MBA Dissertation

College of Business and economics

"SITE SHARING AND COST OPTIMIZATION IN TELECOM INDUSTRY", *A CASE STUDY OF RWANDA*

By

Eric MIHIGO

Reg. Number : 215036754

This Dissertation is submitted in partial fulfilment of the requirements for the award of Master's Degree in Business Administration/Project management at the University of Rwanda.

Supervised by: **Dr. Mbassana Marvin**

May 2016

Declaration

I, Mr. Eric MIHIGO, to the best of my knowledge hereby declare that this work entitled, “Site sharing and Cost Optimization in Telecom Industry: A case study of Rwanda” is my original work and has never been submitted elsewhere for any academic qualification. Any reference in terms of books or any written works has been given attribution.

Signature: ……………………….

Mr. Eric MIHIGO

Date: ……………………………

Certification

The undersigned certifies that he has read and hereby recommends for the acceptance by the University of Rwanda, the dissertation entitled: Site sharing and Cost Optimization in Telecom Industry, in fulfilment of the requirements for the degree of Masters of Business administration/project Management from University of Rwanda, College of Business and Economics.

Signature: ……………………

Dr. Mbassana Marvin

Date: ………………………

Acknowledgements

I am happy to express my sincere appreciation to Dr. Mbassana Marvin, for his valuable guidance, advice, support and close supervision.

I wish to extend my loving thanks to my wife Irene N. MIHIGO and my beautiful son and daughter Shema M. Dylan , Shami M. Naelleand SINE M. Kyla for their spiritual encouragement during my study.

Finally, thanks to all my best friends who cooperated with me in the study as well as shared joy, happiness and sadness.

Dedication

This thesis work is dedicated to Almighty God. This work is also dedicated to my wife Irene N. MIHIGO , who has been a constant source of support and encouragement in the challenges faced during this period. And finally I dedicate this work to my children; Shema M. Dylan; Shami M. Naelle and SINE M. Kyla who have always loved me unconditionally. I am truly thankful for having you all in my life.

Abstract

This research work investigates the impact of site sharing on cost optimization in the Rwanda Telecom Industry.

It had the specific objectives of identifying factors which push telecom companies into site sharing, assessing the variation of cost optimization before and after site sharing in the telecom industry and establishing the relationship between site sharing and cost optimization with an aim of enhancing this practice for better results in the telecom industry.

The study design was largely qualitative but incorporating some degree of quantitative approaches in nature and employed questionnaires in collecting data.

The findings showed that site sharing has impacted on cost optimization in the telecom industry by reducing Opex to levels which go over 50 percent, improved geographical area coverage and given rise to innovations that have improved on service delivery of the telephone companies to their respective customers.

The study recommends the site controlling body, IHS Company and the regulatory authority, RURA, to reduce on the cost they charge for renting these sites as in line with the principle of economies of scale. If applied, the effect will further trickle down to the subscribers because the telephone companies will similarly reduce on the fees they charge subscribers to access their networks. As a result, telecom services will become more affordable and this will increase the number of subscribers.

Key terms: Site sharing, Cost Optimization

Contents

List of abbreviations

4G: 4th Generation mobile wireless standards

JV: Joint venture

KPI: Key Performance Indicator

LT E: Long Term Evolution

MVNO: Mobile virtual network operator

Opex: operational expenditure

CAPEX: Capital expenditure

RAN: radio-access network

RURA: Rwanda Utilities Regulatory Agency

SLA: Service Level Agreement

GSM: Global System for Mobile communication

MNO: Mobile Network Operator

TDMA: Time Division Multiple Access

MSC:Mobile services Switching Center

CHAPTER ONE

1.1 Introduction

This chapter gives the back ground to the study, the problem statement, main and specific objectives together with the research questions which guided the study. More in this chapter are the; significance, scope, hypothesis and limitations of the study. Also in this chapter are the definitions of the key terminologies as used in this study.

It is in this chapter that a global perspective of site sharing and cost optimization and how it has impacted on the telecom industry is explored. Special focus has been put on Africa with specific reference to East Africa in a bid to customise the study to the region where Rwanda is located.

1.2 Back ground of the Study

Site sharing as according to Hasbani, et al (2007), has existed in various forms since the mobile phone began to take a global foothold in the 1980s. Many operators reap significant rewards from network sharing in their business model. This may involve roaming or site sharing, and may even go as far as the sharing of radio assets and the core network.

As the telecom industry moves into a mature stage, the individual actors' focus on improving asset efficiency has tended to increase. It has largely been driven by factors such as deregulation, capex, high levels of competition and significant fixed costs.

Potter and Young (2016), observe that to achieve the targeted efficiency gains, many telecom operators in the world have modernized their business models by splitting up the value chain into specialized segments. This has led to economies of scale in terms of assets, and supported a shift of focus and resources to their core business.

1.3 Problem Statement

The increased use of mobile phones and other modern wireless communications devices around the world has raised public interest in the siting and aesthetics of telecommunication masts/towers as well as possible health concerns associated with exposure to electromagnetic emissions. These concerns relate to both hand held devices, base stations, towers and masts and most of all to the telecom industry, it raises the issue of cutting both installation and operational costs.

In Rwanda, this is increasingly becoming important as the telecom industry into a mature stage of 20 years of existence. The three telecom companies operating in Rwanda as by 2015; MTN, Tigo and Airtel have had the above challenges crippling their profits until the RURA policy framework (2011) which proposed and introduced to them the practice of site sharing.

Then to realize the full benefits of putting away the burden of sites from these telecom companies, RURA licensed IHS Holdings Ltd Company in 2014 to take over the role of installation and management of these infrastructures. This was in a move to enable the telecom operators lower their operating costs yet enabling them to access an enlarged network coverage and accelerated network rollout times, as well as higher network capacity and improved quality of service as included in IHS terms of reference. This would enable the telecom companies to concentrate on their core business.

Mohamad Darwish (2015), writes that with such a synergy venture, telecom companies can save up to 30 percent of operational expenses. Four years down the road, the telecom companies' off net calling rates per minute have remained relatively low at RwF 60 for MTN, RwF 55 for Tigo and RwF 62 for Airtel. They have more affordable packages of cross border calling rates to their subscribers and they have continued to expand their network coverage yet their net profits are going up by the day.

There is therefore a need to explore whether the site sharing scheme has affected their individual present customer subscription which stands at 4,054,163 subscribers for MTN, 3 million for Tigo and 1,527,449 for Airtel. This represents a 78 percent penetration rate of the telecom industry (RURA 2016) report. Also to investigate whether this has not affected their quality of service and net profit at individual company level.

1.4 Main objective of the study

The main objective of the study is to determine the effect of site sharing and its impact on cost optimization in the telecom industry.

1.4.1 Specific objectives

The following are the specific objectives which the study set out to establish.

To identify factors which push telecom companies into site sharing.

To assess the variation of cost optimization before and after site sharing in the telecom industry.

To establish the relationship between site sharing and cost optimization and how it can be enhanced in the telecom industry.

1.5 Research questions

1. What factors influence telecom companies to move into site sharing?

2. What is the variation of cost before and after site sharing in the telecom industry?

3. What is the relationship between site sharing and cost optimization and how can it be enhanced for the better cost optimization in the telecom industry?

1.6 Significance of the Study

The theoretical perspective of the study is that it will add on the existing literature about site sharing and its impact in the telecom industry. This additional knowledge will not only be of benefit in the field of academia, but to policy makers as well who will make use of it wherever they will be in need of enhancing the telecom industry in various global locations.

This work will as well improve individual telecom companies' practices as regards to what they ought to do to promote their performances amidst the competitive global market forces.To the Researcher, the study is an academic requirement for his award of his MBA degree.

1.7 Scope of the Study

The study was carried out in the three telephone companies of MTN, Tigo and Airtel which constitute the telephone industry of Rwanda. All these companies have national network coverage of this country which satisfies the geographical scope of this study. It will also involve technical staffs of HIS company LTD which that manages these sites.

The study covered the period between 2012- 2015. It is this period that has consolidated the practice of site sharing in this industry after RURA came with this policy in 2011.

In this research, the following seven (7) hypothesis were postulated and tested for validity and reliability.

1.8 Hypothesis

Hypothesis 1: Network infrastructure sharing leads to a significant reduction in the operational expenditures of sites (OPEX) dissipated for telecoms operators in Rwanda.

Hypothesis 2: Network infrastructure sharing results in a significant reduction in cost of network infrastructure rollout and capacity expansions for telecoms operators in Rwanda.

Hypothesis 3: Network infrastructure sharing would lead to improved service delivery by telecoms providers in Rwanda.

1.9 Limitations of the study

The study covered site sharing in general with no special attention to challenges which individual telecom companies face in their day to day operations.

It further looked at Rwanda through the lenses of a country recovering from war; the 1994 genocide against the Tutsi. Through this prism therefore, the study was much concerned about the state of affairs of a society recovering from war; in need of fast trucking policies to enhance development.

The study did not cover the cost which the individual telecom companies incurred during the construction of these sites before 2011. It was assumed that they recovered these costs formed the market value of the price which IHS paid to these individual companies when it was buying them off.

The study did not consider other increases in a company's expenditure which can affect its net profit like taxes.

1.10 Definitions of Key terms

This section gives a definition of the various terminologies as they have been used in specific reference to this study.

Exclusion zone: An area around a transmitting station within which exposure limits may be exceeded.

Existing Mobile site: An existing mobile site is any mobile site which is fully developed and operational.

Fall zone: The area on the ground within a prescribed radius, beginning from the base of a telecom structure or an antenna support structure that may be impacted if a telecom structure fails or collapses.

Infrastructure provider: Any telecommunication operator who owns or is in control of facility or infrastructure on whose access to which another operator desires infrastructure sharing.

Infrastructure seeker: Any telecommunication operator desirous or into an agreement with other telecommunication operator who own or in control of telecommunication's infrastructure and facility for the purpose of collocation or infrastructure sharing.

A telecommunication tower that is constructed to be self-supporting by lattice type supports and without the use of guyed wires or other supports.

Passive Infrastructure sharing: The sharing of non-electronic facility like; physical sites, buildings, shelters, towers/masts, electric power supply and battery backup, grounding/earthing, air conditioning, security arrangement, poles, ducts, trenches.

1.11 Conclusion of this Chapter

This chapter covered the background to the topic of this study and highlighted the background of site sharing in the telecom industry and the need to investigate it in Rwanda to prove its worthiness. It as well elaborated the objective of the study and gave its scope for acceptable results. Highlighted in this chapter was the definition of key terminologies as used in relation to this study.

CHAPTER 2

LITERATURE REVIEW

2.1: Introduction

This chapter provides an overview of GSM network as well as the previous research on site sharing as strategy for cost optimization. It introduces the framework for the case study that comprises the main focus of the research described in this thesis.

It is important to set the context of this literature review work by first providing:

- An explanation of its specific purpose for this particular case study;
- Comments on the previous treatment of the broad topic of site sharing, and the role it in cost optimization activity;
- It define the sharing and GSM
- An indication of scope of the work presented in this chapter.
- It also shows the previous empirical studies related to this research work

The main purpose of the literature review work was to survey previous studies on site sharing and cost optimization. This was in order to scope out the key data collection requirements for this research to be conducted. An appreciation of previous work in this area served three further purposes. First, through

providing direction in the construction of data collection tools, it guarded against the risk of overload at the primary data collection stages of the project. Second, working the findings from extant literature into a formal review helped maintain throughout the study a sense of the topic's perspective. Finally, this activity raised the opportunities for articulating a critical analysis of the actual "meaning" of the data collected when the data analysis stages of the research were reached.

