(32.0)	21(6.6)	40(12.5)	2(0.6)	1.85
Send/Receive SMS	90(28.2)	134(42.0)	43(13.5)	48(15.0)	4(1.3)	2.19
Paying bills	40(12.5)	70(21.9)	72(22.6)	47(14.7)	90(28.2)	3.24
Send/Receive money	75(23.5)	174(54.5)	13(4.1)	53(16.6)	4(1.3)	2.18
GPS	20(6.3)	25(7.8)	74(23.3)	185(58.0)	15(4.7)	3.42
Online Shopping	14(4.4)	11(3.4)	131(41.1)	163(51.1)		3.47
Internet	21(6.6)	65(20.4)	109(34.2)	86(27.0)	38(11.9)	3.39
Watch TV	29(9.1)	103(32.4)	79(24.8)	26(8.2)	82(25.0)	3.17
Listen to Radio	72(22.6)	163(51.1)	44(13.8)	29(9.1)	11(3.4)	3.09
Facebook	49(15.4)	101(31.7)	76(23.8)	93(29.2)		2.20
Whatsapp	29(9.1)	115(36.1)	112(35.1)	45(14.1)	18(5.6)	2.67
Email	40(12.5)	86(27.0)	80(25.1)	90(28.2)	23(7.2)	2.71
Instagram	20(6.3)	94(29.5)	69(21.6)	114(35.7)	22(6.9)	2.91
Mean						2.83

Source: Field Data, 2016

On average, mobile phone was most frequently for voice calls at 48.3%. Sending and receiving money was most frequently used by 23.5% of the respondents. Mobile phone use of sending or receiving SMS was most frequently used by 28.2%. Paying bills was most frequently used by only 12.5% of respondents. Fishers also frequently used it in social forums like Facebook (15.4%) and chatting on Whatsapp (9.1%) with some using it to watch TV (9.1%) as shown in Table 4.17. Mobile phone was least frequently used for online shopping as done by 4.4% of the respondents. The low levels of use of mobile telephony for services that require internet access and smart phone corroborated the fact that only about 16% of fishers owned smart phones.

On an average scale, the mean for use of mobile phone for voice call and SMS was 1.85 and 2.19 respectively which meant that they were sometimes used on an average scale. Most of the other services were on the scale of 3 on average which meant that their usage was very low. Internet use, GPS and paying of bills using mobile phones on average scale were used very scantly with scales of between 3.24 and 3.47. The overall mean for use of mobile phone services for all the beaches was 2.82. This confirmed that the services were sometimes used. As shown in Tables 4.18 to 4.23 the average means per beach on types of services used with mobile phones were Usoma 3.10, Usare 2.59, Rota 2.52, Rari 3.12, Paga 2.82, Ogal 2.98. The scores per beach did not have a significant difference and were bordered around a scale of 3.

Table 4.18 to 4.23 show the uses of mobile phone for each of the 6 beaches.

Table 4.18: Usoma Beach uses of mobile phone

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	Means
Voice Calls	26(40.6)	22(34.4)		16(25.0)	0(0.0)	2.84
Send/Receive SMS	22(34.4)	21(32.8)	2(3.1)	19(29.7)	0(0.0)	2.29
Paying bills	12(18.8)	8(12.5)	15(23.4)	24(37.5)	5(7.8)	2.94
Send/Receive money	13(20.3)	18(28.1)	1(1.6)	32(50.0)	0(0.0)	2.78
GPS	9(14.1)	4(6.3)	4(6.3)	9(14.1)	1(1.6)	3.72
Online Shopping	11(17.2)	3(4.7)	14(21.9)	36(56.3)	0(0.0)	3.48
Internet	9(14.1)	6(9.4)	11(17.2)	37(57.8)	1(1.6)	3.29
Watch TV	21(32.8)	20(31.3)	7(10.9)	12(18.8)	4(6.3)	3.27
Listen to Radio	25(39.1)	22(34.4)	14(21.9)	1(1.6)	0(0.0)	3.19
Facebook	13(20.3)	19(29.7)	8(12.5)	24(37.5)	0(0.0)	3.20
Whatsapp	13(20.3)	23(35.9)	8(12.5)	19(29.7)	1(1.6)	3.17
Email	13(20.3)	17(26.6)	6(9.4)	27(42.2)	1(1.6)	3.11
Instagram	12(18.8)	17(26.6)	5(7.8)	29(45.3)	1(1.6)	3.01
mean						3.10

In Usoma beach, voice calls and SMS were the most frequently used services. Use of social media frequently was 20% which was a higher rate in Usoma beach as compared to the other beaches

Table 4.19: Uses of mobile phones in Usare Beach

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	Means
Voice Calls	22(40.0)	25(45.5)	5(9.1)	3(5.5)	0(0.0)	1.80
Send/Receive SMS	21(38.2)	22(40.0)	7(12.7)	5(9.1)	0(0.0)	1.93
Paying bills	10(18.2)	30(54.5)	3(5.5)	4(7.3)	8(14.5)	2.45
Send/Receive money	18(32.7)	33(60.0)	2(3.6)	2(3.6)	0(0.0)	1.78
GPS	4(7.3)	5(9.1)	13(23.6)	33(60.0)	0(0.0)	3.53
Online Shopping	1(1.8)	4(7.3)	15(27.3)	35(63.6)	0(0.0)	3.36
Internet	3(5.5)	28(50.9)	12(21.8)	8(14.5)	4(7.3)	3.53
Watch TV	1(1.8)	27(49.1)	19(34.5)	2(3.6)	6(10.9)	2.67
Listen to Radio	6(10.9)	32(58.2)	14(25.5)	3(5.5)	0(0.0)	2.73
Facebook	11(20.0)	27(49.1)	8(14.5)	9(16.4)	0(0.0)	2.25
Whatsapp	10(18.2)	25(45.5)	12(21.8)	5(9.1)	3(5.5)	2.27
Email	4(7.3)	18(32.7)	14(25.5)	12(21.8)	7(12.7)	2.38
Instagram	2(3.8)	20(36.4)	10(18.2)	13(23.6)	10(18.2)	3.00
Mean						2.59

In Usare beach the use of voice calls and SMS were the most frequently used services at 40% and 38 % respectively.

Table 4.20: Uses of mobile phones in Usare Beach

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	Means
Voice Calls	29(90.6)	1(3.1)	1(3.1)	1(3.1)	0(0.0)	1.22
Send/Receive SMS	6(18.8)	24(75.0)	1(3.1)	1(3.1)	0(0.0)	1.94
Paying bills	2(6.3)	7(21.9)	23(71.9)	0(0.0)	0(0.0)	2.66
Send/Receive money	6(18.8)	24(75.0)	2(6.3)	0(0.0)	0(0.0)	1.88
GPS	2(6.3)	18(56.3)	12(37.5)	0(0.0)	0(0.0)	3.34
Online Shopping	1(3.1)		24(75.0)	7(21.9)	0(0.0)	3.31
Internet	2(6.3)	6(18.8)	21(65.5)	3(9.4)	0(0.0)	3.19
Watch TV	19(59.4)		12(37.5)	1(3.1)	0(0.0)	2.78
Listen to Radio	16(50.0)	12(37.5)	4(12.5)	0(0.0)	0(0.0)	2.44
Facebook	0(0.0)	7(21.9)	23(71.9)	2(6.3)	0(0.0)	1.63
Whatsapp	0(0.0)	7(21.9)	24(75.0)	1(3.1)	0(0.0)	2.84
Email	1(3.1)	6(18.8)	24(75.0)	1(3.1)	0(0.0)	2.81
Instagram	0(0.0)	1(3.1)	17(53.1)	14(43.8)	0(0.0)	2.78
Mean						2.52

In Rota beach, use of mobile phones for voice call was the highest most frequently used service as compared to other beaches. Use of Facebook and Whatsapp was nil in terms of most frequently used services among the respondents. Use of SMS most frequently was low at less than 20% in comparison with other beaches.

Table 4.21: Uses of mobile phone of Paga Beach

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	Means
Voice Calls	19(31.1)	8(13.1)	14(23.0)	19(31.1)	1(1.6)	2.59
Send/Receive SMS	28(45.9)	22(36.1)	6(9.8)	4(6.6)	1(1.6)	1.82
Paying bills	6(9.8)	19(31.1)	18(29.5)	15(24.6)	3(4.9)	2.84
Send/Receive money	13(21.3)	36(59.0)	2(3.3)	8(13.1)	2(3.3)	2.18
GPS	6(9.8)	3(4.9)	17(27.9)	32(52.5)	3(4.9)	3.34
Online Shopping	1(1.6)	3(4.9)	31(50.8)	26(42.6)	0(0.0)	3.38
Internet	4(6.6)	11(18.0)	20(32.8)	24(39.3)	2(3.3)	3.34
Watch TV	2(3.3)	23(37.7)	22(36.1)	7(11.5)	7(11.5)	3.15
Listen to Radio	16(26.2)	30(49.2)	4(6.6)	9(14.8)	2(3.3)	2.90
Facebook	5(8.2)	12(19.7)	29(47.5)	15(24.6)	0(0.0)	2.20
Whatsapp	1(1.6)	13(21.3)	37(60.7)	8(13.1)	2(3.3)	2.89
Email	4(6.6)	10(16.4)	28(45.9)	16(26.2)	3(4.9)	2.95
Instagram	2(3.3)	12(19.7)	28(45.9)	16(26.2)	3(4.9)	3.07
Mean						2.82

Paga beach had more respondents use SMS most frequently (46%) as compared to voice calls (31%). Social media was also used less frequently at between 2 to 8%.

Table 4.22: Uses of mobile phone in Ogal Beach

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	Means
Voice Calls	54(76.1)	15(21.1)	1(1.4)	1(1.4)		1.28
Send/Receive SMS	13(18.3)	41(57.7)	11(15.5)	5(7.0)	1(1.4)	2.15
Paying bills	7(9.9)	6(8.5)	10(14.1)	2(2.8)	46(64.8)	4.04
Send/Receive money	25(35.2)	29(40.8)	6(8.5)	9(12.7)	2(2.8)	2.07
GPS	1(1.4)	7(9.9)	13(18.3)	43(60.6)	7(9.9)	3.49
Online Shopping	1(1.4)	0(0.0)	32(45.1)	38(53.5)	0(0.0)	3.68
Internet	3(4.2)	11(15.5)	32(45.1)	12(16.9)	13(18.3)	3.51
Watch TV	4(5.6)	10(14.1)	9(12.7)	4(5.6)	44(62.0)	3.30
Listen to Radio	7(9.9)	33(46.5)	20(28.2)	3(4.2)	8(11.3)	4.04
Facebook	10(14.1)	23(32.4)	8(11.3)	30(42.3)	0(0.0)	2.61
Whatsapp	1(1.4)	31(43.7)	22(31.0)	9(12.7)	8(11.3)	2.82
Email	12(16.9)	20(28.2)	8(11.3)	23(32.4)	8(11.3)	2.89
Instagram	2(2.8)	28(39.4)	7(9.9)	28(39.4)	6(8.5)	2.93
						2.98

Ogal beach had more respondents who used voice calls most frequently 76% and this was the second highest after Rota beach which had 91%. Social media was also used less frequently at between 1 to 14%.

Table 4.23: Rari Beach uses of mobile phone

Type of phone services	Frequently 1	Sometimes 2	Never 3	Do not know 4	Others 5	Total
	N	N	N	N	N	N
Voice Calls	4(11.1)	31(86.1)	1(2.8)		0(0.0)	1.94
Send/Receive SMS	4(11.1)	16(44.4)	15(41.7)	1(2.8)	0(0.0)	3.36
Paying bills	3(8.3)	3(8.3)	2(5.6)	28(77.8)	0(0.0)	4.44
Send/Receive money	34(94.4)	0(0.0)	0(0.0)	2(5.6)	0(0.0)	2.11
GPS	4(11.1)	4(11.1)	24(66.7)	4(11.1)	0(0.0)	3.56
Online Shopping	0(0.0)	0(0.0)	15(41.7)	21(58.3)	0(0.0)	3.78
Internet	3(8.3)	13(36.1)	0(0.0)	18(50.0)	0(0.0)	3.58
Watch TV	1(2.8)	4(11.1)	10(27.8)	21(58.3)	0(0.0)	3.97
Listen to Radio	2(5.6)	34(94.4)	0(0.0)	0(0.0)	0(0.0)	4.00
Facebook	10(27.8)	13(36.1)	13(36.1)	0(0.0)	0(0.0)	1.94
Whatsapp	4(11.1)	16(44.4)	9(25.0)	3(8.3)	4(11.1)	2.44
Email	6(16.7)	15(41.7)	11(30.6)	4(11.1)	0(0.0)	2.64
Instagram	2(5.6)	16(44.4)	2(5.6)	14(38.9)	2(5.6)	2.78
Mean						3.12

In Rari beach, the most frequently used service was to send and receive money at 94% and this was the highest compared to other beaches. Frequency of using mobile phone for voice call was lowest in Rari beach as compared to other beaches.

An emerging trend was stated by Aker and Mbiti (2010) who indicate that nearly 10 years ago as the development of mobile phone-based services and products that go beyond basic voice calls and text messaging was confirmed by the study findings and trend continues as more and more volatile and new technical trends emerge in the use of mobile telephony .Social media has been used not just to find friends but to conduct business. According to Melissa, Hamidati, Saraswati, and Flor (2015) 549,740 users of Facebook in Indonesia were owners of small and medium enterprises. The SMEs used social media accounts which they accessed through mobile phones and allowed their products to be showcased in virtual stores and eliminating the need to have a physical store. The findings in the study are that social media usage was still low yet it had the potential to advance business networks and sales. From the FGDs, it was suggested that fishers be sensitized on some important features of mobile phone. For instance, GPS could be used to enhance security as more than half did now know about GPS. According to (Tasman, 2008) the GPS could be used technology was noted to also improve productivity in the fishing industry from a case study of commercial fishing industry in Australia. Mobile telephony has been used to exchange market information as cited by several studies by Davis and Addon (2010); Gabreal and Budil, (2010). A study by Ifejika *et al*.,(2009) also revealed that mobile phone technology had contributed to relaying market information between fish producers, processors and fish sellers.

In comparing use of SMS for business versus its social purpose, there was a slight difference between the beaches as shown in Table 4.24.

Table 4.24: Purposes for SMS sent out per day for Social or Business Purpose

		SMS daily for social purposes					Total
		Sometimes 4	**Frequently 5**	**Rarely 3**	**Never 2**	**Non responsive 1**	
Beach	Usoma	38.0%	14.3%	21.3%	11.4%		20.1%
	Usare	31.0%	10.2%	6.6%	21.6%		17.2%
	Rota	8.5%	16.3%	16.4%			10.0%
	Paga	8.5%	14.3%	4.9%	43.2%		19.1%
	Ogal	7.0%	42.9%	31.1%	5.7%		22.3%
	Rare	7.0%	2.0%	19.7%	18.2%	100.0%	11.3%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		SMS daily for Business Communication					Total
		Sometimes	Frequently	rarely	Never		
Beach	Usoma	33.3%	21.3%	21.0%	6.8%		20.1%
	Usare	38.6%	15.7%	11.0%	11.0%		17.2%
	Rota	8.8%	10.1%	16.0%	2.7%		10.0%
	Paga	8.8%	20.2%	2.0%	49.3%		19.1%
	Ogal	7.0%	32.6%	30.0%	11.0%		22.3%
	Rare	3.5%		20.0%	19.2%		11.3%
Total		100.0%	100.0%	100.0%	100.0%		100.0%

Source: Field Data, 2016

From the findings in Table 4.24, the most frequently used purpose for SMS is social, up to 42.3% in Ogal beach while Rari was only 2.0%. For business communication, the findings indicate that Usare had the majority, 38.6% who sometimes mobile phones used while Usoma had 33.3% sometimes, and 21.3% frequent users.

When gender was considered, 87 out of 147 respondents made calls for social purposes irrespective of their gender while 60 female respondents made calls for social purposes. The gender difference was observed with regard to entertainment. A bigger proportion of male respondents (60.3%) affirmed that they used daily calls for entertainment purposes. This compares with 43.5% of female respondents who said the same.