A synthesis of the earlier work provides an overview of the research topic. Material drawn from

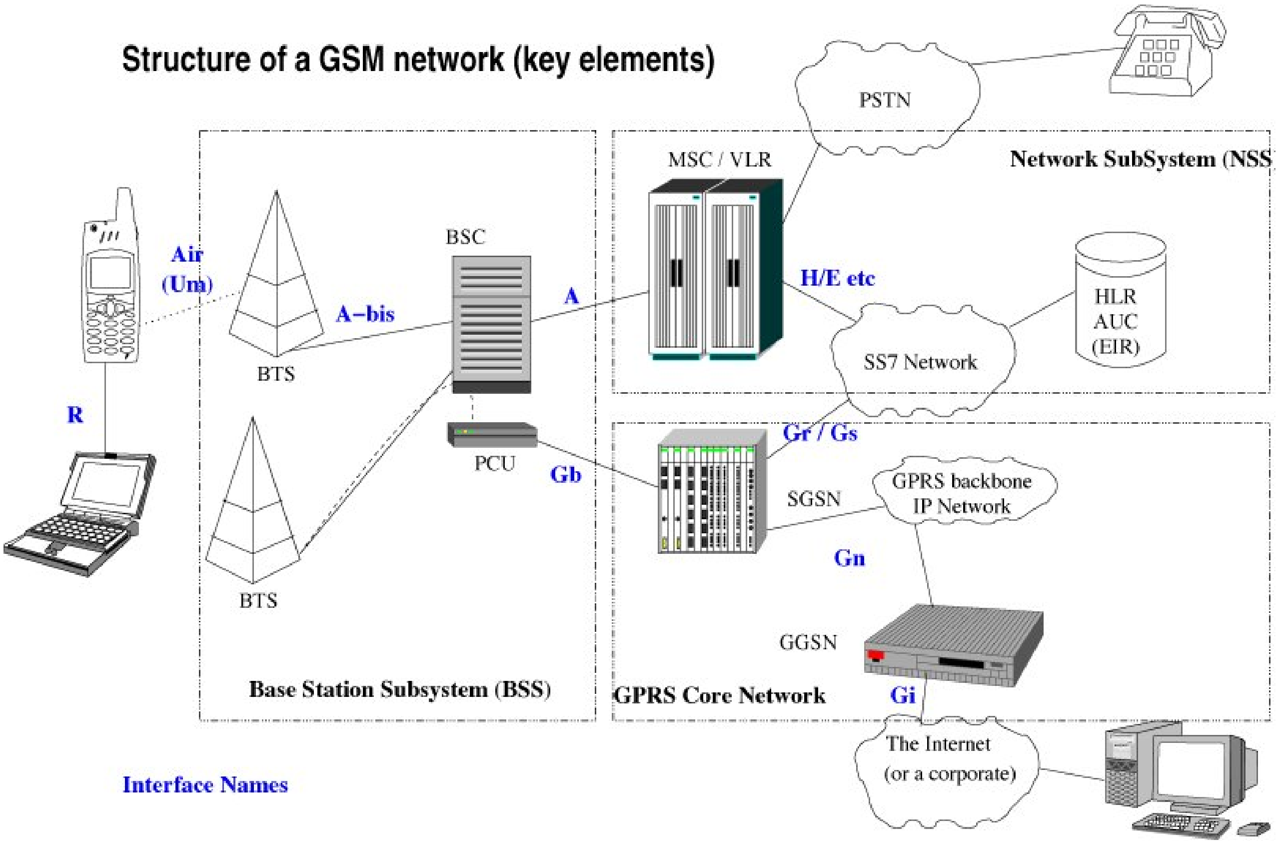
the review led to the development of a taxonomy of incentives for site sharing as a tool of cost optimization , and provided the context for identifying data collection requirements, as well as creating the data collection tools for the primary research. The inadequacies of the existing published research on the site sharing as the tool for cost optimization for MNOs as discussed later in this chapter necessitated the adoption of a broad approach for the research described in this thesis. This takes the

2.2: Architecture of the GSM network

GSM is a TDMA based wireless network technology developed in Europe that is used throughout most of the world. GSM phones make use of a SIM card to identify the user's account. The use of the SIM card allows GSM network users to quickly move their phone number from one GSM phone to another by simply moving the SIM card. Currently GSM networks operate on the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands. Devices that support all four bands are called quad-band, with those that support 3 or 2 bands called tri-band and dual-band, respectively. In the United States, Cingular operates on the 850 and 1900MHz bands, while T-Mobile operates only on the 1900MHz band.

A GSM network is composed of several functional entities, whose functions and interfaces are specified. Figure 1 shows the layout of a generic GSM network. The GSM network can be divided into three broad parts. The Mobile Station is carried by the subscriber. The Base Station Subsystem controls the radio link with the Mobile Station. The Network Subsystem, the main part of which is the Mobile services Switching Center (MSC), performs the switching of calls between the mobile users, and between mobile and fixed network users. The MSC also handles the mobility management operations. The Mobile Station and the Base Station Subsystem communicate across the Um interface, also known as the air interface or radio link. The Base Station Subsystem communicates with the Mobile services Switching Center across the A interface.

Figure 1:GSM Network Showing Access and Core Networks



Source: Secondary data;Ericsson (2004)

2.2.1: Mobile Station

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive calls at that terminal, make calls from that terminal, and receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication, and other information. The IMEI and the IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

2.2.2: Base Station Subsystem

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the standardized Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers.

The Base Transceiver Station houses the radio transceivers that define a cell and handles the radio-link protocols with the Mobile Station. In a large urban area, there will potentially be a large number of BTSs deployed, thus the requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

The Base Station Controller manages the radio resources for one or more BTSs. It handles radio-channel setup, frequency hopping, and handovers. The BSC is the connection between the mobile station and the Mobile service Switching Center (MSC).

2.2.3: Network Subsystem

The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and additionally provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. The MSC provides the connection to the fixed networks (such as the PSTN or ISDN). Signaling between functional entities in the Network Subsystem uses Signaling System Number 7 (SS7), used for trunk signaling in ISDN and widely used in current public networks.

The Home Location Register (HLR) and Visitor Location Register (VLR), together with the MSC, provide the call-routing and roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The location of the mobile is typically in the form of the signaling address of the VLR associated with the mobile station. There is logically one HLR per GSM network, although it may be implemented as a distributed database.

The Visitor Location Register (VLR) contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. The geographical area controlled by the MSC corresponds to that controlled by the VLR. Note that the MSC contains no information about particular mobile stations --- this information is stored in the location registers.

The other two registers are used for authentication and security purposes. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its International Mobile Equipment Identity (IMEI). An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center (AuC) is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and encryption over the radio channel.

2.2.4: Value Drivers in telecom industry

These are variables which significantly affects the value of a telecom company. These are the bases of a business worth or overall performance. Value drivers could be qualitative or quantitative. Most value drivers of organizations are tied or linked up with the organization's key performance indicators (KPIs).

Key performance indicators (KPIs) are indices through which an organization or enterprise defines and measures progress towards its goals and objectives.

By studying the financial reports of most telecoms companies the following key financial indicators are often regarded by telecoms investors as primary or fundamental to their business successes. Alfred Rappaport identified seven key drivers of value:

- Sales growth rate
- Operating profit margin
- Tax rate
- Fixed capital investment
- Working capital investment
- Planning period
- Cost of capital.

However, since most GSM mobile operators are low margin and high volume companies in their sales strategy and hence are growth-driven, we will be looking mainly at the following key performance indicators as set out below:

- Mobile subscriber growth
- Operating profit margin
- Revenue growth

▪ Average revenue per user (ARPU)

▪ EBITDA – Earnings before interest, tax, depreciation and amortization

▪ Depreciation

▪ Assets and Return on Assets

▪ Expenditure - CAPEX

▪ Expenditure - OPEX

▪ Goodwill and other intangible assets like brands and registered trademarks

▪ Cash flow

▪ Cost of Capital

▪ Human resource

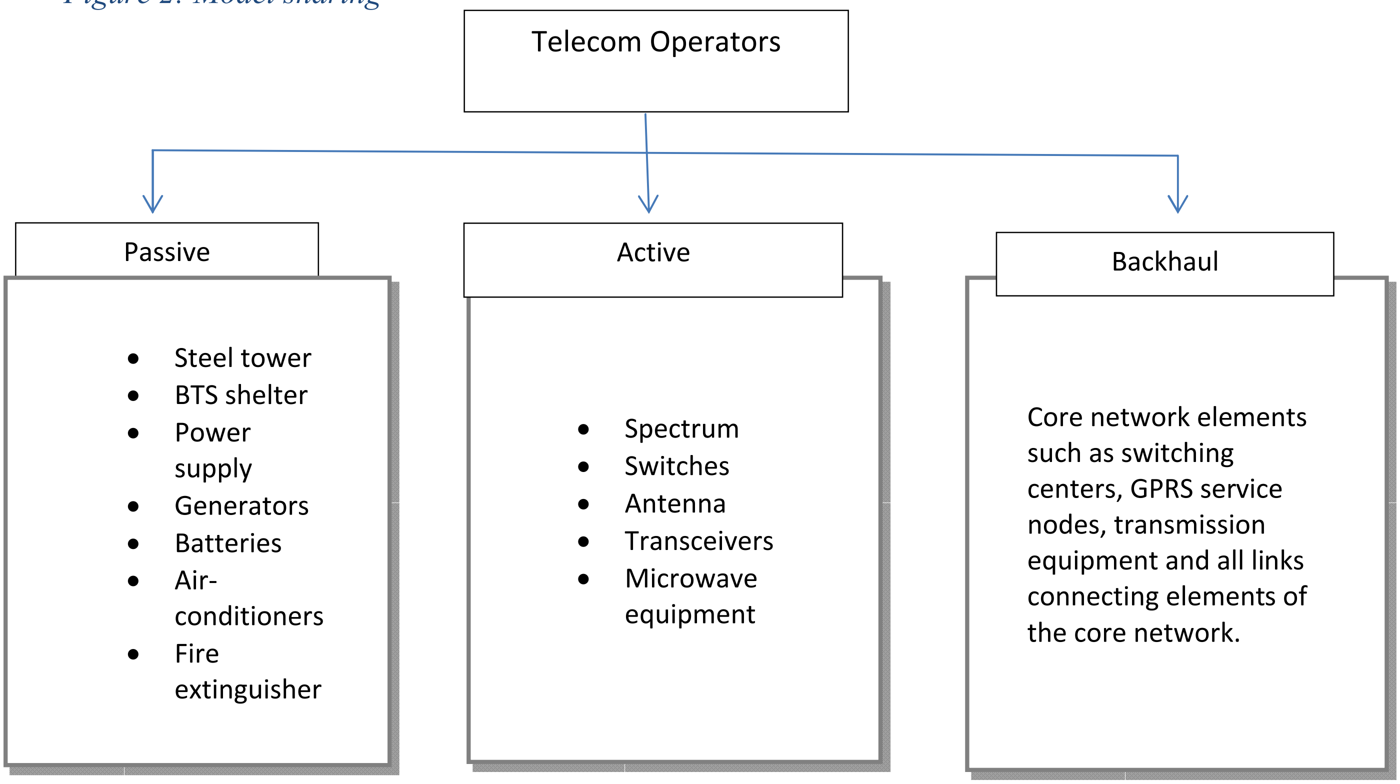
2.3: Telecoms infrastructure for operators primarily consists of:

• Active infrastructure (such as spectrum, switches, antennae)

• Passive infrastructure (such as towers, BTS shelters, power)

• Back hall

Figure 2: Model sharing



Source: Secondary data; Ericsson (2004)

The researcher's assessment will focus only on the current most commonly shared infrastructure among operators which is passive infrastructure, as it is easier to contract its set-up and maintenance. Sharing passive infrastructure only, means that newer operators still need to set up their own passive and backhaul infrastructure which take less time of setting up compared to the time which a passive infrastructure can take to setted up.

Conditions and Benefits of site sharing in telecom industry (CAPEX saving and OPEX saving)

Conditions that promote tower sharing Market conditions that make tower sharing more likely are:

Mature networks: Network maturity is a very important aspect that drives tower sharing. In countries where the war to gain a customer is still being fought on the grounds of better network coverage, operators will not be willing to share tower assets as it would mean giving away the advantage of a wider/better network

Growing market: Growing markets mean an ever-increasing need to expand network for the operators. If operators have the ability to share towers, they will typically be able to roll networks out much faster

High cost regional/rural areas still being rolled out: Operators tend to have a rollout obligation as part of their licenses. This could mean several unprofitable investments as certain sparsely populated rural areas might need every operator to set up a network. Tower sharing can be a good option for such rollouts as all operators can rely on a single set of infrastructure for their network

New entrants looking to build scale: Because towers take time to build, new entrants can increase their speed of network rollout by sharing towers with existing operators

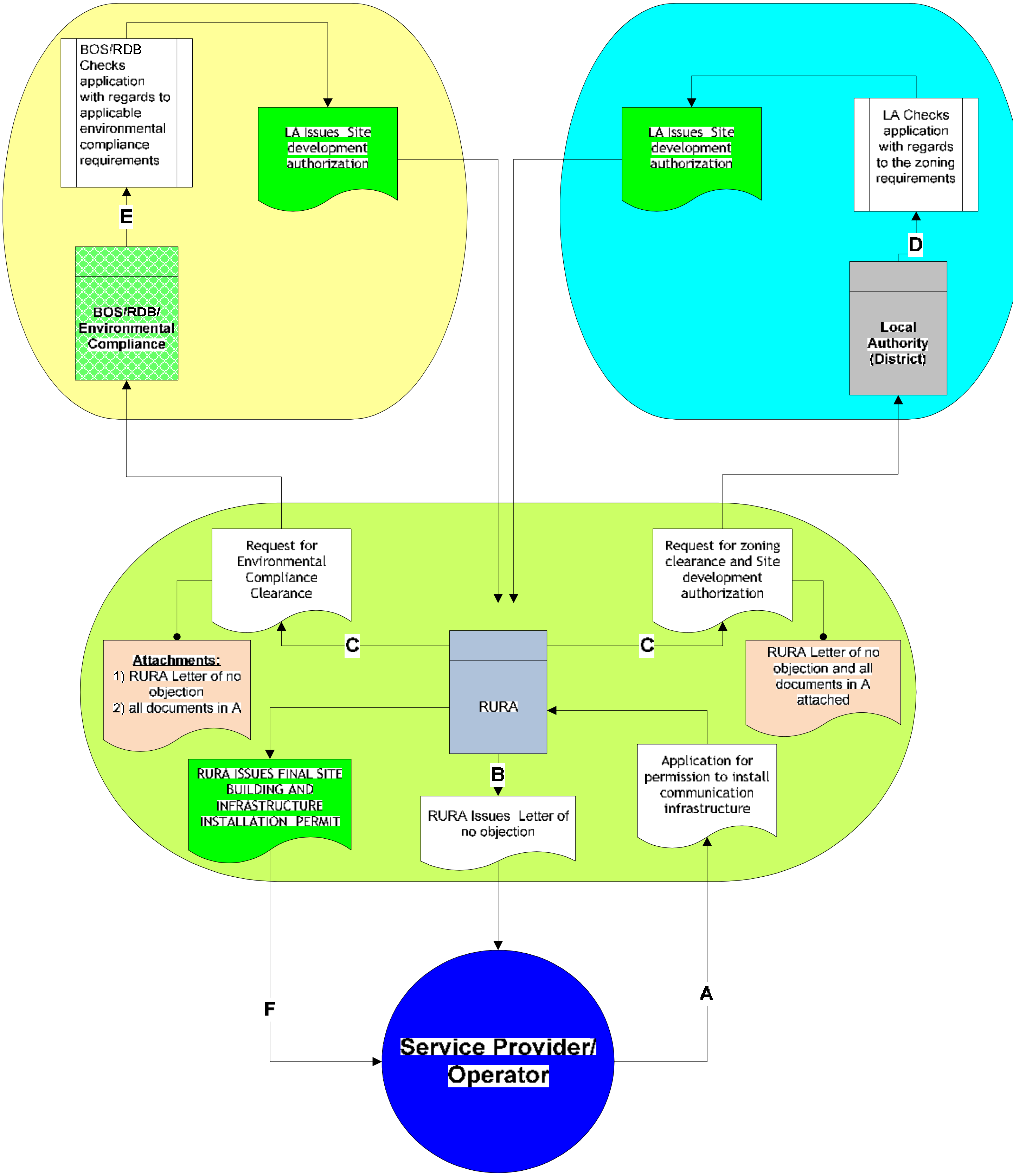
Pressure on costs: In an increasingly competitive market, low cost is the key to profitability, and operators can save on Capex and Opex by sharing towers.

2.4: Site sharing

This is the sharing of the non-electronic infrastructure at the cell site. It is also known as Site Sharing and in this form of sharing, operators agree to share available infrastructure such as site space, buildings and easements, towers and masts, power supply and transmission equipment (Chanab et al,2007). This kind of sharing is suitable for densely populated areas with limited availability; expensive sites such as underground subway tunnels and rural areas with high transmission and power costs.

The key challenges in this model are for incumbent operators to accept the opening of the infrastructure to other players and for new operators to trust that incumbents will provide them with the appropriate access to sites without tactical delays to prevent them from rolling out thier networks effectively (Chanab et al,2007). Enforcing such cooperation is a major challenge to regulatory authorities.

Figure 3:Current procedural flowchart for site sharing



BOS/RDB Checks application with regards to applicable environmental compliance requirements
LA Issues Site development authorization
E
BOS/RDB/ Environmental Compliance
LA Issues Site development authorization
LA Checks application with regards to the zoning requirements
D
Local Authority (District)
Request for Environmental Compliance Clearance
Request for zoning clearance and Site development authorization
Attachments:
1) RURA Letter of no objection
2) all documents in A
C
RURA
C
RURA Letter of no objection and all documents in A attached
RURA ISSUES FINAL SITE BUILDING AND INFRASTRUCTURE INSTALLATION PERMIT
B
RURA Issues Letter of no objection
Application for permission to install communication infrastructure
F
Service Provider/ Operator
A

Source: Secondary data; RURA Guidline (2011)

2.5: Price-Setting for Passive Infrastructure Sharing

2.5.1: Site categories

In order to determine maximum prices for passive infrastructure sharing, the Regulator examined the actual cost of passive infrastructure sharing for access to towers as well as access to electricity (both, grid and generator power). This cost study has taken into consideration the most common configurations based on lattice towers in three categories for heights, and site configurations with and without access to the electricity grid, so the three categories for lattice towers are:

- Towers with heights below 30 meters
- Towers with heights between 30 and 50 meters
- Towers with heights above 50 meters

The categories for power access are following:

- Mobile sites with equipment room and access to the electricity grid
- Mobile sites with outdoor installations and with access to the electricity grid
- Mobile sites with outdoor installations and without electricity grid access (http://www.rura.rw/fileadmin/docs/Board_Decisions/GUIDELINES_SITING_SHARINGB_BTS.pdf)

2.5.2: Price setting methodologies

When determining the maximum prices for tower and electricity access sharing, the regulator took into consideration three different approaches for price setting, such as

- leaving price-setting to the market, i.e. based on negotiations between licensees
- Price-setting based on benchmarking
- Cost-based price setting

Negotiation-based price setting is most adequate, if there is an efficient market of players with similar market power. However, in case of one (or few) dominant players, negotiation-based prices will lead to suboptimal results, as dominant players can exert their market power to determine actual price levels. In addition, negotiation-based price setting is often highly in transparent and the public interest is usually not taken into consideration.

Price-setting by benchmarking is an often used efficient method e.g. to quickly reduce prices to (international) best-practice prices. One major problem with benchmarking is the choice of reference countries, which can lead to widely varying results and gives an additional difficulty of how to adjust prices to local market circumstances.

Cost-based price-setting is a most widely used approach by regulators to set prices at levels of an efficient operator. The two main approaches (each of which comes with different variants) are Long-Run- Incremental Cost (LRIC) and Fully-Allocated Cost (FAC).

According to economic theory, both approaches will converge to the same results, if they are based on current costs of an efficient operator and use a full-service (or long-run average) increment. However, in most cases, LRIC-based cost models lead to lower prices, by using a more narrow definition of the actual service increment or by applying forward-looking efficiency improvements.

2.5.3: Fully allocated cost approach

In the case of price-setting for tower and electricity access sharing, the Regulator applies in an initial approach a fully-allocated cost methodology, using actual cost figures provided by all main operators in Rwanda. This approach uses weighted-average capital-expenditures (CAPEX) figures with different categories for asset life time and weighted-average operating costs (OPEX) retrieved from data submitted by operator.

A cost-based service price is defined as:

Service cost = Opex + Depreciation+ Return on capital

While operating costs can be determined relatively straight-forward, return on capital and depreciation charges can be based on different approaches, depending on the form of depreciation. Most commonly used approaches are straight-line depreciation (used in most accounting systems) and annuities.

Straight-line depreciation has the advantage, that it can be easily based on operator accounts. However, the main disadvantage is that the return on capital changes significantly over time: As return on capital is based on the net book value of an asset, this net book value decreases over the life time of an asset to zero, leading to a very high price at the beginning of the asset life time and a zero price at the end.

A more adequate approach for service price setting are annuities, as they keep the combination of depreciation and return on capital constant over the life-time of an asset.

The formula for calculating the annualization factor of annuities is:

Cost of capital/{1-[1/(1+cost of capital)]^asset life}

Currently Maximum Monthly Prices for Passive Infrastructure Sharing

The following table shows the calculation result of the maximum monthly prices for Tower Sharing according to regulation provided by the regulator.

Table 1:Monthly prices for Tower Sharing

Type of Lattice Tower:	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
Maximum Monthly Price in USD:	912	971	1254

Source: Secondary data; RURA Guideline (2011)

There is also additional Monthly Prices for Sharing of Electricity Access which are as additional monthly price in the regulation provided by the regulator, but if there is no need for an upgrade of the electricity generator. These monthly charges include all expenses, such as the cost of capital, maintenance costs as well as monthly electricity and generator fuel expenses:

Table 2:Monthly expenses on power

Type of electricity access:	Equipment room with grid access	External site With grid access	External site with-out grid access
Maximum Monthly Price in USD:	1,108	1,158	2,391

Source: Secondary data; RURA Guideline (2011)

Another additional Monthly Prices for Generator Upgrade are summarized in the following table as an example for the additional monthly prices, but this is applicable if the infrastructure provider pays for an upgrade of the electricity generator.

Table 3:Monthly expenses for Generator Upgrade

	Asset Life (Yrs)	Upgrade Cost (USD)	Annualization Factor	Annual Charge (USD)	Monthly Charge (USD)
Upgrade of Backup Generator (grid access):	8	15,000	0.2229	3,343	279
Upgrade of Main Power Generator (no grid access):	4	15,000	0.3503	5,254	438

Source: Secondary data; RURA Guideline (2011)

The annualization factors are based on a cost of capital of 15% .The example upgrade cost of $15,000 (incl. material and installation cost) is based on the following two example data sets:

Upgrade of $15,000 = New Gen. of $20,000 minus NBV of Old Gen. of $5,000,

Upgrade of $15,000 = New Gen. of $25,000 minus NBV of Old Gen. of $10,000

These prices must not be levied in cases where the infrastructure seeker pays for the generator upgrade.

2.5.4: Background and Main Input Data

The maximum monthly prices stated in the Regulator guidelines have been calculated by applying the methodology specified in the regulation. The overall approach for calculating the monthly prices for tower and electricity access sharing is based on a fully-allocated cost model, using annuities for annualizing the depreciation charges and the return on investment. Through different rounds of industry consultations, the regulator collected data from all main operators in Rwanda on the actual cost of passive infrastructure elements.

The service cost is calculated by applying the following formula:

Service Cost = Operating Cost + Annualization Factor * Capital Expenditure

Annuities are a commonly used approach for service price setting, as they keep the combination of depreciation and return on capital constant over the life-time of an asset.

The formula for calculating the annualization factors of annuities is:

Cost of capital/{1-[1/(1+cost of capital)]^asset life}

For the purpose of service price setting of passive infrastructure sharing of mobile towers, The regulator applies a cost of capital of 15%, which is based on a review of various operator submissions and a comparison with international benchmarks.

An important element for annualization of service costs is the asset life time. Operator replies on Regulator's data request show asset life ranges from 10 to 20 years for tower infrastructure and from 3 to 10 years for power equipment.

For the purpose of cost modeling, The regulator decided to apply the following asset life times:

- 15 years for CAPEX on towers (including material costs, installation charges and foundation costs – as well as access roads)

- 8 years for CAPEX on power access in the case of connectivity to the electricity grid

- 4 years for CAPEX in generators for sites with no connectivity to the electricity grid (in this case, generators have a much shorter expected useable life)

Applying the formula for annuities above with a 15% cost of capital, the resulting annualization factors are as follows:

Table 4: Annualization factors

Asset Life:	AnnualizationFactor:
Land	0.1500
15 years	0.1710
8 years	0.2229
4 years	0.3503

Source: Secondary data; RURA Guideline (2011)

The Regulator collected data for actual capital expenditures and operating costs from all main operators in Rwanda. These collected data sets have been analyzed and categorized into different cost groups. After categorization of all cost elements, weighted averages have been calculated to arrive at an “average cost” for different classes of towers and access to electricity.

The applied cost categories are as follows:

- CAPEX for towers including material, installation charges, costs for foundations, and – if applicable – additional costs e.g. for access roads

- CAPEX for land acquisition (which has no depreciation, but a return on capital)

- CAPEX for power access, including grid connection, backup generators, backup batteries (if applicable)

- Operating costs for tower maintenance (excluding any maintenance costs for active equipment or antennas)

- Operating costs for power access, including costs of diesel for power generators

The following table shows the results of the weighted average cost categories for building a tower location in Rwanda, based on operator inputs:

Table 5:Weighted average cost categories for building a site

	Type of Lattice Tower: (all cost figures in US-Dollar)	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
CAPEX:	Material, Acquisition, Installation, Road construction	84,869	94,138	131,983
	Land Acquisition	19,081	15,699	14,105
OPEX:	Total annual OPEX:	4,522	4,857	5,415

Source: Secondary data; RURA Guideline (2011)

Applying the above annualization factors leads to the following fully-allocated service costs for towers. The monthly costs for tower sharing are derived by dividing these annual costs by 12 and again by 2, assuming sharing between two operators.

Table 6:Monthly costs for tower sharing

Type of Lattice Tower:	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
TOTAL SERVICE COST (in USD per year)	21,898	23,311	30,102
Monthly Cost when sharing between 2 operators (USD):	912	971	1,254

Source: Secondary data; RURA Guideline (2011)

Regarding access to electrical power, there are three typical configurations (based on operator inputs): locations with an equipment room and access to the electricity grid, locations with outdoor installation and grid access, and outdoor locations without grid access (making use of power generators only). In the latter case, all assets related to power generation have been put in the "short life" category applying a 4 year asset life to the cost annualization.

The following table shows the results of the weighted average cost categories for electricity access at a tower location in Rwanda, based on these operator inputs. OPEX figures include the additional electricity and fuel usage to serve a second operator.

Table 7:Monthly results of the weighted average cost categories for power

	Type of Electricity Access: (all cost figures in US-Dollar)	Equipment room with grid access	External site with grid access	External site with-out grid access
CAPEX:	Material, Acquisition, Installation (long life)	10,722	11,713	9,856
	Generator, incl. Installation (long life)	16,457	17,942	0
	Generator, incl. Installation (short life)	0	0	16,747
OPEX:	Total annual OPEX:	20,535	21,180	49,311

Source: Secondary data; RURA Guideline (2011)

Applying annualization factors leads to the following fully-allocated service costs for electricity access. The monthly costs for tower sharing are derived by dividing these annual costs by 12 and again by 2, assuming sharing between two operators.