Table 4.25: is a contingency table of observed and expected values when comparing the education level with frequency of using short message services daily for social reasons.

Table 4.25: Education versus SMS daily for Social Purpose

Education Levels		SMS daily to Friends				Total
		Never	Rarely	Sometimes	Frequently	
No School	Observed	10	2	15	5	32
	Expected	8.8	6.2	7.1	9.9	32.0
Primary	Observed	49	33	17	47	146
	Expected	40.3	28.3	32.4	45.0	146.0
Secondary	Observed	25	21	26	30	102
	Expected	28.2	19.8	22.7	31.4	102.0
Tertiary	Observed	0	4	7	9	20
	Expected	5.5	3.9	4.4	6.2	20.0
University	Observed	3	1	5	6	15
	Expected	4.1	2.9	3.3	4.6	15.0
Total	Observed	87	61	70	97	315
	Expected	87.0	61.0	70.0	97.0	315.0

Source: Field Data, 2016

There was no respondent with tertiary education who never used short message services for social reasons. This gave an observed value of zero yet the expected count was 5.5. However, this occurred only once hence the results are reliable.

Based on the findings in Table 4.20, a Chi-Square test on whether there was any association between respondents' education level and their socialization with friends was carried out. Table 4.20 shows the results from the Chi-Square tests of association between respondents' education level and their socialization with friends.

Table 4.26: Chi-Square test for Level of Education and SMS for Social Purpose.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.348[a]	12	.000
Likelihood Ratio	42.605	12	.000
Linear-by-Linear Association	6.696	1	.010
N of Valid Cases	315		

a. 6 cells (30.0%) have expected count less than 5. The minimum expected count is 2.90.

The study postulated a hypothesis which stated that (Ho: there is no association between level of education and sms for social purposes" The question was whether there was an association between education level and the frequency of communicating for social purpose through the short message services. The two-tail test yielded a p-value of 0.000, which is less than 0.05.

There was statistical evidence to indicate that there was an association between education level and the frequency of communicating for social purpose through the short message services. The Chi-Square test yielded a coefficient of .348 which indicated a weak relationship between a respondent's "level of education" and his "frequency of using SMS to contact friends, family and colleagues".

To further understand better the kind of relationship, the symmetric measures on the correlation between respondents' level of education and their use of short message services for social reasons was carried out.

Table 4.27: Correlation for Level of Education and SMS for Social Purpose

			Value	**Asymp. Error[a]**	**Std.**	**Approx. T[b]**	**Approx. Sig.**
Interval by Interval		Pearson's R	.146	.052		2.612	.009[c]
Ordinal by Ordinal		Spearman Correlation	.138	.053		2.460	.014[c]
N of Valid Cases			315				
Based on normal approximation.							

Source: Field Data, 2016

The correlation test had a direction of relationship unlike with the Chi-Square test. This test gave the correlation coefficient using both Spearman (non-parametric) and Pearson (parametric). The aim was to establish if there was a correlation between respondents' level of education and their frequency of use of SMS for social purpose. The results yielded p-value of less than 0.05 as shown in the last column of table 4.20. We conclude that there was a correlation between the education level of the respondents and their frequency of use of SMS for social purposes. The Pearson's coefficient of correlation was 0.146. This is a weak correlation since it is closer to 0. However, it was positive. A positive correlation in this case implied that respondents with more education tended to send SMS more frequently for social purpose.

Table 4.28: Frequency of Using Calls & SMS for Business Communication Per Day

Type of phone services	Frequently 1	Sometimes 2	Rarely 3	Never 4	Others 5	Total	mean	mode
	N	N	N	N	N	N		
Business communication	84(26.3)	127(39.8)	72(22.6)	33(10.3)	3(0.9)	319(10.0)	2.16	2
Ordering goods/services	62(19.4)	141(44.2)	45(14.1)	71(22.2)		319(10.0)	2.23	2
mBanking	30(9.4)	97(30.4)	22(6.9)	78(24.5)	92(28.8)	319(10.0)	3.46	4
Mean								2.62

Type of phone services	**Frequently**	**Sometimes**	**Rarely**	**Never**	**Others**	**mean**	**Mode**
	N	**N**	**N**	**N**	**N**		
Business communication	57(17.9)	89(27.9)	100(31.3)	73(22.9)	0(0.0)	2.61	3
Ordering goods/services	42(13.2)	96(30.1)	38(11.9)	143(44.8)	0(0.0)	2.61	2
mBanking	17(5.3)	92(28.8)	28(8.8)	90(28.2)	92(28.8)	3.29	2
						2.84	

Source: Field Data, 2016

As Table 4.28: shows, almost half of the respondents frequently called for ordering goods and services purposes with another 19.4% using calling for same purposes less frequently. Only 39.8% of them used it for mobile banking. The mean for both business communication and ordering of goods/services is 2.61, which rounded off to a whole number of 3 which implies that these purposes were sometimes used. The mean for mBanking was also 3.29 indicating that use of the mobile phones for mbanking done sometimes. The modes were 3, 2,2 respectively for the three usage that are indicated in the Table.

Two thirds of the respondents (66.1%) said that most of their phone calls were for business communication which entailed ordering, selling, making enquires and mobile banking. Overall, two out of three respondents made calls on business related communication. This included 63.6% who made phone calls to order goods and services. Shopping was attributed to business related activities.

The gender difference was observed in mobile banking. Male respondents dominated with 47.6%. On the other hand, 34.7% of the female respondents said that they used mobile phones for mobile banking. Less than half the respondents aged below 18 years (43.7%) made daily calls for business communication as compared to a minimum of 69.6% from the other age groups. Furthermore, only 16% of them used the daily calls for mobile banking as compared to the 45.9% minimum for the other age groups.

Table 4.29:Voice Calls for Business Communication and Level of Education.

Education level		Call daily for business communication			Total
		Never	Sometimes	Frequently	
No School	Observed	2	5	18	25
	Expected	1.8	9.2	14.0	25.0
Primary	Observed	15	41	69	125
	Expected	9.1	46.1	69.8	125.0
Secondary	Observed	3	44	45	92
	Expected	6.7	33.9	51.4	92.0
Tertiary	Observed	0	7	10	17
	Expected	1.2	6.3	9.5	17.0
University	Observed	0	4	11	15
	Expected	1.1	5.5	8.4	15.0
Total	Observed	20	101	153	274
	Expected	20.0	101.0	153.0	274.0

Source: Field Data, 2016

Chi-Square was used to test for association between education levels with frequency of using voice calls daily for business communication. Table 4.29:Voice Calls for Business Communication and Level of Education. is a contingency table considering the two variables providing both the observed and expected counts. In three instances, the expected count was less than 5 which was the usually required minimum count. This was only 20% of the total cells hence the results are can be used.

When comparison was done across different age groups, it was observed that nearly half of the respondents who had been in business for less than six years (44.4%) made daily calls for

business communications. However, at least seven in ten of the respondents with more experience made the business calls daily.

Table 4.30: Chi-Square Test for Level of Education and Frequency of Voice Calls for Business Communication

Chi-Square Tests			
	Value	**Df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	17.007[a]	8	.030
Likelihood Ratio	19.314	8	.013
Linear-by-Linear Association	.687	1	.407
N of Valid Cases	274		

a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is 1.09.

Source: Field Data, 2016Table 4.30: yielded a non-significant result. This means there was very little chance of Chi-Square association between respondents' level of education and their frequency in use of voice calls for business communication. The two-tailed test yielded a p-value of 0.030, which is less than 0.05. This indicates a statistical significance. The quest was to find out if there was an association between the respondent's highest level of education and how frequently they used the phones to make business related calls on a daily basis.

Table 4.31: gives the correlation analysis results for the relationship between respondents' highest level of education and their frequency in using phone calls for business communication daily.

Table 4.31: Correlation between Level of Education and Voice Calls for Business Communications

		Value	**Asymp. Std. Errora**	**Approx. Tb**	**Approx. Sig.**
Interval by Interval	Pearson's R	.050	.054	.829	.408c
Ordinal by Ordinal	Spearman Correlation	-.005	.059	-.081	.936c
N of Valid Cases		274			

Based on normal approximation.

Source: Field Data, 2016

The quest was to find out if there was a correlation between respondents' level of education and their frequency of use of voice calls for business purposes. Pearson's correlation coefficient had a

p-value of 0.408 as shown in Table 4.31:. This is greater than the 0.05 threshold. We conclude that there was no adequate statistical evidence to indicate a correlation between the education level of the respondents' and their frequency of use of voice calls for business communication. The Pearson's coefficient of correlation was 0.050 is very close to zero. A value of zero implies no correlation. The findings indicate that education affected use of SMS but not use of mobile phone for voice calls. It means, therefore, that education levels affected written communication among the respondents. This was equally the concern of Akerin (2009) who stated that despite the fact that the text messages were one-tenth the price of voice calls in Niger, the use of text messages had been relatively limited due to high rates of illiteracy.

Chi-Square was used to test for association between education level with frequency of using short message services daily for business communication.

Table 4.32: is a contingency table considering the two variables providing both the observed and expected counts. In six instances the expected count was less than 5 that is the usually required minimum count. This was only 30% of the total cells hence the results can be used.

Table 4.32: Cross Tabulation of SMS for Business Communication and Level of Education.

Education Levels		**SMS daily for business communication**				**Total**
		Never	**Rarely**	**Sometimes**	**Frequently**	
No School	Observed	12	6	1	13	32
	Expected	12.7	4.0	2.4	12.9	32.0
Primary	Observed	42	10	3	33	88
	Expected	35.0	11.0	6.7	35.4	88.0
Secondary	Observed	26	5	8	30	69
	Expected	27.4	8.6	5.2	27.7	69.0
Tertiary	Observed	5	3	4	8	20
	Expected	7.9	2.5	1.5	8.0	20.0
University	Observed	4	4	1	6	15
	Expected	6.0	1.9	1.1	6.0	15.0
Total	Observed	89	28	17	90	224
	Expected	89.0	28.0	17.0	90.0	224.0

Source: Field Data, 2016

The results from the Chi- square test are provided in Table 4.32. It tested for the association between respondents' education level and their frequency in use of short message services for business communication. The two-tailed test yielded a p-value of 0.145, which is greater than 0.05. There was no adequate statistical evidence to indicate an association between education level and the frequency of business communications through the short message services.

Table 4.33: Chi-Square Test for Level of Education and Frequency of SMS for Business Communication

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.135[a]	12	.145
Likelihood Ratio	16.138	12	.185
Linear-by-Linear Association	1.369	1	.242
N of Valid Cases	224		

a. 6 cells (30.0%) have expected count less than 5. The minimum expected count is 1.14.

Source: Field Data, 2016

Symmetric measures on the correlation between respondents' level of education and their use of short message services for business communication. The question was whether there was a correlation between respondents' level of education and their frequency of use of SMS for business purposes. The results yielded p-value of 0.243 as shown in Table 4.34. This is greater than the 0.05 threshold. We conclude that there was no adequate statistical evidence to indicate a correlation between the education level of the respondents and their frequency of use of SMS for business communication. Furthermore, the Pearson's coefficient of correlation was 0.078 which is very close to zero. A value of zero implies no correlation.

Table 4.34: Correlation between Level of Education and Frequency of using SMS for Business Communications

			Value	Asymp. Error[a]	Std.	Approx. T[b]	Approx. Sig.
Interval by Interval		Pearson's R	.078	.064		1.171	.243[c]
Ordinal by Ordinal		Spearman Correlation	.080	.065		1.202	.231[c]
N of Valid Cases			224				

Based on normal approximation.

Source: Field Data, 2016

The findings imply that for business communication SMS was sent regardless of education level while for social communication through SMS education level was a factor to be considered. However, the mobile phone was generally used more for social purposes more than for business purpose. This was similar to a study in Tanzania in 2008 and in Ghana in 2005 although several years ago the situation did not seem different in Kenya going by the findings of this study. A study in Tanzania shown that mobile phones are used primarily to maintain social networks, although they are also used to maintain "weak links" to business associates, Molony, (2008) argued that, although there are times when individuals use ICT in ways that aid personal or collective development, in much of Africa, mobile phones are more commonly put to a non-developmental use. According to Slater and Kwami, (2005), mobiles are used to manage local embedded reciprocities. Rather than being used to connect to the "global economy," the majority of calls in Ghana, for example, are "used to maintain family relations" in his survey of 31 micro- and small enterprises Donner (2005) found that there were two perspectives on mobile phone adoption. One saw it as a device for pursuing instrumental business goals and functions, whereas others saw mobiles as satisfying intrinsic emotional needs.

4.3.6 Usefulness of Mobile Phones

A Likert scale was used to help the fishers gauge their view of how they felt mobile phones helped them utilize opportunities available to them. The counts and proportions are summarized in Table 4.35.

Table 4.35:Information Update, Ease of Use, Reliability and Access to Information

	SD N 1	DSE N 2	U N 3	ASE N 4	SA N 5	Mean
Information I get through phone is current	61(19.1)	74(23.2)	62(19.4)	16(5.0)	106(33.2)	3.78
My phone is easy to use	54(16.9)	116(36.4)	63(19.7)	18(5.6)	68(21.3)	3.58
My phone is reliable	57(17.9)	87(27.3)	80(25.1)	21(6.6)	74(23.2)	3.97
I have increased access to information	24(7.5)	105(32.9)	66(20.7)	31(9.7)	93(29.2)	4.00
Mean						3.83

KEY: SD-Strongly Disagree, DSE-Disagree to some extent, D-Disagree, U-Uncertain, ASE-Agree some extent, A-Agree

Source: Field Data, 2016

Only 26.9% of the respondents found the mobile phones easy to use while 29.8% (those who agreed to some extent and strongly agreed) of them found it reliable (Table 4.35:). Less than four out of ten fishers used the mobile phones to access information. The finding further shows that 38.9% and 38.2% of respondents indicated that there was increased access to information and that the information is current. On average, the mean for information update, ease of use and reliability was between 3.58 and 4 with an overall mean of 3.83. This implied that the respondents agreed to some extent that information received through mobile phones was current; the phones were easy to use and were reliable.

In addition to the findings in Table 4.29, the key informant who was a boat owner stated as follows on BMU….

> "*All the beaches in Kisumu West Sub-County are run by beaches management units although some beaches do not have office structures within the beach* therefore mobile *phone has been helpfull in reaching out to the BMU officials who do not have offices."*

This response indicates that some of the beaches were completely aided by the use of mobile phones since they did not have office structures. Therefore, communication to the beach management officials was done through the mobile phones.

A correlation analysis was conducted to test whether there were relationships between respondents' reactions to the two statements. The results are provided in Table 4.37:.

Table 4.36: Correlation between Ease of Use and Reliability

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.680	.050	15.860	.000[c]
Ordinal by Ordinal	Spearman Correlation	.675	.050	15.626	.000[c]
N of Valid Cases		294			

c. Based on normal approximation at 95% CI.

Source: Field Data, 2016

Respondents who felt that a mobile phone was easy to use also said that it was reliable. This is seen in Table 4.36 where a correlation analysis was conducted and yielded a p-value of 0.000 which is less than 0.05. The results show that there is strong statistical evidence to indicate a correlation between the fishers who felt that phones were easy to use and their opinion on their reliability. The Pearson's correlation coefficient of 0.680 indicates a strong positive correlation. The calculated p-value is 0.000 which is less than 0.05. There is strong statistical evidence to indicate that the respondents who accessed the information felt that the information was current.

Table 4.37: Correlation between Accessibility and Reliability of Information

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.296	.058	5.304	.000[c]
Ordinal by Ordinal	Spearman Correlation	.298	.059	5.341	.000[c]
N of Valid Cases		294			

c. Based on normal approximation at 95% CI.

Source: Field Data, 2016

The Pearson's correlation coefficient was 0.296 which is a very weak positive correlation. This means that as much as many respondents who accessed information by use of mobile phone felt the information was current, there were others who did not access it yet they felt that the

information was current. This could imply that they got current information by other means. Examining the findings on the level of telephony utilization, it can be deduced that fishers are skewing towards the use of the phones to a large extent for various purposes. Most of these purposes are business related and therefore the mobile phones have solved the time space to a large extent. Economically, the mobile telephony is improving the beaches and their lifestyles especially in information. Therefore, the study relies heavily on the theoretical framework of spatial economic development and the concept of time space convergence.

Spatial economic theory principle of mobile factors of production of capital and technical knowledge are manifested in the findings because the distance and space have been compressed by owners of mobile telephony.

4.4 Mobile Telephony Utilization and Business Transactions

4.4.1 Mobile Service Providers and Applications

To understand the influence of mobile telephony on business transaction data it was prudent to find out about the infrastructure that support the mobile telephony. These include the mobile service providers, information systems and money transfer services. The types of services of interest were those that promoted business both on communicating it and its translation to sales. Data was collected through questionnaires administered to fishers, key informant interviews and focused group discussions. The information sought included mobile phone ownership, duration of ownership, Internet access, expenditure, various uses of mobile phones and its usefulness. The data is analyzed using both descriptive and inferential analysis including frequency tables, cross tabulations, chi-square, correlation and regression analysis.

4.4.1.1 Service Providers

The study therefore sought respondents' views on the frequently used mobile line services. The findings are presented as shown in Table 4.38

Table 4.38: Frequently used Mobile Lines

	Line	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Safaricom	280	87.8	87.8	87.8
	Airtel	30	9.4	9.4	97.2
	Orange	8	2.5	2.5	99.7
	Yu	1	.3	.3	100.0
	Total	319	100.0	100.0	

Safaricom was the most common network in Kenya by infrastructure and coverage. Over time, they managed to penetrate the inner and rural markets by making their call rates cheaper than the rest. Other service providers mentioned during the study include Airtel, Orange and Yu. Among the respondents, 87.8% of them had subscribed to Safaricom while only 9.4% had subscribed to Airtel. Orange and Yu had a cumulative subscription of 2.5%. Fewer respondents, compared to its subscribers, used Safaricom most often (84.6%). Airtel had 10.7% of the respondents using it most often.

A cross tabulation between the mostly used service providers and telephone lines was carried out as shown in Table 4.39. The findings are presented in frequency counts and percentages and the totals put row wise.

Table 4.39: Cross Tabulation of Most Used Mobile Service Provider Versus Mostly Used Mobile Line

Most used Mobile Service Provider		Mostly used mobile line				Total
		Safaricom	Airtel	Orange	Yu	
Safaricom	Count	267	4	5	1	277
	Expected Count	236.7	29.8	8.8	1.8	277.0
Airtel	Count	1	29	0	0	30
	Expected Count	25.6	3.2	.9	.2	30.0
Orange	Count	2	1	5	0	8
	Expected Count	6.8	.9	.3	.1	8.0
Yu	Count	0	0	0	1	1
	Expected Count	.9	.1	.0	.0	1.0
Total	Count	270	34	10	2	316
	Expected Count	270.0	34.0	10.0	2.0	316.0

Source: Field Data, 2016

The findings indicate that the most commonly used mobile service provider and also mobile line was Safaricom, with 236 of the respondents. This was followed by Orange, 5, and Airtel, 4 and the least which was Yu with only one.

A Chi-Square test of association was conducted to determine whether there was a statistically significant association between the common mobile service provider and the most commonly used mobile line. The results are presented in Table 4.40 . The test was to find out if there was an association between the most common mobile service provider and the most used mobile line. The test yielded a p-value of 0.000 (<0.05). This is statisticaly significant. Further correlation tests were conducted to test whether there was a correlation between the most common service provider and most used mobile line.

Table 4.40: Chi-Square Test for Most Common Service Provider and Most Used Mobile Line

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	508.248[a]	9	.000
Likelihood Ratio	197.761	9	.000
Linear-by-Linear Association	158.410	1	.000
N of Valid Cases	316		

a. 11 cells (68.8%) have expected count less than 5. The minimum expected count is .01.

The test was to find out if there was a correlation between most common service provider and most used mobile line. The p-value is 0.000 (< 0.05). The Pearson's correlation coefficient (rho) is 0.709. This indicates of a strong positive correlation between most common service providers and most used mobile lines. According to the respondents, a majority of them used Safaricom most often because it was the most common service available. However, several called for the construction of boosters to help improve the network. The only beach with a network booster, Usoma, was further east compared to the rest. This meant that there was lower chance of the booster serving all the beaches.

Table 4.41: The Level of Connectivity for Different Mobile Phone Service Providers

Service provider	Connectivity									
	Often 4		Sometimes 3		Seldom 2		Never 1		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%
Safaricom	280	87.8	25	7.8	14	4.4			319	100
Airtel	47	14.7	116	36.4	156	48.9			319	100
Orange	21	6.6	26	8.2	268	84.0	4	1.3	319	100
Yu	13	4.1	16	5.0	282	88.4	8	2.5	319	100

Source: Field Data, 2016

The respondents were asked to give their opinion on the signal strengths for the different mobile service providers in their areas. The respondents felt that Safaricom was a more dependable service provider. Most rated its connectivity to be often good (87.8%) while there was seldom good connection for Airtel (48.9%), Orange (84%) and Yu (84.4%) as shown in Table 4.41:. This may have informed them on the most common line to use. In this case, it was Safaricom. Carrier signal strength comparison between the two top mobile phone service providers confirm

that the signal strength is not exactly equal and there are places that have good signal strength while some places have really poor signal strength. This is largely due to the availability of base stations around your area and as long as there are enough in the area or if one was within the line of sight, they would have a strong signal. It was ironical that the most common service provider was Safaricom but still the provider Safaricom did not provide adequate coverage thereby hampering use of mobile telephony amongst the fishers. Using Google earth, the birds' flight distance between Paga and Usoma is 9.27 Kilometers, which is quite far. On the other hand, the network coverage according to Safaricom showed that no beach fell in places with strong Safaricom signal. Figure 17 gives the signal strength in the region as at 19 September 2017. This shows that there was still limited network in the region as at the time of the research. Given that Safaricom is a profit-making enterprise, it considers the size of the beach in terms of market before installing masts. This made it difficult in the beaches since there were few registered fishers (155 and below) in all of them. However, the fishers stated that there were delays in transaction due to poor network. There was no adequate network coverage in the lake and this confirmed the fishers' statement that it inhibited the business communication from the lake with land. According to Strategy and Unit, (2005), the Geneva Plan of Action paragraph 6 indicated 10 targets to be achieved by 2015 that included the impact of ICT access, especially in poor and rural communities and the promotion of ICT applications that can support sustainable development. There was no good network coverage in the lake and this confirmed the fishers' statement that it inhibited the business communication from lake with land. The respondents suggested that service providers should ensure reliable network by installing boosters. The Kenya Communications Act 1998 facilitated the creation of Communications Commission of Kenya (CCK) as the primary regulator of the telecommunication industry to formulate

regulations, monitor, solve disputes and, above all, protect the interests of all users of telecommunication series in Kenya with respect to the prices charged for the quality and variety of such services. Apparently the respondents were not aware of this act and how to address their complaints about poor network services.

Safaricom network boosters were only available in the vicinity of Usoma Beach while the rest of the beaches did not have network boosters in the vicinity. According to An Mey (2014), powering masts in remote areas was a challenge since phone companies typically relied on expensive diesel generators that required frequent fueling but solar powered mobile masts could be erected and operated for less than a quarter of the cost of ordinary mast.

4.4.1.2 Electronic Fish Market Information System

Further interviews with a key informant who was a boat owner affirmed these findings…..

> "*There was an EFMIS system introduced through KEMFRI to help fishers know the prices of fish in different beaches and help them reduce price differences in the beaches given the supply and demand forces. This system was not very well adopted by local fishers because of unreliable service provider networks."*

From the interview feedback, it emerged clearly that, initially, there were efforts from the government and the local initiatives that entailed EFMIS. The system was introduced to help the fishers moderate the price differences in the beaches. However, due to unreliable service providers, the system was not well adopted. This confirms the poor network in some beaches.

Respondents were asked whether they used the Electronic Fish Market Information System (EFMIS) and the results were as shown in Table 4.42.

Table 4.42: Use of EFMIS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Frequently	14	4.4	4.4	4.4
	Sometimes	27	8.5	8.5	12.9
	Never	89	27.9	27.9	40.8
	Do not know	189	59.2	59.2	100.0
	Total	319	100.0	100.0	

From the findings, only 4.4% of the respondents said that they used it frequently while 8.5% indicated that they used it sometimes. Majority of the respondents, 59.2% however indicated that they did not know while 27.9% indicated that they did not use it. Respondents mentioned a number of reasons they used EFMIS as revealed from the interview.

Table 4.43:**Purpose of use of EFMIS, &Fishers' use of EFMIS across Beaches**

EFMIS usage	**Frequency**	**Percentage**
Don't use	17	5.20
Better communication with partners	76	23.85
Easy access to work	143	44.95
Communication to potential customers	83	26.00
Total	319	100.00

Category of Fishers	Frequently 4		Sometimes 3		Never 2		Do not know 1		Total	
	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %
Crew Member	4	4.5%	10	11.4%	27	30.7%	47	53.4%	88	100.0%
Fish processor	2	2.9%	6	8.8%	22	32.4%	38	55.9%	68	100.0%
Fish monger	0	0.0%	4	5.6%	21	29.6%	46	64.8%	71	100.0%
Boat Builder	1	3.0%	3	9.1%	8	24.2%	21	63.6%	33	100.0%
Boat Owner	7	12.5%	3	5.4%	11	19.6%	35	62.5%	56	100.0%
Non-Responsive	0	0.0%	1	33.3%	0	0.0%	2	66.7%	3	100.0%
Total	14	4.4	27	8.5	89	27.9	189	59.2	319	10.00%

The most common reason for use of EFMIS was for better communication with partners as mentioned by 44.95%. The members felt that it was easy to access to work with (23.85%) and cheap to acquire and maintain hence improved communication between the different partners. They further added that they used EFMIS to know more about the fisheries, and to know how their partners were doing. Those who used EFMIS stated that it benefitted them in their communication with potential customers (26%) hence helped them to connect with new ones.

The findings indicate that majority of frequent users of EFMIS were boat owners, followed by crew members, 4.5%, boat builders, 3.0%, fish processors, 2.9% while fish mongers did not use it frequently. Only 29.6% fish mongers said that they don't use it; only 5.6% of them said that they used EFMIS sometimes. EFMIS was used most by fishers in Usoma beach (21.9%) and Paga (16.4%). It was least used by fishers in Rota beach where only 6.3% used it. This System had the potential to offer a platform through which market information could be exchanged in real time

Traders' organization of West Africa in partnership with the private sector, developed a platform, www.tradenet.biz, to exchange market information in real time on-line or through cellular phones on market prices, buy and sell offers and trader contact information (Davis & Addom, 2010).

In Mozambique, Vimala and Ravisankar, (2012) and Scott *et al*., (2004) had shown that farmers with access to market information obtained higher farm prices. Thus, the smart phone holders could use their phones to learn a lot about different markets and government policies through the internet, something they rarely mentioned. A four-year study on fishery markets in Kerala India showed that fish was sold in the home markets of the fishers where they did not get good prices. However, after using phones fishers, found better prices in nearby markets to sell their fish at the

market with the highest price (Jensen, 2007). In "efficient" markets, price equalization or the "law of one price" is meant to prevail and geography is meant not to matter, because information articulation between places eliminates asymmetry.

4.4.1.3 Mobile Telephony and Money Transfers

Mobile money transfer, MPESA was used to send and receive money from clients and other fishing activities and it assisted in communication between buyers and sellers. Therefore there is an increase in security of money since most transactions are done through MPESA because with it they were less exposed to loss of money through theft of their hard cash. In addition, price disparity was reduced due to use of MT in Usoma Beach. They further reported that the MPESA kiosks had created employment for the locals in Usoma Beach. The findings confirm a high level of MPESA usage as had been mentioned by Oteri *et al.*,(2015) who stated that a higher volume of mobile money transaction was recording in Kenya indicating the increased popularity of mobile money transfer services. With the exception of boat builders, at least half of the other fisher categories transferred monies through mobile phones. The lowest groups of respondents who used the mobile money services came from Usoma and they were mostly boat owners. It could be assumed that boat owners used less of this service due to the nature of their economic activities which may have required less communication compared to other categories of fishers dealing directly with the perishable good.

Table 4.44: Mobile phones for Money Transfers Per Fisher Categories

	Use of MP for MPESA									
	Frequently 4		Sometimes 3		Never 2		Do not know 1		Total	
	N	Row %	N	Row %	N	Row %	N	Row %	N	Row %
Crew Member	26	29.9%	47	54.0%	6	6.9%	8	9.2%	87	100%
Fish Processor	19	28.4%	37	55.2%	1	1.5%	10	14.9%	67	100%
Fish monger	18	23.1%	53	67.9%	0	0.0%	7	9.0%	78	100%
Boat Builder	13	39.4%	14	42.4%	4	12.1%	2	6.1%	33	100%
Boat Owner	6	11.1%	20	37.0%	2	3.7%	26	48.1%	54	100%
Total	82	24.0%	171	54.8%	13	4.2%	53	16.9%	319	100%

Source: Field Data, 2016

Table 4.44 summarizes the proportion of respondents per the frequency of using mobile money transfers. The fisher category showed that less than half of the boat owners (46.4%) used mobile money transfer services.

On the other hand, at least eight in ten of respondents falling under other fisher categories confirmed that they used the mobile money transfers. When considering those who only used it frequently, 39.4% of the boat builders, 29.5% of the crew members and 27.9% of the fish processors frequently used the mobile phones for money transfers. However, there was no significant difference in gender using the mobile phone money transfer services. There were 75.1% of male and 82.5% of female respondents who affirmed that they used the mobile money transfer services. Only 4.2% never used MPESA while 16% did not know about MPESA. It was not surprising that MPESA services were far from most of the beaches. Only Ogal beach had an active MPESA shop within the beach. Ogal was the biggest beach by number of fishers (155) and crafts (50). The respondents also stated that Safaricom Mshwari loan services needed to be made affordable for fishers and payment periods be extended and be less rigid.

4.4.2 Mobile Phones and Business Communication

The respondents were asked to state the frequency of using mobile phones to contact customers. The findings are presented as shown in Table 4.45.

Table 4.45:Use of Mobile Phones to Contact Customers

	Overall Frequency	Valid Percent	Cumulative Percent
Yes	262	82.4	82.4
No	40	12.6	95.0
Non-responsive	16	5.0	100.0
Total	318	100.0	

Source: Field Data, 2016

Table 4.45 shows that, when it came to contacting customers, there were eight out of ten respondents who contacted customers using phone calls. This was irrespective of whether the respondent owned a phone or not. This shows that the level of mobile phone penetration in business activities is quite high among the fisher communities. It further implied that the physical interactions had been reduced and that virtual transactions were being carried out. The traditional market where transactions involved physical contacts between buyers and sellers was no longer the common norm and mobile telephony was playing a key role as a tool of advancing for virtual market.

A cross-tabulation was done between use of mobile phones as the most common means of communication with customers and the different fisher categories. This is summarized in Table 4.46.