Table 8:Monthly costs for site sharing as derived by dividing annual costs

Type of Electricity Access:	Equipment room with grid access	External site with grid access	External site with-out grid access
TOTAL SERVICE COST (annual) [Annuity]	26,592	27,789	57,373
Monthly Cost when sharing between 2 operators:	1,108	1,158	2,391

Source: Secondary data; RURA Guideline (2011)

2.6: Benefits of site sharing

Low market penetration and decreasing profit margins for telecom operators in the emerging markets have made tower sharing an attractive proposition.

National regulators in countries like Bahrain have gone a step further in supporting infrastructure sharing by publishing a range of tower sharing template agreements on their websites.

2.6.1: The major benefits of sharing passive infrastructure for operators are:

Infrastructure spending: Allows operators to cut down on capital expenditure.

Infrastructure cost for operators is estimated to decline by 16% to 20%. The tower companies, on the other hand, derive regular annuity income. Tower sharing can be instrumental in allowing a number of operators to enter remote regions that would normally have very high rollout costs. Ever-increasing demand to roll out 3G/Wimax/LTE networks has been putting a lot of pressure on the infrastructure spending of operators. Reduced costs of infrastructure can allow more money to be spent on enhancing infrastructure

Network operation cost: Results in rationalization of operational cost due to reserves produced by sharing site rent, power and fuel expenses

Enhanced focus on service innovation: Alleviates pressure of network rollout and cost management from operators, allowing them to focus on customer service in a highly competitive and customer-centric industry. This becomes especially important in a regulatory environment demanding fast rollout of services

Lower entry barrier: Active and passive infrastructure sharing will result in lower entry barriers, allowing smaller players to penetrate the market.

Identification of deferent types of cost optimization in telecom industry:

Site sharing

Outsourcing non- core competencies

Reduce or Eliminate Support and Maintenance Costs

2. 7: Cost optimization

Cost Optimization is defined as the way of finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones. In comparison, maximization means trying to attain the highest or maximum result or outcome without regard to cost or expense.

In order to excel in OPEX and CAPEX management, full cost transparency must be established in order to identify, prioritize and optimize additional saving measures. Usually the obvious areas will already have been targeted in the first cycle of cost cutting. Therefore the challenge is to find the hidden potential by enabling a broader audience to act cost sensitive. For this reason the first phase of the cost reduction project needs to focus on establishing a stringent OPEX/CAPEX analysis.

Organizations do not always have the data available to act in a cost conscious manner. Many issues can inhibit an organization's cost management ranging from system or process based barriers to political or emotionally driven behavior. The staff responsible for defining strategies, rollout plans and architectures need to know the current cost drivers and the potential alternatives (Arthur D Little, Telecom & Media View point).

All players in the telecoms market will be forced to reduce their long term costs. Incumbents will be affected to the same extent as alternative operators. Arthur D. Little expects these players to

initiate cost saving measures year on year. The management has to ensure that the organization acts cost consciously to leverage operational saving measures. The organization has to have the tools and procedures, including full cost transparency, in place. Basic cost controlling techniques have been established in most organizations but it is now essential for steering tools and procedures to be aligned to actual business drivers.

OPEX optimization (Planning of technicians activities, regular monitoring of KPI like average numbers of intervention per technician or time and location of vehicles used…., energy saving policy,…..), we can also look on out sourcing process of some services which can lead to the saving. So we can realize that the main OPEX are maintenances operation and network monitoring

CAPEX differ from operational expenditures both in terms of why money is being spent and in the planning time frame. Unlike OPEX, which include costs such as wages, taxes, insurance and equipment maintenance, capital expenditures refer to money spent to purchase or upgrade fixed assets such as equipment, technology or real estate. The expenses involved in capital expenditures create a need to plan in advance regardless of whether a capital expenditure is mandatory or discretionary. So CAPEX planning includes the people and procedures a business relies on to evaluate long-term needs and assess long-term business requirements. Comparing needs to long-term plans and business growth objectives helps the business prioritize and plan for capital asset purchases. In some cases this can be as simple as comparing site construction price, and comparing to the rental cost (Sharing cost) and then adding to a capital expenditure plan in order of choosing either to share or to construct a new site. In other cases, however, capital expenditure planning can be significantly more complicated. For example, upgrading an IT infrastructure typically must be planned in a series of stages that in total span a period of months or years.

2.7.1: Optimizing network quality, customer experience, and network Performance

Somewhat paradoxically, even as incumbent telcos see the ability to capture price premiums wane, the importance of network quality continues to increase. However, while most companies monitor network performance at a granular level, few

recognize its enduring connection to customer experience and perception. In fact, McKinsey research shows a strong link between voice service quality and customer perceptions of network quality. Furthermore, in these cost-focused times, companies need to find cheaper and more effective ways to invest in network quality. To accomplish these goals, companies have to understand their current quality performance and customer perceptions, prioritize the drivers of positive customer experience, and determine the investments needed to achieve the required network quality and performance.

Two helpful tools here are:

Network quality impact modeling, which enables operators to allocate funds to projects based upon comparative returns, sustainability (i.e., quick wins versus long-term fixes), and competitive impact

Subscriber acquisition/customer-retention cost modeling enable marketers to prioritize their investments that are focused on acquiring new subscribers or retaining current ones (McKinsey & Company, Inc.., September 2011)

2.7.2: Driving for best-in-class fixed network outsourcing

Operators can gain the most value possible from core network outsourcing and minimize risks by adopting fact based negotiating tactics, choosing an optimal governance model and making sure that the deal makes strategic sense (McKinsey & Company, Inc.., September 2011).

2.7.3: Introducing lean network efficiencies

In many cases, fixed and mobile telecoms operators have not fully realized the cost-reduction potential provided by lean tools and techniques, which not only can generate savings of from 10 to 15 percent on the addressable cost base, but also simultaneously improve overall operational quality levels. By taking an "end-to-end" process view rather than typical functional or categorical approaches, leaders can help ensure that the lean methodology gains traction in the

organization, creating transparency regarding process bottlenecks and inefficiencies. This process should start with a diagnostic phase that covers network planning and implementation, operations, and management infrastructure. In the process, companies can identify unnecessary personnel travel and idle time, and other forms of operational waste that the organization can eliminate (McKinsey & Company, Inc.., September 2011).

2.7.4: Employing cost benchmarking

A systematic benchmarking initiative can quickly help fixed and mobile players discover critical gaps in their performance and act to close them. All benchmarking activities should track processes from beginning to end, with deep-dive analyses being used in key functional areas, such as field force performance. At the end of the benchmarking process, teams should have a prioritized list of actionable recommendations the company can pursue(McKinsey & Company, Inc.., September 2011).

2.7.5: Optimizing the network operations center (NOC)

The network operations centers of many telecoms players face a variety of challenges, including having to deal with technology silos, unclear ownership of network issues, lack of institutional memory that forces teams to "reinvent the wheel" time and again, and others. Given the breadth of opportunities available, operators can often capture reductions of 15 to 35 percent in NOC-related costs. Potential actions include developing a clean-sheet NOC redesign, integrating NOC services on an end-to-end basis, and instilling a problem-solving, high performance mindset within the center (McKinsey &Company, Inc.., September 2011)

2.7.6: Creating a lean field force

Teams can take a holistic approach to boosting the operational efficiency of the network field force, focusing on daily, weekly, and annual capacity planning, work dispatching, and frontline execution. Key elements of the approach include creating a performance management system, adopting a continuous improvement ethos, and ensuring field force reporting accuracy by using advanced tools and techniques, such as GPS-enabled technician tracking (McKinsey & Company, Inc.., September 2011).

2.7.7: Refreshing the zero-based budgeting approach

Applicable to fixed and mobile players alike, revisiting the organization's zero-based budgeting decisions using the latest insights and business priorities can reveal new opportunities to reduce investments and costs in areas where an operator's market share is below critical thresholds.

2.7.8: Introducing design-to-value techniques

Telecoms players can employ proprietary analyses and techniques to improve the amount of value their products deliver to customers, while at the same time, creating cost-efficient designs and calculating target costs.

2.7.9: Making lifecycle management happen

Teams can capture value by pursuing network lifecycle management (LCM) and rationalization – "stress testing" their LCM plans based upon the possible evolution of the external demand drivers by introducing different possible scenarios.

2.7.10: Fostering a performance-driven culture

The benefits of creating a performance-driven culture for both fixed and mobile players come from its ability to amplify subsequent improvement initiatives – in effect, supercharging them. However, as with most transformational approaches, "getting there" will require strong, visible

Commitment from company leaders, solid organizational planning and training, and communication clarity.

2.7.11: Building a green network

Going green is in many ways similar to going lean, since both strive to reduce energy usage and eliminate waste. Fixed and mobile operators can foster green networks by improving network energy and cooling infrastructure, and by installing energy-saving network equipment.

2.7.12: Introducing lean supply chain approaches.

While many operators have already introduced lean thinking and processes in their own operations, some have neglected their suppliers that could benefit significantly from a lean transformation. Companies can standardize vendor reporting procedures and ways of working and communicating, while also introducing performance management techniques among supplier and contractor workforces (McKinsey & Company, Inc.., September 2011).

2.7.13: Capturing value from outsourcing

Fixed-line infrastructure players can outsource network infrastructure and operation to contractors in order to optimize operating and capital expenditures (opex and capex). Making this outsourcing a success requires companies to explicitly split roles and responsibilities with the chosen contractors, establish clear reporting and interface models, and prepare, negotiate, and execute specific contracts and service level agreements (McKinsey & Company, Inc.., September 2011).

2.7.14: Enhancing fiber rollout capabilities

As more incumbents either contemplate or proceed with rolling out fiber optic networks, a key but sometimes overlooked – element of success involves creating a fiber network rollout support office. Done right, such an office can help teams quickly de-bottleneck issues and effectively track overall rollout process in a structured way.

2.7.15: Steering network quality performance and investments via micro markets

Mobile operators can make use of the rich variety of customer data they have on hand to improve their network quality and target investments on a site-by-site basis. Taking this type of highly granular review of network performance metrics, site utilization, and commercial performance will enable leaders to pinpoint spending requirements. For example, one operator compared its network site utilization to the untapped revenue growth potential of each site and found that roughly 20 percent of its sites were underutilized, but had high revenue growth potential; about 10 percent had excessively high utilization rates and required additional capacity; while nearly 55 percent were underutilized, but had limited upside revenue growth potential and thus, were candidates for capacity redeployment to congested areas (McKinsey & Company, Inc.., September 2011).

2.7.16:Dealing with mobile data

Expanding by approximately 75 percent since 2008, mobile data usage at first glance seems like a solid success, but growing price pressure continues to erode customer revenue on a per-megabyte basis. Potential solutions include attempts to shape data traffic that include introducing usage-based and progressive pricing and yield-management techniques, such as offering off-peak bundles. Operators are also attempting to offload traffic to alternative networks, such as in-home femtocells,

public hotspots, or community WiFi networks. Others are upgrading their networks by accelerating the rollout of 3G technologies or investing in 4G LTE solutions (McKinsey & Company, Inc.., September 2011).

2.7.17: Revisiting mobile outsourcing

By introducing optimized governance models, best-practice vendor relationship management techniques, and better negotiation and deal strategies, operators that revisit mobile outsourcing typically identify the potential for an additional 5 to 10 percent in cost reduction, representing 2 to 3 percent of total costs.

2.7.18: Choosing a path to 4G

The growing readiness of a variety of new mobile technologies can give operators access to large amounts of new network capacity with varied upgrade paths. Operators can seek to optimize their migration strategies in a number of ways. For example: Should they leap directly to LTE or continue building upon current 3G technologies, adding incremental 3G bandwidth expansions? Should they begin in rural or urban markets and will 4G enable them to win in new, value-laden customer segments? Operators could also consider participating in network sharing and investigate ways to optimize the cost of upgrading their networks (McKinsey & Company, Inc.., September 2011).

2.7.19: Exploring site and network sharing

An increasingly relevant topic for mobile operators: Should they engage in network sharing with other mobile players? As more active network- sharing deals emerge, the challenges and benefits of doing so are becoming clearer. Furthermore, with the impending arrival of 4G LTE networks, more operators have become interested in active network sharing and equipment vendors have stepped up their introduction of new solutions that enable such deals. At the same time, experience to date highlights growing questions as to its feasibility and commercial implications, along with concerns regarding the best network-sharing negotiation strategies (McKinsey & Company, Inc.., September 2011).

2.8: Empirical Literature

Due to economy of scale property of telecommunication industry, sharing of telecom infrastructure among telecom service providers is becoming the requirement and process of business in the telecom industry where competitors are becoming partners in order to lower their increasing investments and some additional advantages associated to this practice. The degree and method of infrastructure sharing can vary in each country depending on regulatory aspect and competitive climate.

The objectives of Rwanda Utilities Regulatory Authority when setting up the guide lines on infrastructure sharing is:

To protect the social and physical environment from potential negative impacts, while at the same time not restricting the development of essential telecommunications infrastructure.

Minimize disturbance to the environment and loss of amenity in the provision of the telecommunications infrastructure.

To protect the environment by reducing the land use as well as infrastructure and facility installations thereby not changing the aesthetic of the country's landscape.

To maximize the use of network facilities including but not limited to network capacity and capabilities, base station sites, backbone, towers etc.

To optimize operator's capital expenditure on supporting infrastructure.

To set maximum prices for monthly access to passive infrastructure sharing.