Table 4.46: Use of Mobile Phones to Contact Customers per Fisher Categories

Fisher Category	Uses Mobile phones most to contact customers					
	Yes		No		Total	
	Count	Row N %	Count	Row N %	Count	Row N %
Crew Member	56	64.8%	31	35.2%	87	100%
Fish Processor	35	52.9%	32	47.1%	67	100%
Fish monger	46	53.6%	32	46.4%	78	100%
Boat Builder	11	33.3%	22	66.7%	33	100%
Boat Owner	18	32.1%	36	67.9%	54	100%
Total	159	50.6%	155	49.4%	319	100%

Source: Field Data, 2016

Majority of the respondents from all fisher categories indicated that mobile phone was the most commonly used means of communication with customers, ranging between 32.1% and 64.8 percent. The respondents still preferred mobile phone over face-to-face yet the latter is cheaper than purchasing credit for a mobile phone and again most customers lived in the neighborhood. The boat owners and boat builders were the ones who most frequently communicated with their customers via face-to-face channel since only one out of three of them used phones mostly to contact customers. On the other, hand at least half of the other respondents from other fisher categories; crew members, fishmongers and fish processors used mobile phones more often. Rota had more crewmembers and fishmongers than other fisher categories. A closer examination of the data revealed that most of the crewmembers and fishmongers in Rota used mobile phones to communicate with their customers. Despite Usoma beach's dominance by boat owners, other fisher categories used mobile phones in great proportions. It has become easier for boat owners to seek crew members whenever there was work to be done. Communication with those in the lake was easier as they could be informed of any emergencies. It was also much easier to mobilize or gather colleagues for a meeting to discuss issues of concern. A study by Ifejika *et al*., (2009) in Kainji Lake, Nigeria, revealed that mobile phone technology was contributing to relaying market information between fish producers, processors and fish sellers. A likert scale

was used to gauge fishers' views of how they felt mobile phones helped them in business transactions. The counts and proportions are summarized in Table 4.47.

Table 4.47: Importance of the Mobile Phones in Business Transactions

Use of phones on transactions	SD N 5	DSE N 4	U N 3	ASE N 2	SA N 1	Means
I get adequate assistance on phone services (Assistance) e.g. customer service	37(11.6)	43(13.5)	78(24.5)	94	67(21.0)	2.53
I can access all the services I want using phone (Accessibility)	43(13.5)	69(21.6)	72(22.6)	81(25.4)	54(16.9)	2.20
Can use my phone anywhere including when fishing in the Lake (mobility)	33(10.3)	107(33.5)	84(26.3)	52(16.3)	43(13.5)	2.59
Phone has improved my security on shore	39(12.2)	71(22.3)	89(27.9)	79(24.8)	41(12.9)	2.39
Business networks have improved with use of phone	42(13.2)	90(28.2)	76(23.8)	37(11.6)	74(23.2)	2.88
						2.52

KEY: SD-Strongly Disagree, DSE-Disagree to some extent, D-Disagree, U-Uncertain, ASE-agree to some extent, SA-strongly agree

Source: Field Data, 2016

The findings in Table 4.48 indicate that more than half of the fishers affirmed that the mobile phones helped them get adequate assistance in their business. In particular, they get information on customers through mobile services. Almost half of them (42.3%) said that the mobile phones helped them access any service they required. However, only 37.6% reported an increase in business networks as a result of using the mobile phones. The individual mean score for importance of mobile phone for business transactions with regard to assistance, accessibility, mobility and business networks was between 2.20 and 2.88. The overall mean was 2.52 which, indicates that generally, respondents agreed to some extent that mobile phones were important for business transactions.

Table 4.48: **Cross Tabulation on Increased Access to information and Accessibility of Mobile** Services

		Increased access to information					Total
		Strongly Agree 5	**Agree 4**	**Undecided 3**	**Disagree 2**	**Strongly disagree 1**	
Accessibility of Mobile Phone services	Strongly Agree	45.8%	8.6%	9.1%	6.5%	16.1%	13.5%
	Agree	41.7%	35.2%	15.2%	22.6%	5.4%	21.6%
	Undecided	8.3%	5.7%	68.2%	35.5%	8.6%	22.6%
	Disagree		50.5%	1.5%	19.4%	22.6%	25.4%
	Strongly disagree	4.2%		6.1%	16.1%	47.3%	16.9%
Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

According to the fishers, the level of increased access to information through the mobile phone was proportional to the increase in business network. For instance, 45.8% of the respondents strongly agreed that their accessibility to mobile phone services increased access to information. Table 4.49: shows that the p-value for that correlation was 0.000, which showed a very strong statistical significance.

Table 4.49: Correlation between Increased Access to mobile phone services and Access to Information

		Value	**Asymp. Std. Error[a]**	**Approx. T[b]**	**Approx. Sig.**
Interval by Interval	Pearson's R	.726	.035	18.024	.000[c]
Ordinal by Ordinal	Spearman Correlation	.739	.035	18.727	.000[c]
N of Valid Cases		294			
Based on normal approximation.					

Source: Field Data, 2016

The Pearson's correlation coefficient of 0.726 suggests strong positive correlation between increased access to mobile phone services and access to information.

4.4.3 Business Transactions Time and Costs

The findings on the business transaction time and cost were analyzed and presented as indicated in figure 4.13.

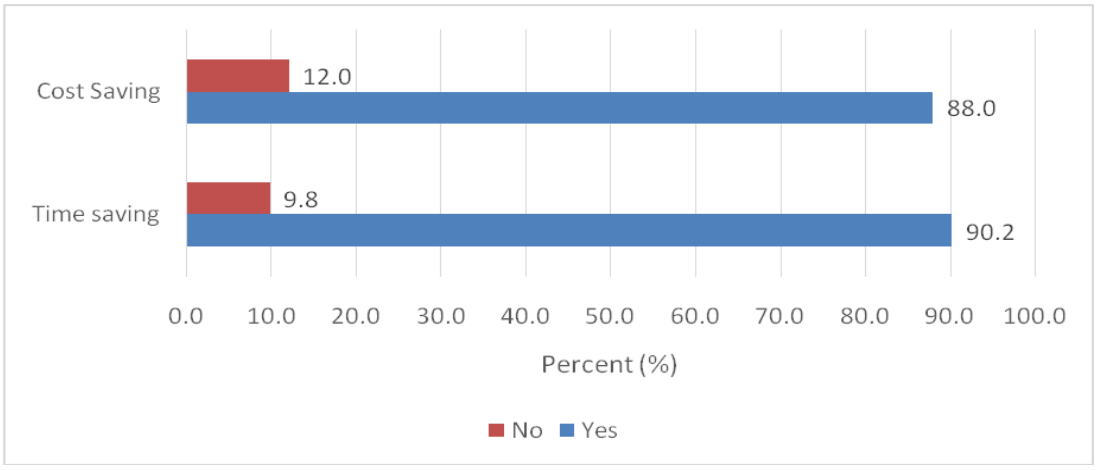

Figure 4.13: Mobile Phone Savings on Travelling Time and Costs
Source: Field Data, 2016

The two main reasons for preferring mobile phones over face-to-face communication was that they helped save time and were affordable. Over 90% of the respondents agreed that the use of mobile phones saved them a lot of time and monies spent on travelling as shown in 4.13. This meant that fishers travelled less and telecommunication played a key role in connecting people and places. A perception survey of 1500 mobile phone users in Nigeria also found that high proportion reported savings in travel time and lower cost of travel and entertainment (Gabriela & Badii, 2010). Therefore, advances in the development of mobile telephony networks services to support the communication traffic. The implication of this is that this technology could be moving spatial development away in a dispersion trend as opposed to a centralized one. Fishers from Usoma, Usare and Rota used mobile phones more than fishers from the other three beaches. This could also be due to the availability of network at the beach. They had been able to save money by reducing overhead costs like; through the mobile phones fishers in Usare could connect to donors and other stake holders; they could also communicate with other fishers so that they could know which beach had more fish. These findings confirm the time space convergence concept which postulates that there will be convergence attributed to improved technology, such

as the time and distance. The findings confirm that due to the use of mobile phones, there is a lot of time and money saved, which is a confirmation of the spatial economic theory. The study thus reveals that there is also economic convergence, which could be extended as a variable from time space convergence of time, transactions and distance.

A simple linear regression model was used to determine the influence of telephony utilization on business transactions. In order to achieve this, the mean for the levels of mobile telephony use as indicated in Table 4.17 variables were computed and an overall mean regressed with business transaction subscale as indicated in Table 4.28 and use of MPESA. This yielded means of 2.83 and 2.62 for the two tables respectively. The result was obtained after regressing business transaction against mobile telephony utilization. The findings are shown in Table 4.50.

Table 4.50: **Influence of Telephony Utilization on Business Transaction**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.688	.150		11.238	.000
	Utilization of telephony	.179	.051	.231	3.471	.001

a. Dependent Variable: transaction

The findings indicate that there was a unique contribution of mobile telephony utilization on business transaction (β=.231, p=.000).This implies that mobile telephony utilization has an influence on business transaction, an influence that is positive due to the positive beta coefficient obtained. In order to establish the percentage change in business transaction accounted for by utilization of mobile telephony, summary model results were presented as shown in Table 4.51

Table 4.51: Summary Model Results for the influence of mobile Telephony Utilization on Business Transaction

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.231[a]	.053	.049	.60454	.053	12.046	1	214	.001

a. Predictors: (Constant), telephony utilization

The findings in Table 4.51 indicate that utilization of mobile telephony accounts for 5.3% change or variation in the business transaction by fishers, (R^2=.053). This supports the influence obtained using the standardized coefficient value. The results are also observed to be significant, (p=.001), implying that indeed utilization of telephony has a positive significant influence on business transaction. The percentage change in business transaction is a positive influence but rather low considering that the ownership is over 92%. The regression equation or model was fit as follows

$$Y = 1.688 + 0.179X + \varepsilon_i$$

The equation implies that Y is the outcome variable, which is (R^2=.053) while 1.688 is the constant term. The constant term implies that there is some change in business transaction before incorporating telephony utilization.

4.4.4 Mobile Phones and Business Income & Profits

The respondents scored the impact of the use of mobile phones to various aspects of their businesses. Table 4.52 gives the counts and proportions of how respondents scored.

Table 4.52: Proportional impact of Mobile Phone Usage on Respondents' Income

	1		2		3		4		5		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Income	94	29.5	31	9.7	6	1.9	33	10.3	155	48.6	319	100
Costs of travel	60	18.8	20	6.3	34	10.7	67	21.0	138	43.3	319	100
Wastage of fish products	81	25.4	51	16.0	61	19.1	49	15.4	77	24.2	319	100

Majority of the respondents felt that the use of mobile phones affected their income by an increase of more than 10%. This estimation was given in comparison with the previous circumstances before use of mobile telephony. In Kerala, India research showed that this led to important welfare improvements for both fishers and consumers; fishers' profits increased by 8 percent, consumer prices declined by 4 percent and consumer surplus increased by 6 percent (Jensen, 2007). The average scores were: Income was 3.69, Cost of travel 3.78 and Wastage of fish products 3.13. The average score was a small increase to medium increase a generally positive impact on the business for the fishers.

Table 4.53: Mobile phones Influence on Incomes Per beach

	Very small 1		**Small 2**		**Moderate 3**		**Large 4**		**Very large 5**		**Total**		**mean**
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
Usoma	33	51.6	5	7.8	2	3.1	4	6.3	20	31.2	64	100	2.27
Usare	8	14.5	1	1.8	1	1.8	7	12.7	38	69	55	100	4.40
Rota	2	6.3			2	6.3	4	12.5	24	75.0	32	100	4.44
Paga	23	37.7	9	14.8	3	4.9	6	9.8	20	32.8	61	100	2.59
Ogal	21	29.6			13	18.3	8	11.3	29	40.8	71	100	3.27
Rari	7	19.4	3	8.3			6	16.7	20	55.5	36	100	4.06
													Mean 3.5

Source: Field Data, 2016

Table 4.53 further shows how respondents from different beaches scored on income because of use of mobile phones. The average score for respondents in Rota, Usare and Rari were 4.44, 4.4 and 4.06 respectively. This was a clear indication that most residents in that region felt that the use of mobile phones had impacted their income positively. The residents from Ogal had an average score of 3.27 which was a clear indication that only half of the respondents agreed that there was a positive influence on income as a result of using mobile phones. The other two beaches, Usoma and Paga, had average scores of 2.27 and 2.59 respectively. The fishers used mobile phones to connect to more clients leading to increased sales. Muto and Yamano (2009)

estimated the impact of mobile phones on agricultural markets in Uganda and found that mobile phone coverage was associated with a 10 percent increase in farmers' profitability for bananas, but not maize thereby suggesting that mobile phones are more useful for perishable crops.

Most respondents 77.1% said that their profits had increased after using mobile phones.

Table 4.54: **Profit decrease and Increase**

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Increase	246	77.1	77.1	77.1
	Decrease	50	15.7	15.7	92.8
	Non responsive	23	7.2	7.2	100.0
	Total	319	100.0	100.0	

Versus use of Mobile Phones	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
%increase in profit	246	0.00	70.00	20.6691	15.47581
% decrease in profit	49	2.00	60.00	22.8776	17.81342

Source: Field Data, 2016

Only 15.7% recorded a decrease in profit because of using mobile phones. Table 4.54 gives the summary of how much profit increased or decreased since the respondent started using a mobile phone. On average, the profit increased by 20.67% among respondents who said that the profit increased and it decreased by an average of 22.8% among respondents who said that it decreased.

The standard deviation in the decrease in profit was also greater (17.8) than that among those who had an increase in profit (15.5).

Table 4.55: **Cross Tabulation of Fisher Category and Profit Increase and Decrease**

		Profits increase or decrease by use of MP			Total
		Increase	**Decrease**	**Non responsive**	
Category of Fishers	Crew Member	26.4%	24.0%	47.8%	27.6%
	Fish processor	24.4%	12.0%	8.7%	21.3%
	Fish monger	19.1%	40.0%	17.4%	22.3%
	Boat Builder	12.2%		13.0%	10.3%
	Boat Owner	17.9%	24.0%	13.0%	18.5%
Total		100.0%	100.0%	100.0%	100.0%

		Profits increase or decrease by use of MP, and Beach			Total
		Increase	Decrease	Non responsive	
Beach	Usoma	21.1%	22.0%	4.3%	20.1%
	Usare	19.1%	16.0%		17.2%
	Rota	8.9%	20.0%		10.0%
	Paga	18.7%	8.0%	47.8%	19.1%
	Ogal	19.9%	22.0%	47.8%	22.3%
	Rare	12.2%	12.0%		11.3%
Total		100.0%	100.0%	100.0%	100.0%

The highest average increase in profit was among crew members. The average increase was 26.4%. The lowest average profit gain of 12.2% was among the boat builders. On the other hand, the crew members who recorded a decrease in profit mentioned that their profit margins had decreased by 24.0% while the profit decrease was 24.0% among boat owners.

Respondents from Usoma Beach experienced both the highest increase in profit of 21.1% and the highest decrease and others experienced the highest decline in profit by 22.0%. This was followed by Ogal beach which recorded the highest increase of 19.9% and Usare beach with 19.1%. Ogal beach also experienced the highest decrease of profit, 22.0% in some instances.

When experience was considered, the highest average increase in profit was observed among the respondents who had been in business for between 6-10 years.

Table 4.56: **Cross tabulation Profit increase, Decrease and Experience**

		Profits increase or decrease by use of MP			Total
		Increase	Decrease	Non responsive	
Experience in the Fishing Industry	1-5	24.0%	48.0%	30.4%	28.2%
	6-10	38.6%	16.0%	26.1%	34.2%
	11-15	22.4%	26.0%	43.5%	24.5%
	16 and above	10.6%	10.0%		9.7%
	Non Responsive	4.5%			3.4%
Total		100.0%	100.0%	100.0%	100.0%

They had an average increase in profit of 38.6% for fishers who had an experience of 16 years and above reported the lowest increase in profit at 10.6%. Use of mobile phones in Kerala, India led to increase in fishers' profits by 8 percent, consumer prices declined by 4 percent and consumer surplus increased by 6 percent (Jensen, 2007). It also led to important welfare improvements for both fishers and consumers.

Table 4.57: Importance of Mobile Phones to the Business Performance of Fishers

	SD N	DSE N	U N	ASE N	SA N	A %
Phone has improved my business performance	63(19.7)	83(26.0)	75(23.5)	44(13.8)	54(16.9)	30.7
Spoilage/wastage of fish and products have reduced with use of MT	73(22.9)	102(32.0)	84(26.3)	19(6.0)	41(12.9)	18.8

Source: Field Data, 2016

From the findings the; two aspects were considered. First, a direct impact of mobile telephony on business as a whole, second, the impact is reduction of waste as a result of using mobile phones

Table 4.58: **Mobile use and Business Performance**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	63	19.7	19.7	19.7
	Agree	83	26.0	26.0	45.8
	Undecided	75	23.5	23.5	69.3
	Disagree	44	13.8	13.8	83.1
	Strongly disagree	54	16.9	16.9	100.0
	Total	319	100.0	100.0	

The proportion of respondents who said that mobile phones positively impacted their business was 30.7%. This is different from the more than 80% who felt that it had increased their business profits. In this section, the respondents considered the business as a whole and not just the profit.