The research conducted by Dawodu Bamidele Friday, Osondu Mary (ISSN-L: 2223-9553, ISSN: 2223-9944 Vol. 4 No. 5 September 2013) explored the effect of colocation arrangement on cost efficiency and operations development of selected GSM firms in Nigeria. In addition it looked into the benefits of colocation of GSM firms resources as a means by which telecoms operators in Nigeria can optimise their capital and operating expenses. The results obtained clearly supported propositions in literature reviews that operators can obtain 30-40% savings on both their CAPEX and OPEX spending by deciding to share telecoms infrastructure with other operators.

The research conducted also by Shruti Bhardwaj (ISSN (Print): 2319–5479, Volume-2, Issue – 1, 2013) show clearly the Benefits of Passive Infrastructure Sharing as stated bellow:

2.9:Reduced Capex

Telecom business is heavy on Capex, and as much as 40-60% of the Capex is utilized for setting up and managing the Telecom infrastructure by sharing infrastructure, Operators can optimize their Capex, and focus on providing new and innovative services to their subscribers.

3.10:Reduced Opex
By outsourcing the day-to-day management of your Telecom infrastructure to Infratel, your Opex costs are hugely reduced. The cost-savings can be used to provide innovative services, and improve customer satisfaction.

3.11:Reduced Time to Market
By leveraging existing Infrastructure that are deployed in active Telecom circles, a new operator can drastically cut down the time taken to begin operations. The resulting savings in Capex can then be diverted towards Marketing and promotional activities which are crucial in the initial months.

3.12:Increased Connectivity
Deployed tower infrastructure in rural and remote locations which are characterized by erratic power supply, poor access, difficult terrain and lack of adequate backup saved the hassle of operating in such conditions, and enables increase in penetration.

Highest uptime

The use of efficient processes and superior monitoring ensures minimum downtime for operators.

3.13:Cost and energy efficiencies
One of the most significant implications of towers sharing is that the reduced number of towers reduces the emissions and hence the diesel consumption. The concept of green tower has also come into existence.

The gap in previous research is on deep analysis of financial figures of MNOs which can show clearly the impact of site sharing on their CAPEX and OPEX within a limited range of time.

Tower sharing has largely been an operator-led initiative in some other developing markets. However, in Rwanda the regulator have also played a significant part in ensuring uptake of tower sharing initiatives. Tower sharing have prevented the proliferation of masts thereby reducing the environmental and visual impact of operator networks especially in urban and ecologically sensitive areas. Tower sharing also helps in spurring competition due to a reduction of entry barrier for new operators. More importantly, from a regulatory perspective. This study will focus on cost analysis on side of operators by comparing CAPEX and OPEX before and after sharing which will show the results of savings from tower sharing according to the number of site shared for every operator as well as the time period.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1: Introduction

This chapter discusses the exploratory and investigative procedures, techniques, study population, sample size, sampling technique and procedure which the study employed. The study was designed to examine the impact of site sharing in the telecom industry of Rwanda.

3.2: Study setting

The study covered views from the senior managers and technical employees of the three telecom companies of MTN, Tigo and Airtel who form the telecom industry of Rwanda. It also covered views from IHS company technical staff who maintain and control these sites.

3.3: Study population

The study population comprised of senior managers, technical staff and employees of MTN, Tigo and Airtel allover Rwanda. The study population was of people who were above 18 years of age Thisis the age at which the Rwanda (2009) policy on child labour grants permission to a person to seek employment; at this stage one is of a sound mind to make independent decisions. The respondents were also in management positions which places them in an advantaged position to assess the capital expenditure (CAPEX) and operation expenditure (OPEX) of their respective companies. It was therefore assumed that respondents of this minimum age bracket exhibited a mature analysis in as regards the research questions they responded to.

3.4: Sample selection

The sample size for this study was 16. This was especially in regard to people with access to relevant data in this industry. The study picked 1Finance Manager of each of the telecom companies of MTN, Tigo and Airtel together with the Finance Manager of IHScompany which is the controlling company in charge of sites.

Then the study picked on the 4 investment managers; one from each of the four companies which make up this industry in Rwanda and also the four managers in charge of risk management in the four companies under scrutiny.

Finally, the study picked on the 4 human resource managers; one from each of the companies which form the current telephone industry.

3.5: Sampling technique

The sampling technique that was used in assigning questionnaires to respondents was purposive sampling technique. This was because the questionnaire as according to Banerjee (2010), was only assigned to respondents that are in senior management positions of the relevant telecom companies that had access to cost variation data of these companies before and after site sharing. People in senior management positions are taken to be working for profit maximization n of their companies and it was therefore assumed that their cooperation was in good faith and from an informed point of view as the study had rays of promoting their endeavor in the positive direction. It was therefore assumed that the information they provided was reliable enough to arrive at a fair conclusion of the study.

3.6: Instrumentation

The major research instrument used was the questionnaire. It was designed in such a way as to elicit the required information for achieving the research objective. In responding to the research questionnaire, the following were assumed to be true:

a) That the respondents were willing and able to correctly complete the questionnaire.
b) That such information was supplied with minimum external interference.
c) That the information supplied on the questionnaire was true and unbiased.

3.6.1: Strength of Questionnaire as research instrument

The questionnaire was subjected to content validity by the Researcher. It was properly restructured and edited until it was considered fair enough for data collection by the Research Supervisor.

3.6.2: Reliability of questionnaire instrument

In order to ensure that the instrument was error free, it was ensured that the questionnaire was filled only by respondents of 18 years of age and above. Also, the key questions that test the research questions and hypotheses were asked more than once in different forms in the questionnaire.

3.7: Validity and reliability of questionnaire

The designed questionnaire was administered to each respondent through personal visits by the Researcher. It took some time before all the questionnaires were completed and returned. They were completed by right thinking citizens.

3.8:Data analysis and interpretation

Data analysis was performed on the semi-structured questionnaires that was used for respondents during interviews using a mix of qualitative and quantitative methods. Hence, hypotheses were subjected to testing using the feedbacks obtained from the respondents during the interviews which lasted between 30 and 60 minutes Also results obtained from financial performance data was cross checked for important or vital trends in cost reduction

3.9:Conclusion

This chapter covered the methodology that the researcher used while collecting data which was tabulated in the chapter that follows. It outlined the population sample size and how it was arrived at together with the sampling techniques as applied in this research.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1: Introduction:

This Chapter presents a detailed analysis of the data as collected from the respondents whose selection is outlined in the previous chapter. It presents the views of the respondents towards the study as they responded to the questionnaire. The frequencies and percentages are presented in tables for easy presentation and tabulation. This sets the stage for easy analysis of the figures as depicted from the returned questionnaire copies. It presents the percentage frequencies of these views for a precision conclusion of the study. The frequencies and corresponding percentages are presented in the tables as below:

4.2: Data interpretation and analysis

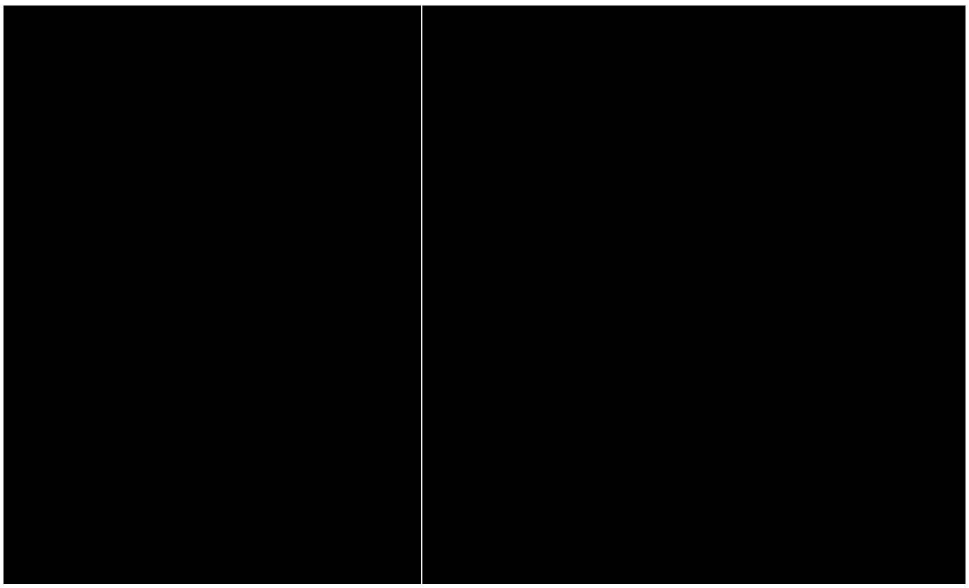
The following are views and analyses as collected by the researcher from the respondents who filled the questionnaire of the study.

Table 9:Profession category of respondents

Category	Frequency	Percentages%
Finance	4	25
Investment	4	25
Risk Management	4	25
Human Resource	4	25
Total	16	100

Source: Primary data May 2016

Figure 4:Profession category of respondents



Source: Primary data May 2016

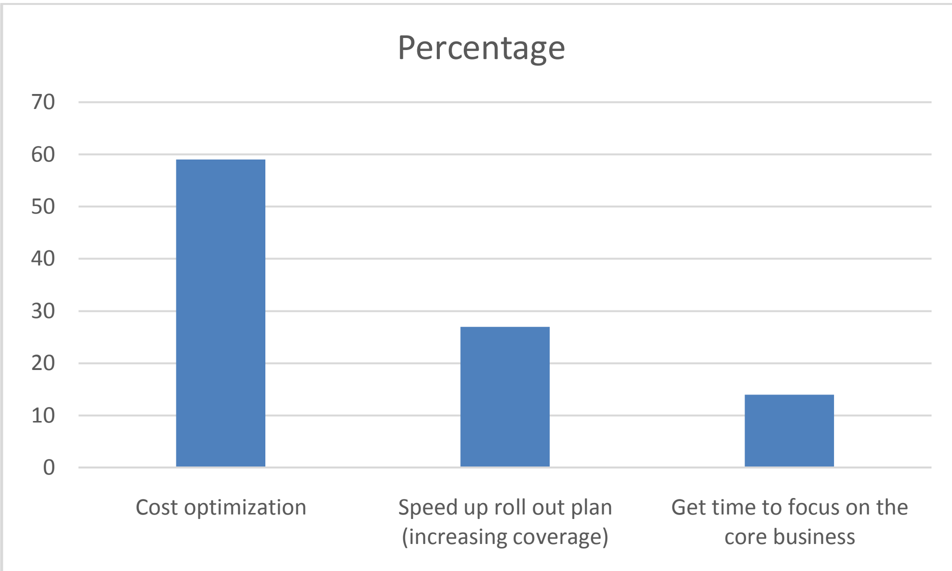
According to the table 9 and figure 4 above, from each of the four companies that form the telecom industry in Rwanda were represented in equal measure. They were the heads of departments of finance, Investment, Risk Management and Human resources because their work dockets are directly in charge of determining and assessing cost optimization measures without compromising on the quality of service delivery of the telecom industry.

Table 10:Respondents views on why their companies went in for site sharing

Reason for site sharing	Frequency	Percentage %
Cost optimization	9	59
Speed up roll out plan (increasing coverage)	4	27
Get time to focus on the core business	3	14
Total	16	100

Source: Primary data; May, 2016

Figure 5:Respondents views on why their companies went in for site sharing



Source: Primary data; 2016

According to the table 10 and figure 5 & 6 above, all the respondents looked at site sharing from an economic point of view although with varying expectations in their business boost.

The majority, who formed 59 percent of the respondents, largely looked at joining the site sharing venture as a means through which their respective telecom companies would realize cost optimization which, as according to Kurt (2016) is the reduction of the baseline costs of the business while maintaining acceptable service levels.

They were anxious of relieving their telecom companies of the operation costs while at the same time not compromising on service delivery and upholding their companies' efforts to capitalize on future growth opportunities.

The second highest numerical percentage of respondents who formed 27 percent, were of the expectation that site sharing will help their individual companies and the telecom industry in general in increasing the area coverage. They therefore concur with Hasbani (2007) who largely views the advantages of site sharing through the prism of increase in area coverage.

According to RURA report on statistics and tariff (2015), the current 2G and 2.5 total land area Network geographical telephone coverage stands at 99.08% for MTN, followed by TIGO Rwanda Ltd with 88.91% and 94.59 % for AIRTEL Rwanda.

This geographic network gives the opportunity to 99.9% of the population to access 2G and 2.5G networks of MTN Rwanda Ltd, 99.81% of TIGO Network and 94.59% of AIRTEL network. The respondents therefore saw site sharing as an opportunity of achieving total Rwanda area coverage for each of the companies that form the telecom industry in Rwanda.

The least number of respondents, who formed 14 percent, were of the expectation that by joining site sharing, the telephone companies would get ample time to concentrate on their core business. They therefore concurred with the KPMG report (2010) which stated that with the rapid evolution of the telephone industry especially mobile telephony, telecom companies are under pressure to provide other value-added services such as mobile broadband and mobile TV to their clients.