Table 4.59: Mobile Phones and Fish spoilage

	Strongly disagree		disagree to some extent		Uncertain		agree to some extent		strongly agree		Total		Agree
	N	%	N	%	N	%	N	%	N	%	N		%
Spoilage/wastage of fish and products have reduced with use of MT	73	22.9	102	32.0	84	26.3	19	6.0	41	12.9	319	100	18.8

Source: Field Data, 2016

Only two out of ten respondents affirmed that spoilage or wastage of fish and products have reduced due to the use of mobile phones as shown in Table 4.59. In Table 4.60, the correlation analysis shows that there was a p-value of 0.000 which means that there was statistical evidence to indicate a correlation between access to information and the reduction in wastage. However, the Pearson's R of 0.363 indicates a moderate-weak relationship. About 19% stated that wastage of fish had reduced with use of mobile phones. A study in India in 2007 by Jensen also found that expansion of mobile phone coverage led to a significant reduction in dispersion of fish prices as well as decline in waste. Tasman (2008) stated that 4% improvement in productivity of the fishing industry was attributed to mobile telephony.

Table 4.60: Correlation between Increased Access to Information and Reduction in Wastage of Fish Products

		Value	**Asymp. Std. Error[a]**	**Approx. T[b]**	**Approx. Sig.**
Interval by Interval	Pearson's R	.363	.061	6.667	.000[c]
Ordinal by Ordinal	Spearman Correlation	.348	.063	6.335	.000[c]
N of Valid Cases		294			

Based on normal approximation.

Source: Field Data, 2016

A summary of the extent to which the use of mobile phones has influenced different aspects of their business transactions is given in Table 4.38. Generally, the mobile phone did not have very high influence on business transactions as less than half of respondents (49.5%) said mobile phones had an influence in getting better prices for their products. More than four out of ten respondents said mobile phones had led to increased sales (47.6%) and increased their safety (43.9%). The respondents suggested that emergency services be provided to enhance safety to crew members who had no access to emergency services or training in rapid response.

Further findings indicate that the information which the respondents received included information about business (35.1% of respondents), weather forecast (35.7% of respondents) and regulations (21% of respondents). It is therefore not surprising that 30.7% of the respondents with mobile phones confirmed that they had experienced an improvement in business performance since they acquired mobile phones.

Table 4.61: **Extent to Which Mobile Telephony Use Has Influenced Respondents' Business Activities**

	Not applicable 1		No influence 2		Small Influence 3		Medium Influence 4		Large Influence 5		Total	
	N	%	N	%	N	%	N	%	N	%	N	Means
New customers	93	29.2	81	25.4	21	6.6	31	9.7	93	29.2	319	3.33
Better prices	81	25.4	80	25.1	63	19.7	58	18.2	37	11.6	319	3.46
Increased sales	83	26.0	84	26.3	68	21.3	66	20.7	18	5.6	319	2.91
Quicker turnover	133	41.7	70	21.9	63	19.7	26	8.2	27	8.5	319	3.64
Receive information on business	165	51.7	42	13.2	27	8.5	33	10.3	52	16.3	319	3.20
Reduced cost of travel	127	39.8	66	20.7	43	13.5	51	16.0	31	9.7	318	3.49
Business networks	140	43.9	55	17.2	9	2.8	47	14.7	68	21.3	319	3.30
Mean												3.33

Source: Field Data, 2016

The findings indicate that 29.2% had their business increase with new customers, 11.6% had mobile phone positively influence better prices. Therefore, the findings resulted in new customers (45.5% of respondents), better pricing (49.5% of respondents) and quicker turnover (36.4% of respondents). These percentages were noted to be generally low and were an indication that the potential of mobile telephony as a tool had not been optimized due to various challenges. There were 64.3% of respondents who said that mobile phones had a positive impact on the cost of travel, 58.9% said that there was a positive impact on the income while only 39.6% said there was an impact on reduction of wastage of fish products. Great impact dominated income (29.8%) while great negative impact was experienced by most on wastage of fish products (16%). Mobile phones had a marginal influence on average on the business activities with a mean score of 3.33. The individual means for each of the activities ranged between 3.33 to 3.49.

Respondents were further asked to rank how they felt the use of mobile phones had impacted their business safety. This is summarized in Table 4.62.The three forms of impact mentioned were on help in emergencies, information on weather and safety.

Table 4.62: Mobile Phone and Business Safety

	Not applicable 1		**No influence 2**		**Small Influence 3**		**Medium Influence 4**		**Large Influence 5**		**Total**		**Influenced Means**	
	N	%	N	%	N	%	N	%	N	%	N	%	%	
Help in emergencies	143	44.8	69	21.6	35	11.0	16	5.0	56	17.6	319	100	33.5	3.10
Information on weather	105	32.9	100	31.3	60	18.8	23	7.2	31	9.7	319	100	35.7	3.35
Safety	99	31.0	80	25.1	74	23.2	24	7.5	42	13.2	319	100	43.9	3.12
Mean														3.19

Source: Field Data, 2016

The lake is a risky place to be without any communication link with land. The respondents were happy that they could use their mobile phones while at lake to communicate (29.8%). In addition, 37.6% of the respondents said that there was increased security because of having

mobile phones. The mobile phone use and its influence on safety of fishing business had an average mean of 3.19 which translated to a minor influence.

According to Adeya (2003), some businesses lacked awareness about the potentials that exist in the use of mobile phones and ICTs. Mobile phone-based development projects are often based on the assumption that mobile phones can improve communication, coordination and service delivery. However, the use of mobile phone technology in these contexts may not always be Pareto-improving. Availability of ICT alone is not sufficient to produce a positive regional development. Other preconditions include the promotion of public awareness of the potential of the information society (European Commission, 1999).

The Poverty Reduction Strategy Paper (PRSP), (2001) identified some key issues that affected the fisheries industry as low incomes for fish farmers and low earnings in the fish industry. There was also low production of fish; and lack of fish marketing infrastructure. Over 10 years down the line, the impediments still stand. The paper proposed priorities for intervention which included the need for: improvement of infrastructure such as access roads, portable water, cold storage, land ownership and access to beaches and landing sites. Considering at the current development of landing sites against the PRSP, the impediments still remain a major concern. The potential of fishers to fully engage in value chain addition has been greatly hampered by lack of facilities such as cold storage facilities and access to basic amenities such as ice. Mobile telephony has the potential to help the fishers mitigate this challenge and it would facilitate a faster movement of the fish product for instance to communicate with the agents who come with their ice and cooler boxes and who, in turn, dictate the fish prices. These findings therefore rely heavily on spatial economic development theory which supports the dependence of spatial economic progress on mobile factors of production and technical knowledge. Thus, the business

transaction and the spatial economic or the distribution of the infrastructural developments relies on the use of mobile telephones to a great extent. The mobile factors of production therefore need to have necessary system and application in order to be functional.

4.4.5 Challenges Facing the Use of Mobile Telephony

Despite the fact that mobile phone ownership was nearly 100 percent, there were challenges that hindered the optimal use of mobile telephony for business transactions which is ultimately expected to have an impact on spatial economic development of the beaches. The challenges mentioned by the respondents are listed in Figure 4.11.

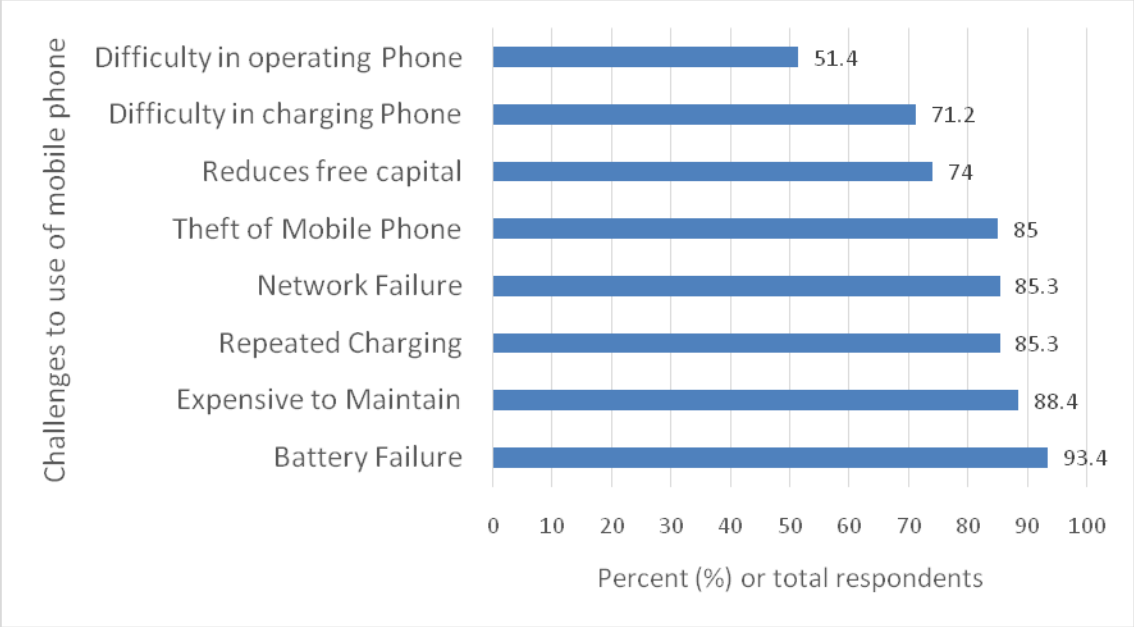

Figure 4.11: Challenges to Use of Mobile Telephony by Respondents

Source: Field Data, 2016

Battery failure and maintenance costs were mentioned as the biggest challenges by nine out of every ten respondents. Considering the brand of mobile phones sampled, it was discovered that majority had low end mobile phones with a possibility that the quality of batteries were low hence the rampant battery failures. Over 80% of the respondents mentioned the high cost of

repeatedly recharging their mobile phones. It could also be possible that exposing the phones to various charging systems including solar may be contributing to battery failures. It was also reported that there were counterfeit batteries available in the market and this could be escalating the challenge. Majority, 91% of the respondents across all the beaches indicated that their phone required repeated charging almost on a daily basis which was cumbersome and interfered with their business communication.

Availability of electricity at the beaches provided opportunities for phone charging and enabled use of mobile telephony for communication among the fishers. Only Usare beach did not have electricity within the beach. The most common means of charging phones was in pay shops, as most fishers did not have electricity in their homes. Due to lack of power supplies and high electricity tariffs in Kenya recharge of the battery of a mobile phone often becomes a hard task. People use shops with electricity, car batteries, solar panels and generators. For these reasons, to charge a full battery costs on average 0.40 USD in Kenya, but there were no standard costs according to Adeya (2005).

Majority, 80% of respondents indicated that their phones were expensive to maintain with regard to charging costs, repairs, replacement of batteries and cost of subscription. The cost of buying credit per day on average translated to about 3000 Kenya shillings per month. A good number, 73% of the respondents across the landing sites felt that mobile phones were expensive to maintain, where some of the expenses on the gadget included airtime, charging and repairs. Some 74% indicated that use of mobile phones had reduced their free capital. The findings corroborate the findings of Pramanik (2017) who stated, that while the mobile phone revolution presents enormous opportunity, challenges to mobile telephony utilization and access remain. Pramanik (2017) further stated that mobile phones were extremely expensive for those living in

low and middle income countries and that the median mobile phone owner in Africa spends over 13 percent of their monthly income on phone calls and texting. According to Adeya (2003), some businesses lacked the awareness regarding the potentials that exist in the use of mobile phone and ICTs. Mobile phone-based development projects are often based on the assumption that mobile phones can improve communication, coordination and service delivery. However, the use of mobile phone technology in these contexts may not always be Pareto-improving. Availability of ICT alone is not sufficient to produce positive regional development. Other preconditions include the promotion of public awareness of the potential of the information society (European Commission, 1999).

Mobile service providers' network failure was one of the greatest challenge to using mobile phones in nearly all the respondents in the landing sites. 85% of respondents indicated that poor network coverage was hindering the use of mobile phones. It was also confirmed that there was only one beach with a network booster within its vicinity. The failure was both at the landing sites and at the lake during the fishing expeditions. The mobile phone had the potential to help in times of emergency while the fishers were in the lake and this could only be possible with availability of network services from the mobile service providers. Theft of mobile phones was also noted as a challenge with 89% of respondents across the beaches indicating so. More than half, 57% of the respondents across the landing sites felt that mobile phones were difficult to operate. This implies that the users are not therefore able to optimally utilize the technology. The reason for difficulty in operating the phones included inability to reach customer care when there were difficulties with services and this was worsened by lack of network services.

The Poverty Reduction Strategy Paper (PRSP), (2001) identified some key issues in fisheries as low incomes for fish farmers and low earnings in the fish industry. Other factors were low

production of fish; and lack of fish marketing infrastructure and over 10 years down the line the, challenges still remain. The paper proposed priorities for intervention including the need for: improvement of infrastructure such as access roads, portable water, cold storage, land ownership and access to beaches and landing sites. Considering the current development of landing sites against the PRSP, the challenges still remain a major concern. The potential of fishers to fully engage in value chain addition has been greatly hampered by lack of facilities such as cold storage facilities and access to basic amenities such as ice. Mobile telephony has the potential to help the fishers mitigate this challenge and it would facilitate a faster movement of the fish product, for instance, to communicate with the agents who come with their ice and cooler boxes and who, in turn, dictate the fish prices

4.5 Influence of Mobile Telephony Utilization on Spatial Economic Development of the Beaches in Lake Victoria, Kisumu County Kenya

This section first presents the spatial temporal changes of the beaches between 2008 and 2018 will a focus on development of infrastructure and super-structures that support the use of mobile telephony. Secondly, it presents the situational analysis of the beaches in view of the spatial economic development as well as contextualization of the time-space convergence concept. Data was collected through observation, as well as secondary data from google map retrieved from 2008 records of the infrastructures and superstructures along the beaches. Data was also collected through questionnaires administered to fishers, key informant interviews and focus group discussions. The data was analyzed using both descriptive and inferential statistics and presented in frequency tables and regression analysis.

4.5.1 Spatial Temporal Changes of the Beaches

The distribution of the infrastructure and super-structures were captured by GIS mapping in a 2018 field survey compared with satellite images obtained for 2008 through Google maps. From the images, it can be seen that various beaches have witnessed varied levels of spatial economic development including infrastructure and super-structures. Specifically, focus was on the structures and infrastructure that have spawned in support of mobile telephony use in business transaction. The key features of interest included mobile banking vendor shops (MPESA), charging shops, phone repair shops, cold rooms, mast in vicinity and mobile networks. Therefore, during the field observation data collection period, the study sought to establish the spatial economic development at the 6 beaches that included Usoma, Rota, Usare, Paga, Rari and Ogal as shown in Figure 4.14 to 4.25.

The observation on the infrastructure and super-structures relating to mobile phones were as follows for Usoma beach.

Usoma Beach infrastructure and super-structure features 2008
No Electricity available at the beach
No MPESA shop
No charging shops
No Phone repair at the beach
No cold room at the beach
No mast in the vicinity of the beach

Usoma Beach infrastructure and super-structure features 2018
Good network for Safaricom(S)
Electricity available at the beach
1 MPESA shop available 200mtrs away from the beach
2 Charging shops available 200 mtrs away from the beach
No Phone repair at the beach
No cold room at the beach
No mast in the vicinity of the beach

4.5.1.1 Usoma Beach

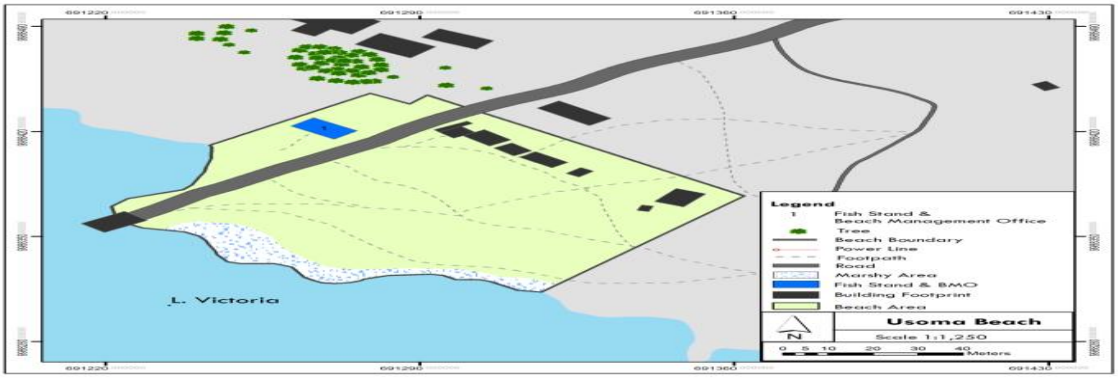

Figure 4.14: Usoma Beach 2008

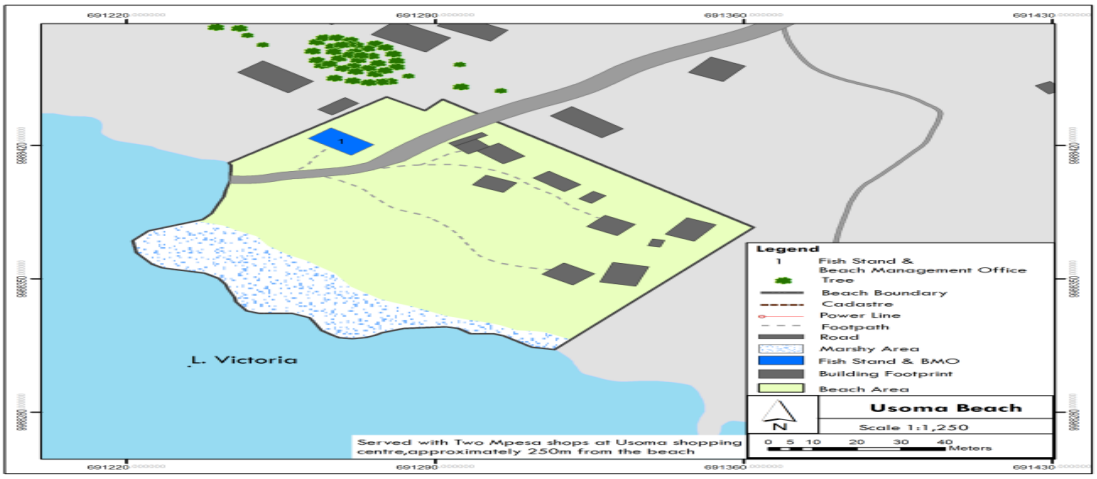

Figure 4.15: Usoma Beach 2018
Source: Field Survey 2018

The map indicates that there is electricity connection, charging shops and a good road. Further observation from the field also established various aspects of development. This included an MPESA and charging shops and mast in the nearest shopping centre about 200 metres away.

Usoma Beach had 140 registered fishers and 50 boats operating at the beach. Usoma beach was the nearest to Kisumu City compared to the other beaches under study. This meant that it had an advantage in terms of reduced distance compared to other beaches. In 2008, the beach area was not as marshy as in 2018 Figures 4.16 and 4.17 show the images of Usoma Beach for the period 2008 to 2018. Between 2008 and 2018, there were some significant changes in the structural

development of Usoma Beach. There were several new structures which was an indication of increase in population.

2.5.1.2 Rota Beach

The observation on the major infrastructure and super-structures relating to mobile phones were as follows for Rota beach.

Rota Beach Infrastructure and super-structure 2008
No electricity available at the Beach No MPESA shop at the Beach No charging shops at the Beach No Phone repair at the Beach No mast in vicinity of the Beach

Rota Beach Infrastructure and super-structure 2018
Good network for Safaricom Electricity available at the Beach 2MPESA available 1.4Km from the Beach 2 Charging shops available 1.4Km from the Beach No Phone repair at the Beach No mast in vicinity of the Beach

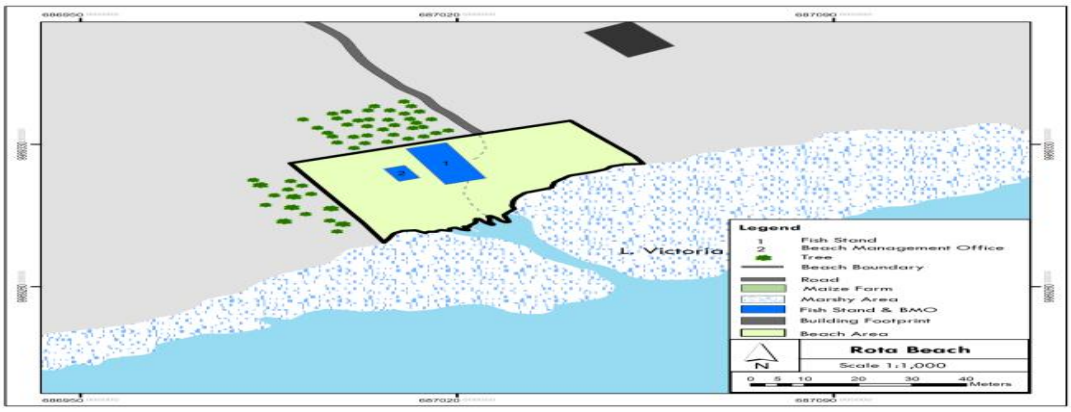

Figure 4.16: Rota Beach in 2008

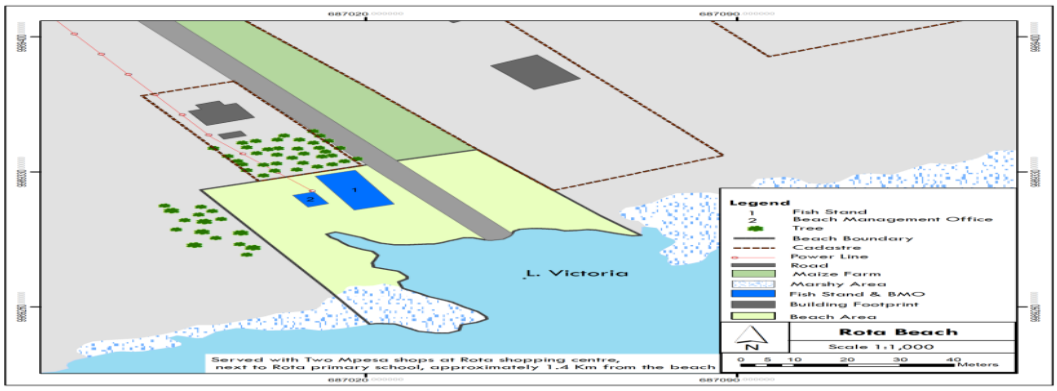

Figure 4.17: Rota Beach in 2018
Source: Field Survey 2018 of various years

Rota Beach had 71 registered fishers and 42 boats operating within the beach. It had a fish stand, BMU offices and an accessible road network. The beach did not have a fish store or a mobile phone service provider network booster in the vicinity. Rota beach road access had improved compared to 2008. This was an indication of increased human traffic with some mobile telephony services within the beach. The nearest MPESA shop was 1.4 km away from the beach.

Plate 4.1: MPESA Shop in Rota Shopping Centre
Source: Field data 2016

Plate 4.1 indicates that there is a presence of MPESA shop 1.4 km from Rota beach. This implies that there are some economic activities going on around the beach, which impacts positively on

spatial economic development. Rota Beach ostensibly had a significant change in spatial temporal development over a span of 10 years as evident in the maps of the 2018 field survey. Carmody, (2012) mentioned two forms of spatial connection heuristically, as spatial articulation to the outside world and social articulation dealing primarily within localities in Africa. An important question is how mobile phones, in particular, change the nature of Africa's spatial articulation with the global economy.

4.5.1.3 Usare Beach

Usare Beach had 40 boats according to LVFO (2012). The beach was active in 2008. It has several structures by then and two main access roads one accessing from the north and the other from the east as shown in Figures 4.18 and 4.19.

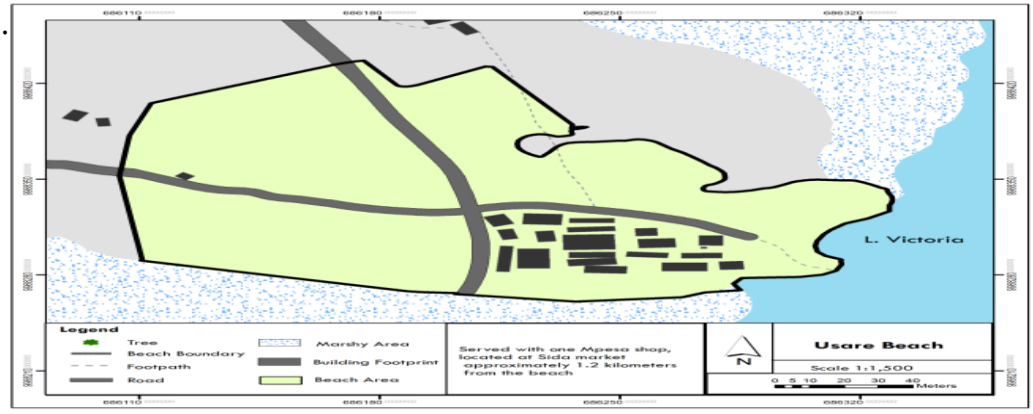

Figure 4.18: Usare Beach 2008

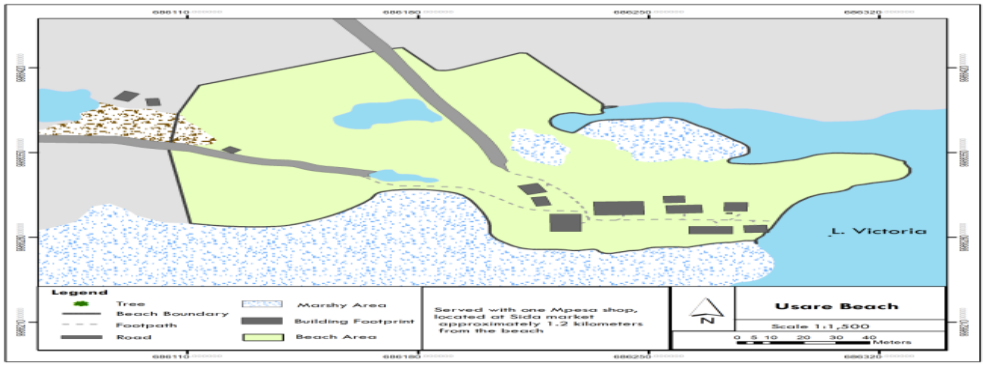

Figure 4.19: Usare Beach in 2018
***Source*: Field Survey 2018**

The observation on the major infrastructure and super-structures relating to mobile phones were as follows for Usare Beach:

Usare Beach infrastructure and super-structures 2008
No Electricity at the Beach
No MPESA shop
No charging shops available
No Phone repair
No mast in the vicinity

Usare Beach infrastructure and super-structures 2018
Good network for Safaricom
Electricity not available at the Beach
MPESA 2Km away in Sida market
Charging shops not available
No Phone repair
No mast in the vicinity

There were no sand mining activities and the beach was less marshy. However, in 2018, the beach was not accessible and the nearest MPESA shop was 1.2 km away in Sida market. This was the only beach among the 6 under study that did not have electricity. Most of the fishers in 2018 had migrated to Paga and Rari beaches.

4.5.1.4 Paga Beach

Figure 4.20 and 4.21 illustrate Paga Beach temporal images for the period 2008 and 2018.

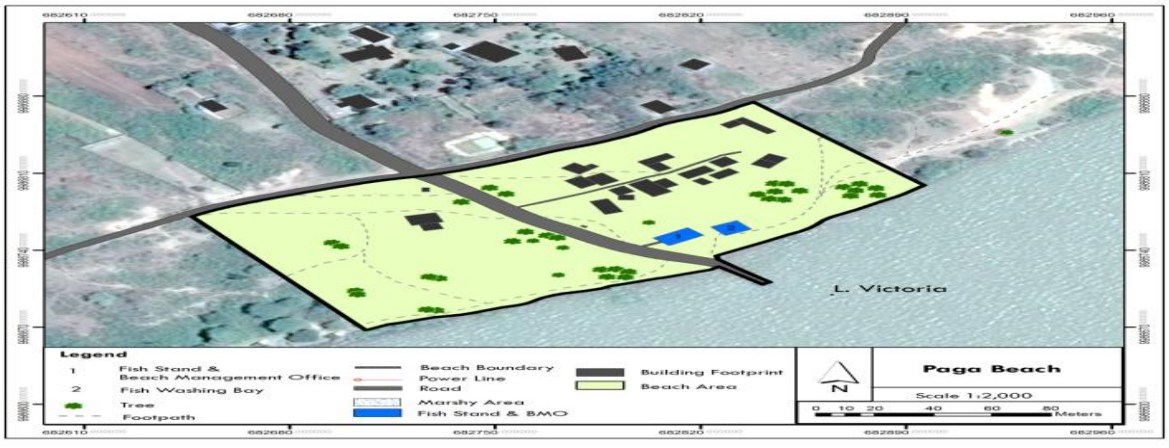

Figure 4.20: Paga Beach in 2008
Source: Field Survey 2018

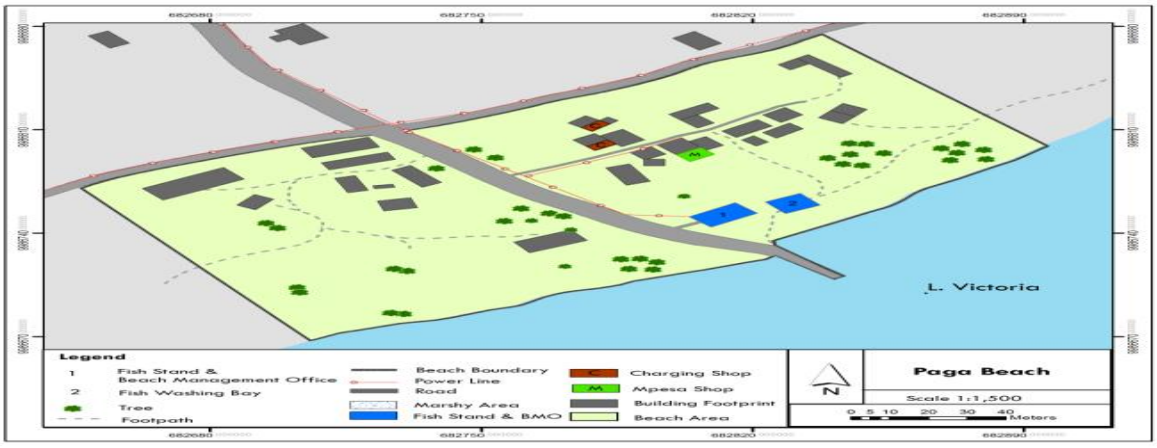

Figure 4.21: Paga Beach in 2018
Source: Field Survey 2018 of various years

The observation on the infrastructure and super-structures relating to mobile phones were as follows.