Table 11: Average cost of running a single site before IHS took them over

No	Service Description	Cost in (RfW)
1	Cost of rent of premises	800,000
2	Cost of Guard	150,000
3	Cost of electricity (National Power)	500,000
4	Diesel for Generator which runs 24/day	6,075,000
5	Diesel Generator maintenance, oil, filters and cleaning	100,000
6	Air-condition and power maintenance	100,000
7	Others costs for site cleaning and water for guard	Included in guard cost
8	Labor cost and transportation	1,600,000 + 1,500,000=3,100,000 /40 (average number of site)=77,500
	Total	7,802,500 for the site running with generator

		24hrs and 2,227,500 for site with national power

Source: Primary data: May, 2016

The table above illustrates the average cost of running a single site which the telephone companies of MTN, Tigo and Airtel used to incur before IHS took these sites over. It totaled to 7,802,500 FRW for the site running with generator 24hrs and 2,227,500 FRW for site with national power grid.

Table 12:Shows Site Operation costs before site sharing for MTN

MTN	Number of site(runs by generator)	Number of site (runs by national power)	Total cost per month (Rfw)
Unit cost for the site runs with generator (Rfw)	7,802,500*30	------------	234,075,00
Unit cost for the site runs by national power (Rfw)	-----------	2,227,500 *528	1,176,120,000
Total Cost per month (Rfw)	1,410,195,000		
Total Cost per year (Rfw)	16,922,340,000		

Source: Primary data May 2016

According to the table above, MTN had 30 sites run by generator and 528 sites run with national power supply. Considering the cost of running a site run by generator (as shown in the preceding table12), MTN used to spend a total of 234,075,00 Rfw per month on running these sites operated by generator alone. To this figure, MTN would add on the cost of running 528 sites that were operated by national power grid supply which also totaled to 1,176,120,000 Rfw per month. This came to MTN spending of 1410,195,000 FRW per month translating into 16,922.340,000 FRW per year on the costs of running these sites.

Table 13:Shows Site Operation costs before site sharing for Tigo

TIGO	Number of site(runs by generator)	Number of site (runs by national power)	Total cost per month (Rfw)
Unit cost for the site runs with generator (Rfw)	7,802,500*23	------------	179,457,500
Unit cost for the site runs by national power (Rfw)	-----------	2,227,500*337	750,667,500
Total Cost per month (Rfw)	930,125,000		
Total Cost per year (Rfw)	11,161,500,000		

Source: Primary data: May, 2016

According to the table above, Tigo had 23 sites run by generator and 337 sites run with national power supply. Considering the cost of running a site run by generator (as shown in the preceding table 13), Tigo used to spend a total of 179,457,500 Rfw per month on running these sites operated by generator alone. To this figure, Tigo would add on the cost of running 337 sites that were operated by national power supply which also totaled to 750,667,500 Rfw per month. This came to Tigo spending of 930.125,000 FRW per month translating into 11.161.500.000 FRW per year on the costs of running these sites.

Table 14:Shows Site Operation costs before site sharing for Airtel

Airtel	Number of site(runs by generator)	Number of site (runs by national power)	Total cost per month (Rfw)
Unit cost for the site runs with generator (Rfw)	7,802,500*7	------------	54,617,500
Unit cost for the site runs by national power (Rfw)	-----------	2,227,500*173	385,357,500
Total Cost per month (Rfw)	439,975,000		
Total Cost per year (Rfw)	5,279,700,000		

Source: Primary data: May 2016

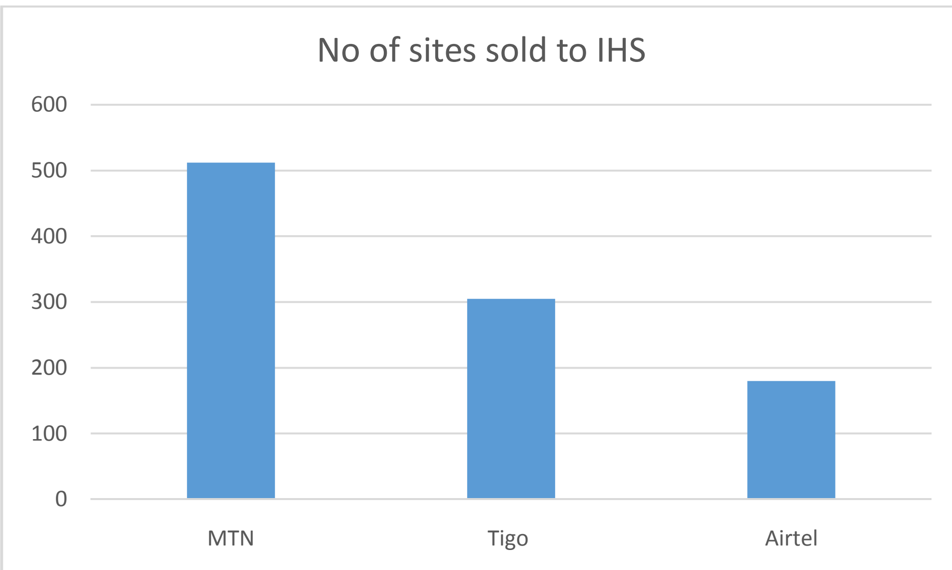
According to the table above, Airtel had 7 sites run by generator and 173 sites run with national power supply. Considering the cost of running a site run by generator (as shown in the preceding table 14), Airtel used to spend a total of 54,617,500 Rfw per month on running these sites operated by generator alone. To this figure, Airtel would add on the cost of running 173 sites that were operated by national power supply which also totaled to 385,357,500 Rfw per month. This came to Airtel spending of 439,975,000 FRW per month translating into 5,279,700,000 FRW per year on the costs of running these sites.

Table 15:Showing Number of sites each company sold to IHS

Company	No of sites sold to IHS	Percentages (%)
MTN	512	51
Tigo	305	31
Airtel	180	18
Total sites bought by IHS	997	100

Source: Primary data, May 2016

Figure 6. Showing Number of sites each company sold to IHS



Source: Primary data; 2016

According to the table 15 and Figure 7 above, MTN sold a total of 512 sites, Tigo sold 305 sites and Airtel sold 180 sites to IHS Company Ltd.

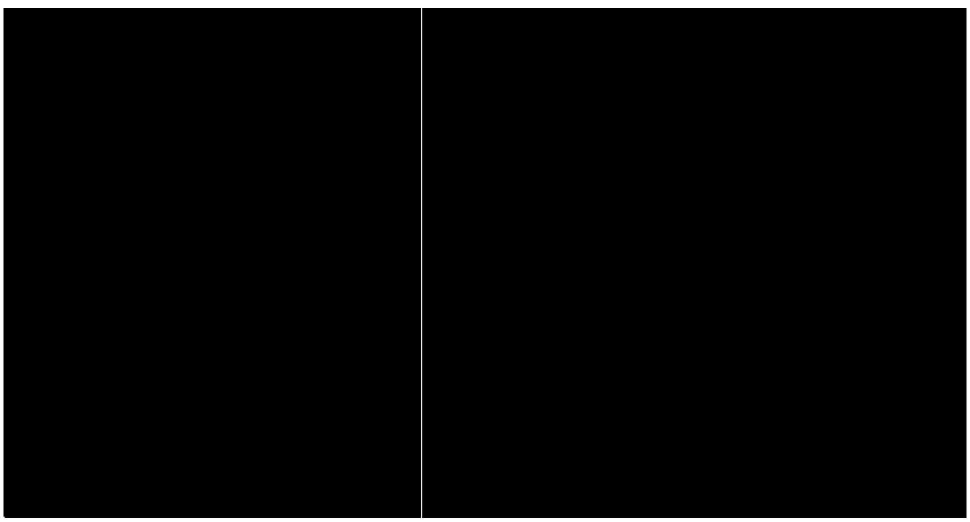
Table 16:Showing number of sites each company rents from IHS

Company	No. of sites rented	Percentage (%)
MTN	588	50
Tigo	360	31

Airtel	218	19
Total sites owned by IHS	1166	100

Source: Primary data, May 2016

Figure 7:Showing number of sites each company rents from IHS



Source: Primary data; May, 2016

According to the table 16 and figure 8 above, MTN now rents 588 sites from IHS from the previous 512 sites it was operating before IHS came on the scene.

It has therefore acquired more 76 sites which are believed to have increased on its geographical network coverage in the different parts of Rwanda.

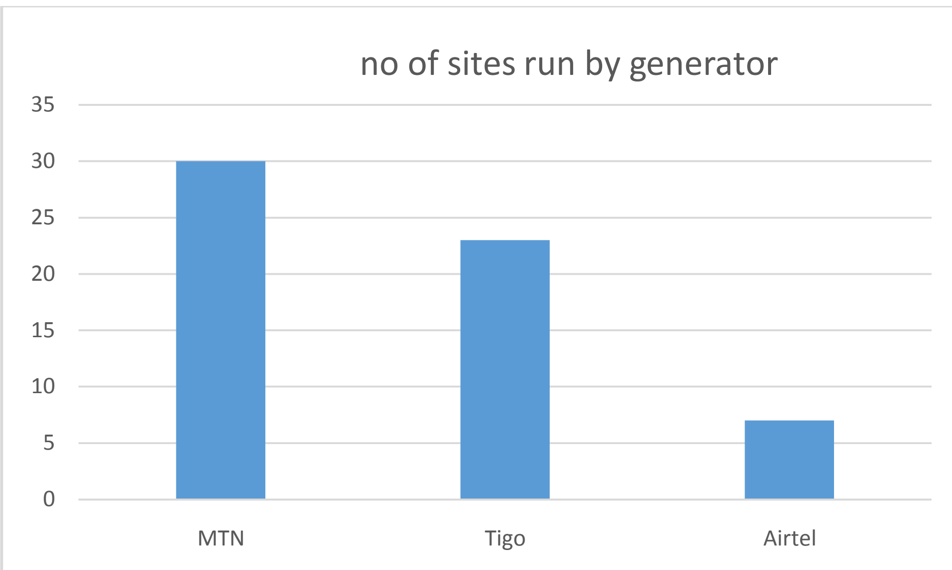
The same applies to Tigo and Airtel which have acquired 55 and 38 more sites, respectively. Their advantages in regard to these more acquired sites remain in the same direction as that of MTN.

Table 17: Showing no. of sites run by generator for each company before IHS

Company	No. of sites rented	Percentage (%)
MTN	30	50
Tigo	23	38
Airtel	7	12
Total sites by generator	60	100

Source: Primary data May 2016

Figure 8: Showing no. of sites run by generator for each company before IHS



Source: Primary data; May 2016

According to the table 17 and figure 9 above, MTN had 30 sites run by generator before HIS took them over. It represented 50 percent of sites run by generator in the whole country at the time.

Tigo had 23 sites in the similar category which represented 38 percent of sites run by generator while Airtel had 7 sites inthis category representing 12 percent of generator run sites.

Table 18: Category and number of sites MTN rents from IHS and their computed cost

Type of Lattice	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m

Tower:			
Maximum Monthly Price in Rfw:	720,000	760,000	1,000,000
Number sites	89	319	180
Total amount per month (Rfw)	64,080,000	242,440,000	180,000,000
Total amount per year (Rfw)	5,838,240,000		

Source: Primary data: May 2016

According to the table above, MTN currently rents 89 sites of <30m lattice power from IHS for which it pays 720,000 FRW for each site per month which totals to 64,080,000 FRW.

It as well rents 319 sites of Tower2: 30m..50m for which it pays 760,000FRW for each site per month totaling to 242,440,000 FRW per month and 180 sites of Tower3: >50m for which it pays1,000,000 FRW for each site per month which equals 180,000,000 FRW per month.

Added together, MTN pays 486,520,000 FRW per month for renting sites from IHS which translates to 5,838,240,000 FRW per year.

Table 19:Category and number of sites Tigo rents from IHS and their computed cost

Type of Lattice Tower:	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
Maximum Monthly Price in Rfw:	720,000	760,000	1,000,000
Number sites	60	102	198
Total amount	43,200,000	77,520,000	198,000,000
Total amount per year (Rfw)	3,824,640,000		

Source: Primary data: May 2016

According to the table above, Tigo currently rents 60 sites of <30m lattice power from IHS for which it pays 720,000 FRW for each site per month which totals to 43,200,000 FRW.

It as well rents 102 sites of Tower2: 30m..50m for which it pays 760,000FRW for each site per month totaling to 77,520,000 FRW per month and 198 sites of Tower3: >50m for which it pays1,000,000 FRW for each site per month which equals 198,000,000 FRW per month.

Added together, MTN pays 318,720,000 FRW per month for renting sites from IHS which translates to 3,824,640,000 FRW per year.

Table 20:Category and number of sites Airtel rents from IHS and their computed cost

Type of Lattice Tower:	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
Maximum Monthly Price in Rfw:	720,000	760,000	1,000,000
Number sites	45	105	68
Total amount	32,400,000	79,800,000	68,000,000
Total amount per year (Rfw)	2,162,400,000		

Source: Primary data: May 2016

According to the table above, Airtel currently rents 45 sites of <30m lattice power from IHS for which it pays 720,000 FRW for each site per month which totals to 32,400,000 FRW.

It as well rents 105 sites of Tower2: 30m..50m for which it pays 760,000FRW for each site per month totaling to 79,800,000 FRW per month and 68 sites of Tower3: >50m for which it pays1,000,000 FRW for each site per month which equals 68,000,000 FRW per month.

Added together, Airtel pays 180,200,000 FRW per month for renting sites from IHS which translates to 2,162, 400,000 FRW per year.

Table 21:Opex before and after site sharing per year

Company	Cost before site sharing (_000)	Cost after site sharing (000)	Amount saved due tosite sharing(000)
MTN	17,724,240	5,838,240	11,084,100
Tigo	11,161,500	3,824,640	7,336,860
Airtel	5,279,700	2,162,400	3,117,300

Source: Primary data:May, 2016

According to the table above, MTN currently spends 5,838,240,000 FRW from the previous 17,724,240,000 FRW which is a 67% saving on Opex of running their sites.

Tigo currently spends 3,824,640,000 FRW as compared to the previous 11,161,500,000 FRW which is a 66% saving on Opex of running their sites.

Similarly, Airtel currently spends 2,162,400,000 FRW while previously it used to spend 5,279,700,000 FRW which represents a 59% saving on opex running their sites.

This agrees with Kurt (2016) prediction when he argued that site sharing is one of the winning strategies through which telecom companies can apply to cut on their Opex costs and not compromise on their service delivery.

The best way to determine whether a statistical hypothesis is true would be to examine the entire population. Since that is often impractical, researcher typically examine a random sample from the population which is one year Opex for running all sites.

4.15: Hypothesis testing

There are two types of statistical hypotheses used to test our hypothesis:

Null hypothesis. The null hypothesis, denoted by H0, is usually the hypothesis that sample observations result purely from chance.

Alternative hypothesis. The alternative hypothesis, denoted by H1 in our case, is the hypothesis that sample observations are influenced by some non-random cause.

Hypothesis test of difference in mean (Mean of amount spend for site operation before and after site sharing) by three telecom companies. The previous tables show the difference in figures as well as in percentages but the following are statistical testes which will prove our hypothesis.

To test the Null hypothesis :

Ho: $\mu_1 = \mu_2$: The annual mean amount spent by the companies before and after sharing are the same

To test the alternative hypothesis

H1 : $\mu_1 \prec \mu_2$: The annual mean amount spent by the companies before and after sharing are different and decrease considerably after sharing.

Where μ_1 is the mean amount spent per year by telecom companies and

μ_2 is the mean amount spent per year by telecom companies

The decision rules is : We reject Ho if $t = \frac{\mu_1 - \mu_2}{s / \sqrt{n}} \succ t_{n-1}, \alpha$ or if

$$t = \frac{\mu_1 - \mu_2}{s / \sqrt{n}} \prec -t_{n-1}, \alpha$$

Where S : Standard deviation , n : number of companies

t_{n-1} : degree of freedom

α : Significance level (0.05)

The annual mean of amount spent before the sharing is:11,121,180,000 Rfw and The annual mean of amount spent after the sharing is 3,941,760,000 Rfw as shown in tables bellow:

Table 22:Mean before and after sharing

Company name	After sharing	Before sharing
MTN	5,838,240,000	16,922,340,000
TIGO	3,824,640,000	11,161,500,000
AIRTEL	2,162,400,000	5,279,700,000
Mean	3941760000	11121180000

Source: Primary data; May 2016

The standard deviation after sharing is 2,603,166,436 Rfw was computed by using bellow formula:

$$Variance = \frac{(x_i - \bar{x})^2}{n}$$

The standard deviation is square root of Variance.

After compilation, we found that:

$$t = \frac{\mu_1 - \mu_2}{s / \sqrt{n}} = \frac{3941760000 \quad - 1112118000 \quad 0}{2{,}603{,}166, \quad 436 \ / \sqrt{3}} = -4.8$$

$-t_{n-1}, \alpha$ =t (2; 0.05)= -2.9 (from the student t distribution table).

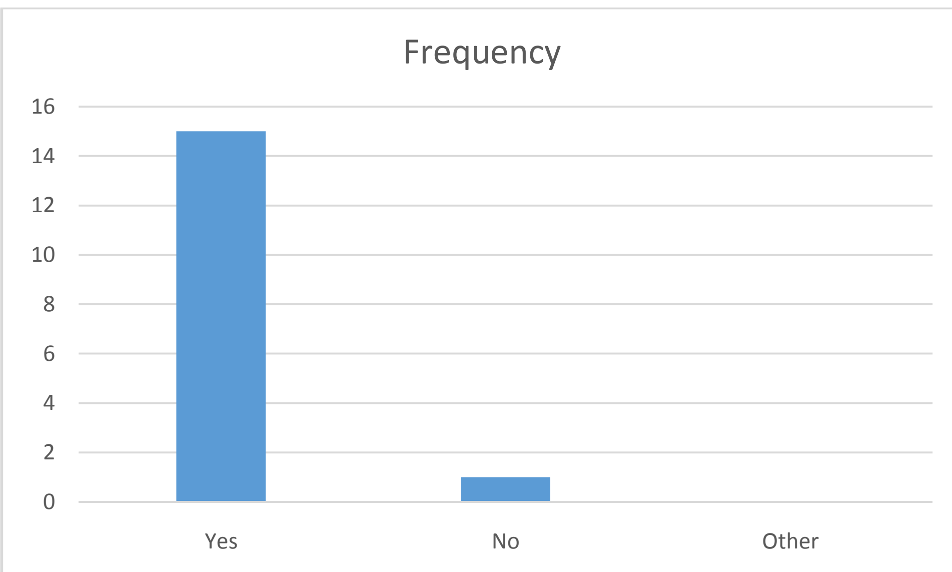
As t calculated is less than t table value (-4.8) , we reject Ho and prove that the annual mean amount spent by the companies decrease significantly which we fail to reject H1.

Table 23:Views on meeting cost optimization expectations since site sharing practice

View	Frequency	Percentage (%)
Yes	15	94
No	1	6
Other	0	0
Total	16	100

Source: Primary Data: May, 2016

Figure 9: Views on meeting cost optimization expectations since site sharing practice



According to the table 23 and figure 10 above, 94 percent of the respondents were of the view that site sharing has achieved the cost optimization of their telecom companies. Only 6 percent were of the dissenting view.

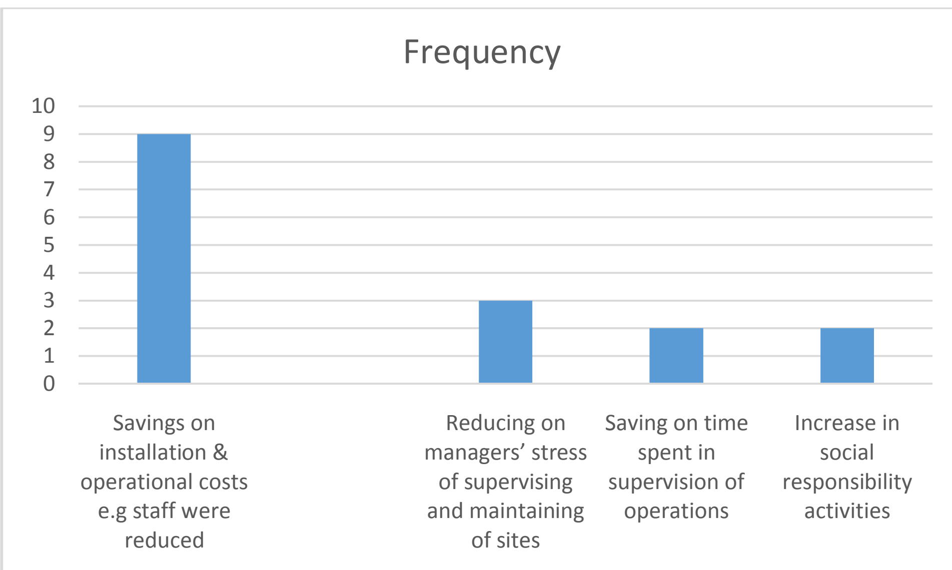
Table 24:Views on cost optimization out comes since site sharing

Outcome	Frequency	Percentage(%)
Savings on installation & operational costs e.g staff	9	56

were reduced		
Reducing on managers' stress of supervising and maintaining of sites	3	19
Saving on time spent in supervision of operations	2	12.5
Increase in social responsibility activities	2	12.5
Total	16	100

Source: Primary data: May 2016

Figure 10: Views on cost optimization out comes since site sharing



Source: Primary data: May 2016

According to the table 24 and figure 11 above, 56 percent of respondents said that savings on installation and operational costs like staff salaries were some of the outcomes their companies have registered since site sharing was introduced. This is because with site sharing, telecom companies did away with all direct operational costs like those to deal with; access network, national switching network, national transmission network, international switching network, international transmission network, Salaries and wages of staff at sites.

With such trend of invents, the telecom companies are destined to save up to 30% on their operational expenditures as per the IHS projection plan (2015).

A sizeable 19 percent were of the view that site sharing has reduced the stress of the telecom company managers especially in the areas of requesting for construction permits of these sites from the regulator, looking for land where these sites have to be constructed and yet also after finding them, negotiating to reach an agreement with the land lords was another stressing experience.

Such experiences were diverting the concentration of managers which could bar them from coming up with new innovations for customer satisfaction.

Respondents who viewed site sharing through the lenses of saving on time spent in supervision of operations were 12.5percent. They equaled those who have attributed it to the current increase in social responsibility activities of the telephone companies.

These outcomes are a high breed of factors ranging from less workload of managers (since the load of managing sites is off their back) which now gives them more time for innovations and also the availability of more money saved from Opex which can be spent in giving back to the subscribing population.

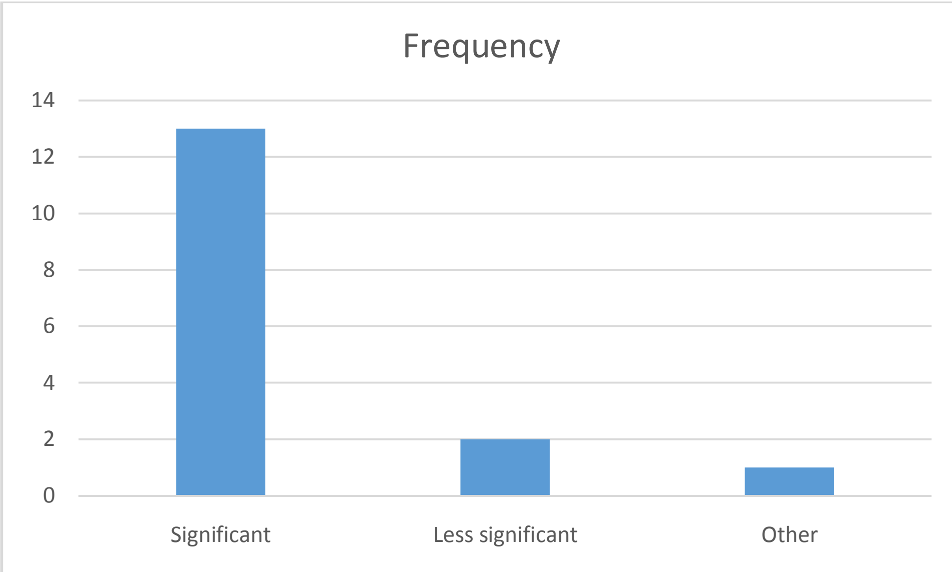
It is therefore not surprising that from the recent past to today, Rwanda has witnessed more of social responsibility activities like helping genocide survivors in various ways spearheaded by telephone companies.

Table 25: Views on the impact site sharing has had on cost optimization

View	Frequency	Percentage(%)
Significant	13	81
Less significant	2	13
Other	1	6
Total	16	100

Source: Primary Data May 2016

Figure 11: Views on the impact site sharing has had on cost optimization:



Source: Primary Data May 2016

According to the table 25 and figure 12 above, 81 percent of respondents agree that site sharing has had significant impact on cost optimization of their respective companies. Yet 13 of the respondents regard site sharing to be of less importance on their companies' cost optimization.

Their assessment is based on the ground that since they realized a reduction in the construction and maintaining of sites, there has been an up word trend in the taxes they have to pay to sustain their companies which eat into their profits.

They quote the Rwanda National Budget (2013) in which government announced a 25% increase on telecom equipment from 0 Percent. This was additional to 26percent exercise duty of 8% and 18 percent VAT which telecom companies are required to pay.

This according to these respondents, was affecting the cost of doing business for telecom companies in Rwanda and also affecting the speed of the cite rolling of geographical penetration.

However, some 6 percent of the respondents were not decided on the assessment of this on grounds that they could not quantify with arithmetic precision the value of the burden of stress which was off the telecom companies back when they sold away these sites to IHS.