Paga Beach infrastructure and super-structures 2008
Electricity available at the beach
No MPESA shop available at the beach
No charging shops within the beach
No Phone repair shops
No mast in vicinity of the beach

Paga Beach infrastructure and super-structures 2018
Electricity available at the beach
1 MPESA shop available at the beach
2 Charging shops within the beach
No Phone repair shops
No mast in vicinity of the beach
Poor network coverage for Safaricom

According to LVFO (2012), Paga Beach had 133 registered fishers with 42 boats operating at the beach.The beach had electricity within it but had no cold room nor network booster in the vicinity. There were at least 3 new structures and several in the area around the beach. No change was observed in the road network. Structural development concentrated around the beach as well as along the road but was scattered. Paga beach had one MPESA shop and two mobile

charging shops within its environs. Electricity was not available in 2015 but was available in 2018. Residential structures were developing on the western side within the beach boundary and showed evidence of convergent patterns of structural development at the beach.

Plate 4.2: Crew Members at Paga Beach using mobile phones
Source: Field data 2016

4.5.1.5 Rari Beach

The observation on the infrastructure and super-structures relating to mobile phones were as follows.

Rari Beach infrastructure and super-structures 2008
No electricity available at the Beach
No MPESA shop at the Beach
No charging shop within the Beach
No Phone repair at the Beach
No mast in vicinity of the Beach
No private Communication Mast available within the Beach

Rari Beach infrastructure and super-structures 2018

Electricity available at the Beach
I MPESA shop 2Kmaway from the Beach
1 Charging shop within the Beach
No Phone repair at the Beach
No mast in vicinity of the Beach
Weak network signal for Safaricom and others
Private Communication Mast available within the Beach

Figures 4.22 and 4.23 represents images of Rari Beach for 2008 and 2018 respectively.

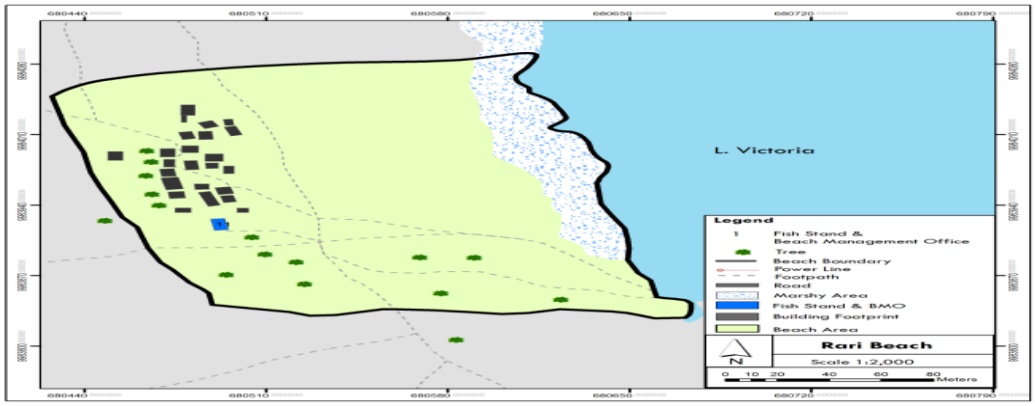

Figure 4.22: Rari Beach 2008

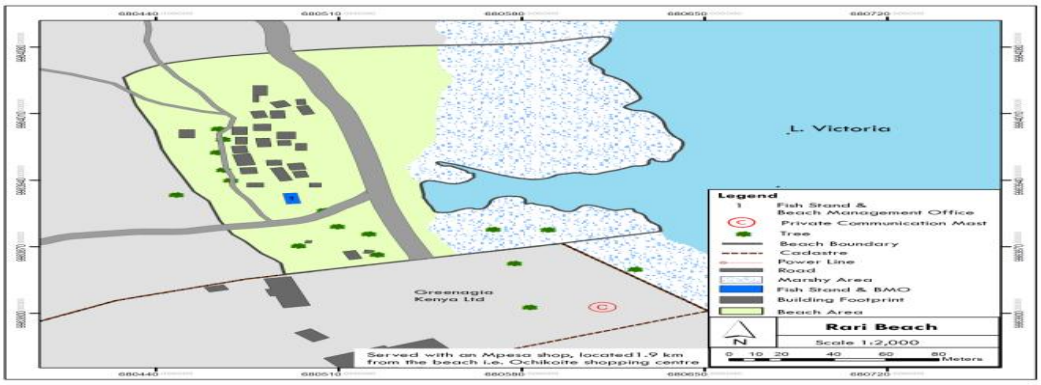

Figure 4.23: Rari Beach 2018
Source: Field Survey 2018

Rari Beach had 80 registered fishers and 45 boats, according to LVFO (2012).

There was no proper road access in 2008 and this was an indication of low human traffic. The structures in 2008 and 2018 were observed to follow a linear pattern parallel to the shore line. After the establishment of a briquette making company within the beach, there was an opening

up of the main access road to the beach. The nearest MPESA shop to Rari beach was approximately 1.9 km away. The beach with a newly commissioned fish stand and a Beach Management Unit office. While there was evidence of human traffic due to open road, there were no activities supporting mobile phone use within the beach. The nature of structural development was a central evidence of a converging pattern of development.

Plate 4.3: MPESA shop superstructure at Rari Beach

Source: Field Data 2016

4.5.1.6 Ogal Beach

The observation on the infrastructure and super-structures relating to mobile phones were as follows.

Rari Beach infrastructure and super-structures 2008
Electricity available within the Beach
1MPESA 250 mtrs away from the Beach in Ogal shopping centre
1 Charging shop250 mtrs away from the Beach
No Phone repair within the Beach and no masts within vicinity of the Beach
No mast in vicinity

Rari Beach infrastructure and super-structures 2018
Good network for Safaricom
Electricity available within the Beach
3MPESA 250 mtrs away from the Beach in Ogal shopping centre
1 Charging shop250 mtrs away from the Beach
No Phone repair within the Beach and no masts within vicinity of the Beach
No mast in vicinity

Figure 4.24: Ogal Beach 2008

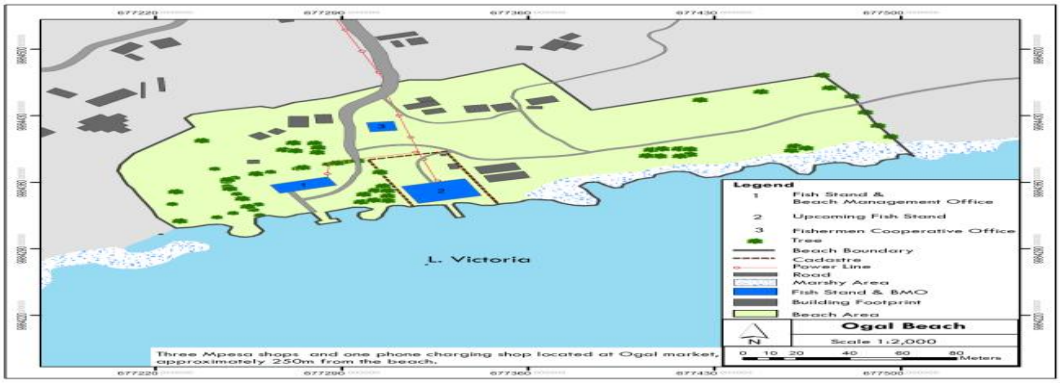

Figure 4.25: Ogal Beach in 2018
Source: Field Survey 2018

Ogal Beach had 155 registered fishers according to LVFO (2012). This was the highest in all the beaches. It had 50 boats operating in the beach. It was the only beach with a cold room. There was no significant change in spatial development in Ogal Beach between 2008 and 2018 for a span of 10 years. Most of the mobile telephony services including MPESA and phone repairs

were accessed through the Ogal Centre which was about 250 meters away from the beach. As shown in Figures 4.25 and 4.26, in 2008, there was only one fish stand with a BMU office. The beach was easily accessible from the eastern side via a well-established murram road and beach activities were spread along the eastern shore within the beach. In 2018, several structures within the beach that were present in 2008 had been abandoned and were in poor condition. Activities in 2018 had shifted to the western side of the beach near the newly established fish stand. The beach was being accessed through the northern access road which seems closer to Ogal Market. The market is about 250 meters from the beach and had 3 MPESA shops with 2 phone charging shops.

Plate 4.4: MPESA Shop at Ogal Shopping Centre
Source: Field data

Ogal shopping centre in the peripheral area may be slowing the development of the beach as the business centre attracted several structural developments.

Plate 4.5: MPESA shop superstructure at Ogal Beach

Source: Field data

Therefore, structural development was along the road as opposed to around and within the beach. Going by the structural development we can deduce an increase in population in the area around the beach.

4.5.2 Situational Analysis of Spatial Economic Development of Beaches

The six beaches had a total of 269 fishing crafts with Ogal Beach having the highest number of 50 of fishing boats against an average 45 per beach. According to LVFO (2014), Kisumu West Sub County had 288 fishing boats out of 446 in Kisumu County's Lake Victoria. Fishing is one of the key economic activities that drive the agricultural sector in Kenya. These findings confirmed that fishing activity was indeed an ongoing economic activity in Kisumu County of Lake Victoria Kenya.

In general, there were new business entities engaged in activities supporting mobile telephony. These included majorly MPESA shops that were not there in 2008. Other opportunities for small

businesses relating to mobile telephony were clearly not visible. For instance, phone kiosks and repair shops were scarce. Small and medium sized enterprises which include fishers have continued to contribute significantly to Kenya's economic development. However, enterprises face many challenges including poor infrastructure, lack of qualified personnel and poor access to adequate credit and financing. The World Bank's 'Doing Business 2013' report ranked Kenya 117th out of 183 economies in its ease of doing business (Breuil & Grima, 2014). More of these small businesses were expected to be present at the beaches but were glaringly missing and this may be attributed to poor infrastructure and decline in the fish harvest. Furthermore, it was observed that the superstructures that support use of mobile telephony were in 4 beaches located within 250 metrers to 1.4 kilometers away from the immediate beach environment under the control of BMU.

Mobile telephony is one of the most widespread ICT, in the current world and more so in Africa and Kenya. Indeed, ICTs are implicated in further and new forms of social stratification between the "information rich" and poor. Rather than leading to spatial and social homogenization, new ICTs create geographies and social topologies of "enablement and constraint" (Bijker & Law, 1992) cited in Graham, 2008). Mobile telephony could be used to visualize human activity patterns and collective motion traces and project future beach development trends. The spatial motion patterns could be observed by monitoring the changing locations of single mobile phones over time and Geographic Information Systems could be applied to record the motions. The visualization could expose a wide range of urban dynamics; information and communication networks, movement patterns of people and layout of transportation systems, spatial and social usage of public space and neighborhoods as was mentioned by Ratti *et al*., (2006). This is an

opportunity for exploration given the level of mobile telephony ownership as a way of unlocking the reason for slow transformative influence of mobile telephony.

Fishers were also asked to share the extent to which they perceived spatial economic development of the beaches. The findings are presented in Table 4.63 that follows

Table 4.63: Spatial Economic Development of the beaches

Spatial economic development	SD (1)	D (2)	NS (3)	A (4)	SA (5)	M
Generally, mobile telephony utilization has contributed to beach development infrastructures and superstructures	12(3.8)	14(4.4)	41(12.9)	106(33.2)	146(45.8)	4.13
The MPESA shops at the beach are due to mobile telephones	27(8.5)	26(8.2)	63(19.7)	70(21.9)	133(41.7)	3.80
The phone repair shops at the beach are due to mobile telephony	56(17.6)	16(5.0)	35(11.0)	69(21.6)	143(44.8)	3.71
We have good phone connectivity (networks) and hence faster sale of fish to buyers	58(18.2)	28(8.8)	17(5.3)	65(20.4)	151(47.3)	3.70
The phone charging shops at the beach are due to mobile telephones	31(9.7)	23(7.2)	60(18.8)	100(31.3)	105(32.9)	3.71
Mobile Phone use has contributed to infrastructural development at the beach eg masts, electricity	52(16.3)	33(10.3)	27(8.5)	42(13.2)	165(51.7)	3.74
Overall mean						3.75

KEY: SD-strongly disagree, D-Disagree, NS-Not Sure, A-Agree, SA-Strongly Agree, M-Mean.

Source: Field Data, 2016

The findings in Table 4.63 indicate that majority, 133(41.7%) of the respondents also attributed the increase in MPESA shops to mobile telephones while 143(44.8%) attributed the increased phone repair shops at the beach to use of mobile telephony although in four out of the six

beaches the mobile banking vendor shops, phone charging shops were located out of the BMU beach boundary. It is also clear from the findings that mobile phone use has contributed to infrastructural development at the beach as revealed by majority, 165(51.7%) of the respondents who strongly agreed and this included electricity and mobile service provider network . Furthermore, majority of the respondents, 151(47.3%) strongly agreed that they have good networks hence faster sale of fish to buyers while 146(45.8%) strongly agreed that generally, beach development is due to mobile telephony utilization. The mean ranged between 3.46 and 4.13 implying that respondents perceived above the average mean of 3.0, that there was spatial economic development of the beach due to telephony utilization. An overall mean of 3.75 confirmed that there was an agreement among the fishers that the spatial economic development could be attributed to the use of mobile telephony. The means obtained in Table 4.17 were used in the regression model. Therefore, a simple linear regression model was carried out to determine the influence of utilization of mobile telephony on spatial economic development of beaches. This was achieved by regressing the means obtained from Table 4.17 on the extent of utilization of mobile telephony against the spatial economic development means in Table 4.63 with values of 2.83 for telephony utilization and 3.75 for beach development. The findings on the influence of mobile telephony utilization using standardized coefficients are presented in Table 4.64.

Table 4.64: Influence of Utilization of Mobile Telephony on Beach Development

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.294	.164		7.912	.000
	Mean mobile telephony utilization	.567	.049	.542	11.497	.000

a. Dependent Variable: beach development

Source: Field Data, 2016

The findings in Table 4.58 indicate that utilization of mobile telephony had a positive significant contribution on spatial economic development of beaches (β=.542, p=.000). This means that the greater the utilization of mobile telephony, the more the spatial economic development among the beaches. The study thus revealed a positive influence on spatial economic development of the beaches. Further results on the summary model indicating the overall percentage change in spatial economic beach development accounted for by utilization of mobile telephony are presented in Table 4.65.

Table 4.65: Summary Model of influence of mobile telephony utilization on Beach Development

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.542[a]	.294	.292	1.360	.294	132.188	1	317	.000

a. Predictors: (Constant), mean utilization of mobile telephony

Source: Field Data, 2016

The findings as indicated in Table 4.65 show that utilization of mobile telephony accounted for 29.4% change in spatial economic development of the beaches. The findings were also significant as indicated by a p value that was less than .05, (p=.000). This implies that utilization of mobile telephony has a positive significant influence on spatial economic beach development. The model was also fit as indicated in the following equation

$$Y = 1.294 + 0.567X + \varepsilon_i$$

From the model, it is clear, that before incorporating mobile telephony utilization, there is a constant improvement in beach development (B=1.294). However, telephony utilization also positively contributes to beach development (β=0.567). The outcome (R^2=.294) is also significant.

Fishing is one of the key economic activities under agriculture that drive the Kenyan economy. According to Breuil and Grima, (2014), Kenya's economy is primarily driven by four sectors: financial intermediation, tourism, construction and agriculture (including agriculture, hunting, forestry and fishing). In Kenya, inland fisheries dominate the fishery sector contributing to about 85 percent of the national fish production, mainly from Lake Victoria. Marine fisheries and aquaculture contribute about 6 percent and 8 percent respectively. According to the Perspective (1999), some of the criteria and indicators of spatial development include changes in population numbers; changing nature and location of economic activities; technological changes in transport and telecommunication.

The beach facilities were mostly in poor state but despite those challenges, the benefits of mobile telephony on spatial development were achieved to a minimal extent. Carmody, (2012) stated that benefits of mobile phones might be proportionately greater in resource-constrained settings, e.g. the poor and rural populations. This is particularly true of extreme poverty that results from isolation. Mobile phones are seen as a potential solution to this problem by connecting the continent, both to the outside world and internally. Much of the literature on information and communication technology for development focuses on how ICTs enable socioeconomic connection or articulation, thereby, almost axiomatically, reducing poverty (Carmody, 2012).