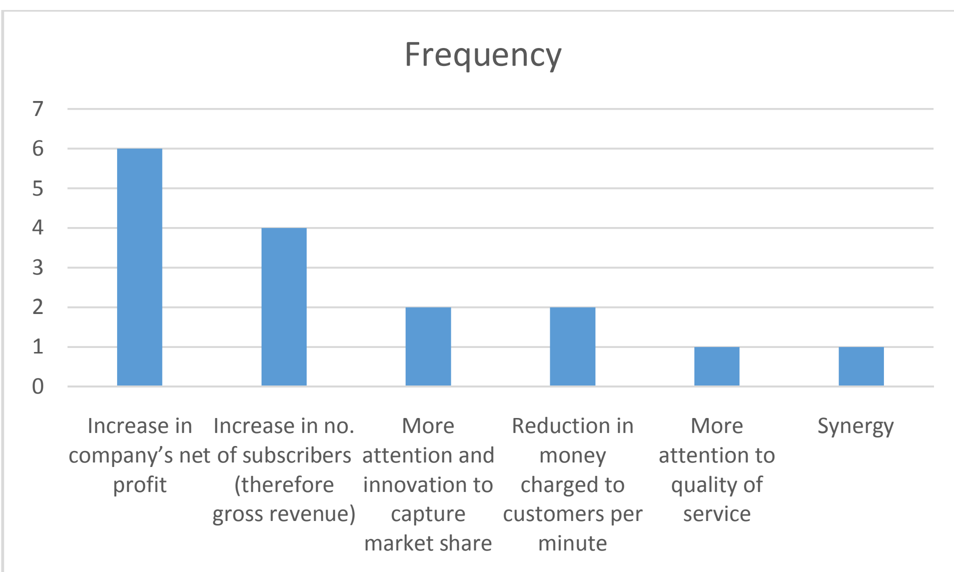
Table 26:Views on how the impact has helped in the growth of Telecom Industry

Impact	Frequency	Percentage (%)
Increase in company's net profit	6	38
Increase in no. of subscribers (therefore gross	4	25

revenue)		
More attention and innovation to capture market share	2	13
Reduction in money charged to customers per minute	2	13
More attention to quality of service	1	5.5
Synergy	1	5.5
Total	16	100

Source: Primary data: May 2016

Figure 12:Views on how the impact has helped in the growth of Telecom Industry



Source: Primary data; May 2016

According to the table 26 and figure 13 above, the impact that was rated highest as resulting from site sharing is the increase of net profit of the telephone companies. It was rated at 38 percent. The proponents of this view support it with the reduction in the Opex of the telephone companies as a result of doing away with the costs of constructing and operating these sites. Referenceis made to Table 21 above which illustrates a 67 % saving on Opex by MTN, 66% saving by Tigo and 59% saving on Opex by Airtel.

The second rated impact of site sharing has been the increase in the number of telephone subscribers. It was rated at 25 percent by respondents. According to Rwanda - Telecoms, Mobile and Broadband - Statistics and Analyses (2015) report, the Rwanda telecom penetration rate stands at 77% for mobile, 0.5% for fixed lines and 34% for internet. This represents a sustained growth of between 7% and 8% annually since 2008.

The attention which the Telecom industry staff dedicate to innovation together with the reduction in the amount of money charged from customers were rated at 13 percent as an outcome of site sharing on cost optimization. The respondents who supported this view agree with Knox, Maklan et al (2003), that innovations will always follow in work environments with less workload burden. Similarly, when sites were taken over by IHS, the work load burden of constructing and maintaining them was a big relief to the managers and employees of the telephone companies in general. In turn, they now have more time which they dedicate to service delivery and customer satisfaction.

More attention to quality of services offered and increase in synergies between the telephone companies were each rated at 5.5 % as outcomes of site sharing and its impact on cost optimization in the telecom industry of Rwanda.

With the site sharing venture continuously registering success in terms of reducing Opex, Wübben (2007), writes that telecom companies today (Rwanda inclusive), are continuously striving to obtain favorable prices from vendors. As a result, they have traditionally sought to achieve technology synergies by centralizing procurement.

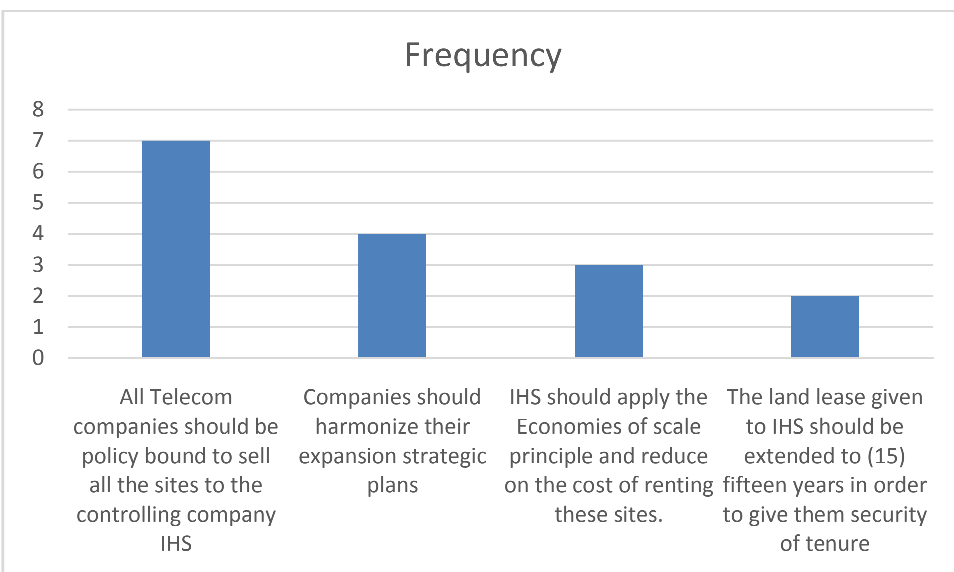
Table 27:Showing views on improving on cost optimization through site sharing

View	Frequency	Percentage (%)
All Telecom companies should be policy bound to sell all the sites to the controlling company IHS	7	44
Companies should harmonize their expansion strategic plans	4	25
IHS should apply the	3	19

Economies of scale principle and reduce on the cost of renting these sites.		
The land lease given to IHS should be extended to (15) fifteen years in order to give them security of tenure	2	12
Total	16	100

Source: Primary data: May, 2016

Figure 13:Showing views on improving on cost optimization through site sharing



Source: Primary data; May 2016

According to the table 27and figure 14 above, the majority of the respondents are of the view that all telecom companies in Rwanda, should be policy bound to sell all their sites to the controlling company IHS for site sharing is to enhance cost optimization in the telecom industry.

Respondents with this view formed 44 percent of the respondents. To them, the current scenario where some telecom companies like Tigo still have some sites which are not under IHS does not leverage the ground for perfect completion in the telecom industry.

The numerical strength of this view was followed by another 25 percent respondents who are of the view that there is need for telecom companies which are renting sites from IHS to harmonize their expansion strategic plans.

This, they argue, is to avoid feelings of sabotage or favoritism in case the site controlling operator chose to expand sites in a given direction that may not match or match the expansion strategy of a telecom company which rents it sites.

In essence IHS must be seen to be fair to all by respecting the expansion strategies of all the telecom companies that subscribe to its sites.

To achieve this, IHS managers must sit on table with the managers from the respective telecom companies and agree on the direction of area coverage expansions to take.

Some 19 percent of the respondents were of the suggestion that IHS should think of reducing on the cost it charges in renting these sites (whether run by generator or national power supply). In doing this, it will be applying the principle of economies of scale.

The proponents of this view argue that IHS has come of age in the construction of these sites which De Witte and Rui (2011), describe as producing on a larger scale, yet with (on average) less input costs. In such a circumstance they propose, economies of scale should berealized. Alternatively, this means that as IHS Company constructs and controls more sites, it will have a better chance to decrease its costs.

So in turn, it should also reduce on the costs it charges per site and this will spark off a circle where the telephone companies will also reduce on the costs they charge to the subscribers. This will make telecom communication more affordable among the Rwanda population.

A sizeable 12 percent of the respondents were of the view that the land ownership lease given to IHS should be revised and extended to fifteen years.

They argue that this will give IHS Company a security of tenure on this land so that they can feel secure in the execution of their work. Most probably the security derived from this will lead to external economies which as according to De Witte and Rui (2011),must be seen trickling down to the telephone subscribers.

4.22: Conclusion

This chapter covered the views of respondents as collected by the researcher. The researcher used tables for the easy display of respondents' views with their corresponding percentages. The majority of the views from respondents pointed at the increase in net profit of telecom companies and the increase in area geographical coverage as the major ways through which site sharing has impacted on cost optimization of the telecom industry in Rwanda.

They then proposed the application of economies of scale by IHS Company towards the telephone companies as a way of enhancing this site sharing to greater heights. It is the views of respondents as shown in this chapter that formed the conclusion and recommendations of this study as shown in the following chapter of conclusion and recommendations.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1: Introduction

This chapter carries the conclusions of the study depending on the views of the respondents as regards the policy of site sharing and how has impacted on cost optimization in the Rwanda telecom industry vis-a vis the current RURA regulatory frame.

5.2: Conclusion

It can be concluded that site sharing has impacted on cost optimization of these telecom companies especially in ways of;

Network infrastructure sharing leads to significant savings in the operational expenditures for operating their sites (OPEX) dissipated by telecoms operators in Rwanda.

Network infrastructure sharing leads to significant reduction in cost of network infrastructure rollout and capacity expansions for telecoms operators in Rwanda

reducing prices for the end users

quality improvement and innovation (services and technologies)

5.3: Recommendations

The literature and expert studies have focused on the economic interest and consequences of network sharing.

Yet, the conditions under which network sharing may be allowed may on the other hand cause negative outcomes of this venture if they are not clearly thought out by authorities.

Diversity of the motive of individual telephone operators notwithstanding, RURA's regulator's actions should focus on the following points:

a) Transparency:

There is a need to set a regulatory framework that is transparent and non-discriminatory which informs all operators about the existence of the conditions applied to network sharing in the country.

b) Competition:

There is need to ensure perfect competition in the telecom industry market and prevent anticompetitive behaviors such as exclusive agreements; where some of the telecom companies are allowed to retain the construction and maintenance of some of the sites. For example, Tigo has some of its sites outside the site sharing arrangement which it still maintains to-date.

c) Coverage:

There is need by the individual telecom companies to harmonize the identification of priority areas for network expansion with the site controlling company of IHS. For example, you can find a situation where one telecom company's strategy is to expand in rural areas and it is limited by not having sites there because the company in charge of site construction, IHS has not put sites in those location; and may be it does not have any plans to install sites in such locations in the near future. This, therefore brings into focus the following recommendation of conflict resolution.

d) Conflicts:

There is need to set up a clear framework for dispute resolution between operators. This is because in some ways, the site controlling body of IHS may be seen in to be favoring one operator's expansion strategy; may be by constructing sites in areas where one operator wants to expand at the expense of the other operators who may not have the same strategy which may cause a misunderstanding that calls for arbitration.

RURA to take into consideration the economies of scale when revising the guideline on infrastructure sharing especially the price for rent.

f) Prices:

There is a need set up price mechanisms of infrastructure usage with the following objectives: realistic prices for small operators in and those that may wish to join the telecom industry and yet at the same time taking into account the return on investment for the network owner which in this case is IHS company LTD.

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APPENDIX A - INTERVIEW GUIDE

Background of the questionnaire

The bearer of this questionnaire is a student at UR College of Business and Economics and currently doing a research in the telecoms industry on Site sharing and Cost Optimization. He requests your cooperation in providing the data bellow.

The information collected shall be used for purely academic purposes and will be treated with utmost confidentiality.

For the purpose of this study, telecoms infrastructure sharing is an arrangement whereby two or more telecom service providers (or operators) can agree to share passive or active infrastructure for the purpose of enhancing their business objectives and operations.

Passive infrastructure refers to all non-electronic components of a cell or BTS site such as towers, shelters, air conditioning equipment, diesel electric generator, battery, electrical supply, technical premises, easements and pylons.

Active infrastructure sharing involves sharing of electronic components such as electronics equipment, antennas, switches, BTS, microwave radios, and transceivers used for telecom signal processing.

Questionnaire

1. Profession category of respondent

Finance ☐

Accounting ☐

Engineering ☐

2. What factors pushed your company into site sharing?

3. How much were you spending on these elements before IHS took over of the sites?

No	Service Description	Cost in (RfW)
1	Cost of rent of premises	
2	Cost of Guard	
3	Cost of electricity (National Power)	
4	Diesel for Generator which runs	

	24/day	
5	Diesel Generator maintenance, oil, filters and cleaning	
6	Air-condition and power maintenance	
7	Others costs for site cleaning and water for guard	
8	Labor cost and transportation	
	Total	

4. How many sites did you sell to IHS?

5. How many sites do you currently rent from IHS?
6. How many sites did you have that were run with power from generator?
7. How many sites do you have in the categories below

8. Have your company's cost optimization expectations been met since your company joined site sharing?

Yes ☐

No ☐

Other ☐

9. What major cost optimization outcomes has your company registered since it joined site sharing?

-Savings on installation & operational costs ☐

-Savings on cost of paying staff (b'se they were reduced) ☐

-Reducing on managers' stress of maintaining sites ☐

- Saving on time spent in supervision of operations ☐

-Increased in the social responsibilities activities ☐

Other: Reduce the stress of requesting the construction permit to the regulator, land finding and contracts with those landlord etc…

(Justify your answer above)…………………………

10. How do you gauge the impact which site sharing has had on cost optimization of your company since 2012?
11.

Significant ☐

Less significant ☐

Other ☐

12. How has this impact helped in the growth of the telecom industry?

More attention to customer needs ☐

More attention to quality of service ☐

More innovation to capture market share ☐

Reduction in money charged to customers per minute ☐

Increase in no. of subscribers (therefore gross revenue) ☐

Increase in company's net profit ☐

Other: Synergy ☐

(*Justify your answer above***)…………………………..**

13. What do you think can be done to increase the impact of site sharing to cost optimization in the telecom industry?