Mobile phones have then been absorbed into, but have not transformed, economic structures in Africa. In fact, these inequitable structures produce poverty, as do mobile phones for many less powerful, if not quite powerless, people, when mobiles are inserted into the structures. Only developmental states in Africa can leverage the positive developmental potential of mobile phones and other new ICTs to achieve wider economic transformation(Soludo *et al*., 2004) . The

foregoing situation seems to be the case from this study as generally the transformative influence is not yet evident even though the technology had been absorbed.

According to Doxiadis, (1966), a successful system will provide man with much greater horizons and give new dimensions to his life, depending on how well communication systems are interconnected into an organic whole. Vision 2030 identified agriculture as one of the key sectors to deliver the 10 percent annual economic growth rate envisaged under the economic pillar. To achieve this growth, transforming smallholder agriculture from subsistence to an innovative, a commercially oriented and modern agricultural sector is critical (Breuil & Grima, 2014). Fishing activity is a major contributor to the county's GDP. The 6 beaches studied are the major beaches in the sub-county that are to lead in actualizing Vision 2030. Whereas mobile telephony is a space adjusting technology that can be used to fast trackthe business activities and ultimately spur spatial development of beaches, it had not influenced the development to a transformative level cited in other findings.

Focus group discussions were carried out to determine the distances between Kisumu and the respective beaches and the time of communication between 2000 and 2018 in hours. The findings are presented in Table 4.66.

Table 4.66: Time Space Convergence per Beach

Beach	Distance from Kisumu City (Km)	2019 Communication time by phone in hours	2000 Transport time in hours	TSC 2000 and 2019
Ogal	24.9	0.016666667	1	-0.051754386
Rare	21.5	0.016666667	0.75	-0.038596491
Paga	21.8	0.016666667	0.5	-0.025438596
Usare	29	0.016666667	0.46	-0.023333333
Rota	27.7	0.016666667	0.41	-0.020701754
Usoma	8	0.016666667	0.3	-0.014912281

Source: Field Data, 2016

From the focus group discussions, it was established that Kisumu is the main market where fish produce from the beaches are sold. On the distance from Kisumu to the beaches, it was established that Rota was the furthest while Usoma was the nearest. From the FGDs, it was established that it took between 1 hour and 30 minutes in 2000, to reach the various beaches to transact business as shown in Table 4.60. Due to mobile phone utilization in 2018, there had been a consequence of time and space denoted by the negative scores. Use of mobile phone offers almost instantaneous transaction, and thus a consequence of time over distance as a result of mobile factor of production.

Spatial economics theory is centered on the problem of uneven distribution of factors of production and the role of distance. The factors of production can either be mobile or immobile. Economic activities are concerned with bridging the space between buyers and sellers because they are dispersed in space and overcoming the distance between them can be costly. Transport and communication are key to bridging the space between buyers and sellers and improvements in transport and communications have been among the main driving forces of economic progress. According to Kasper (1994), spatial economics theory is an approach that looks at the role of space in the functioning of society. In the current study, we found that time and space have been compressed by use of mobile telephony such that physical travel to make transaction was no longer necessary due to utilization of mobile telephony. However, it was still necessary to have the necessary infrastructural and super-structural development to support the use of mobile telephony as was found in the study.

CHAPTER FIVE

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This section presents the summary, conclusion and recommendations based on the three objectives of the study. The first objective assessed the level of mobile telephony utilization amongst the fisher communities in Lake Victoria, Kisumu West Sub-County Kenya.

The second objective established the influence of mobile telephony on the business transactions of fisher communities in Lake Victoria, Kisumu West Sub-County, Kenya. The third objective assessed the influence of mobile telephony use on spatial economic development of the Beaches in Lake Victoria, Kisumu West Sub-County, Kenya

5.2 Summary of Findings

The findings on the level of mobile telephony utilization among the fishers were reflected on the different dimensions assessed. Based on ownership, there was a high percentage among the fishers compared to those who did not own them. However, smart phone ownership was low. Most of the fishers have also owned the phones for a long period of time and with high expenditure on airtime among the different categories of the fishers. Various platforms of the telephone utilization also emerged to be the expected common forms that included communication, money transfer, and entertainment. Use of mobile phone for social media was also low among the fisher communities. The findings also revealed that the level of telephony utilization among the fishers was highly ranked on the three main business uses that included communication, ordering goods/services and mBanking. There, were however, other factors that were associated with the level of telephony utilization as gauged by chi square tests, which included age, education level, ease of use, its usefulness and reliability. In general, it can be

summarized that there was a high level of mobile telephony utilization among the fishers in beaches in Kisumu West Sub-County.

The second objective of the study sought to establish the influence of mobile telephony utilization on the business transactions among fishers in Kisumu West Sub-County beaches. The findings revealed the existence of Electronic Fish Market Information System (EFMIS) which aided in business transactions. This was confirmed by the significant influence of increased access to information on business network. The findings also revealed that mobile telephony utilization had a positive and significant influence on business transaction, particularly on money transfer, and business incomes, performance and profits. Correlation between access to information through use of mobile telephony and reduction in wastage of fish products further confirmed the positive influence of telephone utilization on business transactions. In addition, there was a remarkable improvement in business safety attributed to utilization of mobile telephones. In summary, the findings give a positive influence of mobile telephone utilization on business transactions with a lower change as compared to the level of ownership of mobile telephony.

The final objective of the study was to determine the influence of mobile telephony on spatial development of the beaches in Lake Victoria Kisumu County. A comparison of the various beaches before and after utilization of mobile telephony revealed spatial economic development of structures and superstructures that support use of mobile telephony. Intuitively, the findings conform with the time space convergence which occurred in the beaches as a result of using mobile telephony. The spatial distribution of infrastructure and super-structures supporting the use of mobile phones including Mbanking, shops, charging shops, masts have increased between 2008 and 2018 based on longitudinal observation. The spatial economic development of the

superstructures tended to be evident in areas near the beach and not necessarily within the beach area managed by BMU. There is a convergence, which does not reduce the actual distance but makes communication more effective with reduced time travel. Additionally, the overall business atmosphere among the beaches indicates an improvement, indeed, a simple linear regression model revealed a positive significant influence of telephony utilization on spatial development among the different beaches. The percentage change in development accounted for by the telephony utilization was nearly 30% implying that there is enough evidence to attribute the spatial development of the beaches on the utilization of mobile telephony.

5.3 Conclusions

The first objective was to establish the level of mobile telephony utilization. Mobile telephony utilization is not theoretical but practical in Kenya, more so, among the fishers around the lake Victoria beaches. Utilization is highly indicated through the communication features that entail entertainment, communication and business transactions. Ranging from the different service providers through the gadget to the amount spent through the phones, it is clear that there is a high level of ownership but low levels of ease of use and use with software applications and social media. It can be deduced that the trends in the utilization of mobile telephony does not differ much from the international trends in the developed countries although the fishers utilized mobile telephony more for social purposes than for business.

In the second objective, the influence of telephony utilization of business transaction was measured through various aspects, which revealed the expected outcome. It can be concluded that use of mobile phone was preferred over face to face transaction. This can be proved through the improved access to information, easy ordering of goods and services, faster payments and ferrying of the fish products with reduced wastage. The high level of ownership is not

commensurate with the increase in income and profit and an indication that there are drawbacks to optimal use of mobile telephony for business transactions. There also seems to be low adoption of other applications that can enhance functionality of mobile telephony like EFMIS and GPS.

There has been spatial economic development of beaches in terms of infrastructure and super-structures that support the use of mobile telephony to a minimal extent within the beaches. However, there has been a trend in location of certain superstructures within the periphery of the beach and out of the BMU boundaries. This could be attributed to stringent conditions of BMU that lead to establishment of these superstructures outside the BMU managed beach boundaries. Finally, as a way to prove the working of the time space convergence theory, telephony utilization has positively led to the reduction of the time used in the operations of the businesses around the beaches hence the beach space has been compressed with the main markets for fish products. The final conclusion is that mobile telephone utilization has had a positive influence on spatial economic development of fisher communities through advancement in fishing activities and spawning of infrastructure and superstructures that support use of mobile telephony.

5.4 Recommendations

i. The service providers and other ICT support groups should conduct demonstrations on use of Internet, software applications and social media to enhance fishing business operations.

ii. ICT support groups should come up with mobile phone based systems or applications that can fast track business communication amongst fishers and the market. The software

application to be user friendly and an ICT support hub be created within the beaches to support use of mobile telephony.

iii. BMUs should create conditions that are attractive for investors and allow for development of infrastructure and super-structures within the beach boundaries to support use of mobile telephony. The Kisumu County planning department should institute development control measures for superstructures in the beaches to optimize use of space.

5.5 Suggestions for Further Research

Further studies on the spatial distribution of mobile phone service provider signals strengths around the beaches and fishing sites should be undertaken.

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APPENDICES

Appendix 1: Fishers' Questionnaire

This questionnaire is being used to find out mobile telephony utilization amongst fishers in Kisumu County of Lake Victoria, Kenya. Your responses will be used purely for academic purpose; hence confidentiality and anonymity are assured.

INSTRUCTIONS:

Please read the following questions carefully – Tick () appropriate answer(s) in the spaces provided and specify where necessary. **Thank you.**

Entry Number_____

GENERAL SURVEY DATA

Date of Interview_____2.Beach_____

DEMOGRAPHIC CHARACTERISTICS DATA

1. Gender Male Female
2. Age 19-29 30-40 41-51 52 and above
3. Marital Status Married Single Divorced Widow/Widower
4. Category of Fisher: Crew member Fish Processor Laborer Boat Builder Other_____
5. Education

No School Primary Secondary Tertiary University

6. Experience in Fishing Industry

1-5 6-10 11-15 16 and above

7. Own a mobile phone? Yes No
8. Working Hours? Day Night Day & Night Any time

OBJECTIVE 1: Assess the level of mobile telephony utilization amongst the fishers.

How long have used mobile phone less than 1 year 2 -3years 3-4 years 4-5 years 5-6 Move than 6 years

Expenditure of airtime per day less than Ksh 20 Ksh. 20 Ksh50 Ksh.100 Ksh.250 more than Ksh. 250

Is the mobile phone airtime affordable? Yes No

Mobile Phone brand name_____Model:_____

Means of charging Phone most of the time Home Pay Shop Friends Solar

Subscribes to :Safaricom Airtel Orange You Other

Connectivity: indicate whether, Always, Sometimes or Never

Safaricom_____, Airtel_____Orange_____, You_____Other_____

Connectivity to Information System on phone Yes No

8. Information System used: EFMIS GIS GPS Other (specify)_____

9. Purpose for using information system_____

10. Results of using the information system_____

11. Uses of mobile phones

Type of phone services	Frequently	Sometimes	Never	Do not know	others
(i)Voice Calls					
(ii)Send/Receive SMS					
(iii)Paying bills					
(iv)Send/Receive money (M-PESA)					
(v)GPS					
(vi)OLX					
(vii)Use phone for Internet					
(ix) Watch TV					
(x) Listen to Radio					
(ix) Other uses					

12. Number of calls made and SMS sent on average per day indicate

Frequently/sometimes/ Rarily/never

Category	Calls made	SMS sent
(i)Friends, colleagues, family		
(ii) business communication		
(iii)Ordering goods/services		
(iv)mBanking		
(v)Entertainment		
(vi)others		

OBJECTIVE 2: Establish the influence of mobile telephony utilization on economic activities amongst the fishers.

1. Profit increase or reduced by use of mobile phone _____

2. Increase or decrease by what % approximate_____

3. Time Space Convergence

	Strongly disagree	disagree to some extent	uncertain	agree to some extent	strongly agree
(i)Information I get through phoneis current					
(ii) I get adequate assistance on phone services (Assistance) e.g. customer service					
(iii) I can access all the services I want using phone (Accessibility)					
(iv) My phone is ease to use					
(v) My phone is reliable					
(vi) Can use my phone anywhere including when fishing in the Lake (mobility)					
(vii) Phone has improved my security on shore					
(viii) Phone has improved my business performance					
(ix) Spoilage/wastage of fish and products have reduced with use of MT					
(x) Business networks have improved with use of phone					
(xi) I have increased access to information					

4. Indicate the extent to which mobile telephony use has influenced each of the following activities for you.

	Not applicable	No influence	Small Influence	Medium Influence	Large Influence
New customers					
Better prices					
Increased sales					
Quicker turnover					
Help in emergencies					
Receive information on business					
Better coordination with other partners					
increased awareness On legal rights, regulations etc					
information on weather					
Safety					
Reduced cost of travel					

Business networks					

5. Which of these challenges do you face as a fisher in the use of mobile phone?

(Tick as may apply**)**

Mobile phone network failure

Mobile phone battery failure

Theft of phone

Repeated recharging of mobile phone is money consuming

Mobile phone expensive to maintain

Mobile phone reduces the free capital accessible to fishermen in harsh economic times

Difficulty in operating phone

Difficulty in charging phone

List other challenges to mobile telephony utilization_____

_____

OBJECTIVE 3: Spatial patterns of the Beaches in view of mobile telephony utilization amongst the fishers in Lake Victoria

Describe daily economic activities_____

_____

2. Where do most of your customers live? In neighborhood Some other part of the county

other counties Abroad

3. Do you contact most of your customers in 1 by phone? YES NO

4. On a daily basis how many times do you communicate with customers(s)

Face to face____ By Mobile Phone____

5. Does use of Mobile phone saved your time on travel? YES NO

6. Does use of phone save you on cost? YES NO

7. What proportional impact (%) has using the mobile phone had on?

	Can't tell	Net loss/decrease	No change	Small increase (6-10%)	Medium increase	Large >10%
Income						
Time						
Costs						
Wastage of fish products						
Movt per day						

8. Rate the extent to which you agree with the following statements on spatial economic development among the beaches.

Spatial economic development	SD (1)	D (2)	NS (3)	A (4)	SA (5)
Generally, mobile telephony utilization has contributed to beach development infrastructures and superstructures					
The MPESA shops at the beach are due to mobile telephones					
The phone repair shops at the beach are due to mobile telephony					
We have good phone connectivity (networks) and hence faster sale of fish to buyers					
The phone charging shops at the beach are due to mobile telephones					
Mobile Phone use has contributed to infrastructural development at the beach eg masts, electricity					
Generally, mobile telephony utilization has contributed to beach development infrastructures and superstructures					

9. .Number of trips to Kisumu City Centre for Business?

Daily_____Weekly_____Monthly_____Other_____

9.Means of transport to Kisumu City Centre?

10.Which services would you like the mobile service providers to provide to aid your fishing activities?_____

11.Which services would you like the government and corporate institution to provide to aid your fishing activities_____

Appendix 2: Interview Guide for Key Informant: Boat Owner

List of areas to be covered in the interview with key informant:

Boat Owner:

- Management of Beaches
- Government initiatives, local initiatives
- Infrastructure/facilities
- Changing nature and location of economic activities

Appendix 3: Observation Schedule

- List of attributes to observe at the Beaches:
- Roads status
- Buildings status
- Electricity availability
- Means of Transport
- Banks
- Fishing vessels (types, sizes, traffic)
- Mobile Phone service providers presence (Safaricom, Airtel, Orange and others)
- Phone Repairs
- Environment (cleanliness, attractiveness, electronic waste management)
- Types of mobile phone sets
- General indication of businesses at the sites
- General indication of activities at the sites
- Nearness to fish processing plant
- Retail outlets
- Human activities pattern mapping at the Beaches

Appendix 4: Document Review Checklist

- List of items to be identified in the document reviews:
- Characteristics of Lake Victoria Fishers
- Lake Victoria governance issues (authorities, networks)
- Fishing industry management (local and global)
- Statistics on fishers and the fishing industry (local and global)
- Other studies on: fishers, in Lake Victoria, global perspective;
- Other studies on use of mobile telephony by fishers (local and global)
- Diffusion and planning ICT and mobile telephony
- Market information exchange
- Mobile telephony service providers

Appendix 5: Focus Group Discussion Guide

How has mobile telephony use influenced fishing business?

How has mobile phone use influenced development of superstructures and infrastructure in the beach?

Where is the main market for fish products?

Indicate the average transportation time in hours in 2000 from your beach to the main market